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### إشراف:

أ.د. أروول أسيل تورك  
جامعة فرات - تركيا

### إعداد:

د. شيماء كامل مويش  
العراق – بغداد

### تنسيق:

أ. عامر النمر  
مدير قسم العلاقات الخارجية  
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جامعة ألانيا علاء الدين كيكوبات الحكومية – تركيا

23-21 سبتمبر/أيلول 2018

## الافتتاحية:

الحمد لله الذي وهبنا العلم وجعله نوراً نهتدي به، أما بعد..  
لقد تم بعون الله ترتيب كتاب أبحاث المؤتمر العلمي الدولي الأول للعلوم والهندسة (اس آر) الذي نظمتها جامعة ألانيا علاء الدين كيكوبات الحكومية بالتنسيق مع مركز بابير للدراسات والأبحاث بمحافظة أنطاليا في تركيا للمدة من 21 الى غاية 23 سبتمبر/أيلول 2019. تضمن الكتاب نتائج وتوصيات واسعة من الباحثين المشاركين في المؤتمر.

ويتضمن كتاب أبحاث المؤتمر، على القيمة العلمية والأكاديمية التي ترفد مسيرة البحوث العلمية في مجال العلوم الهندسية والصرافة بالمعلومات القيمة تناغمت هذه العلوم وانصهرت في نتائج موحدة، تخدم مسيرة العلم والتكنولوجيا المستقبلية المتفائلة للعلوم الهندسية والصرافة.

نضع بين أيديكم كتاب وقائع المؤتمر، لعله يكون في المستوى المرغوب ونكون قد وفقنا في جمعه وكتابته ولم نقصر فيما احتوى عليه من عناصر وأهداف متعددة نوقشت في جلسات مفتوحة بعناية فائقة.

وسيجد القارئ الكريم لهذا الكتاب أن العناوين والأبحاث المطروحة تسهم في تطوير التكنولوجيا لخدمة الإنسان والمجتمع، وسوف يشعر القارئ بالفائدة العلمية والفنية التي يتميز بها هذا الكتاب.

نسأل الله سبحانه وتعالى أيضاً أن يكتب لنا النجاح والتوفيق، وأن ينال هذا الكتاب إعجاب الباحثين والمشاركين في المؤتمر، ونتقدم الشكر الجزيل لكل من أسهم في نتاج هذا العمل العلمي الرصين والذي يظهر الجهد الذي قدمه القائمون على إنجازه.

د. شيماء كامل مويش

العراق – بغداد

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## Preparation Platinum Nano catalysts for Fabricating Membrane fuel cell

*Prof Dr.Nathera .A. Ali*  
*University of Baghdad*  
*Baghdad, Iraq*

*Email: [nathera2007@yahoo.com](mailto:nathera2007@yahoo.com)*

*Haleemah J. Mohammed ,*  
*University of Baghdad*  
*Baghdad, Iraq*

*Email: [alhamdaniya2003@yahoo.com](mailto:alhamdaniya2003@yahoo.com).*

**Abstract-** In recent years, It is actively looking at the fuel cell technology has increased remarkably. A fuel cell is that converts chemical energy directly into electricity. An electric fuel cell is generated by a chemical reaction. Each fuel cell has two electric electrodes, named, respectively the negative electrode and the positive electrode. Each fuel cell has an electrolyte membrane also, which carries electrically charged molecules from one electrode to another and stimulates, accelerating interactions in the electrodes. Hydrogen is the primary fuel, in this paper for the purposes of electrical insulation and control of the movement of ions and electrons between alkali cell electrodes, in the platinum catalyst is used. ( $H_2PtCl_6 \cdot 6H_2O$ ) at a concentration of 50 mM (5.1 V and 0.60 A) for two hours to form a black platinum catalyst layer and then to clean it with distilled water and dry it . The sample was also tested from the atomic force microscope to determine the roughness of the prepared surface. Voltages were also obtained at 1.48 volts and current at 3.6 A of alkaline fuel cell...

**Keywords -** *fuel cell, Membranes fuel cell, platinum Nano catalyst, X-ray diffraction, atomic force microscope.*

### **I. INTRODUCTION**

One of the most promising systems for generating electricity is fuel cell technology and nations and society. Energy demand has consistently increased in line with population growth and economic consumption [1, 2] Fuel cells are electrochemical devices that convert chemical energy to interact directly into electrical energy. Depending on the type of fuel cells used in electricity are classified into different groups. , Each fuel cell has two electric electrodes, named, respectively the negative electrode and the positive electrode. An electrolyte membrane also, which carries the charge of molecules electrically from one electrode to the other and a catalyst [3]. More catalysts materials used in electrodes for fuel cells is platinum (Pt) because of its excellent properties in high catalytic oxidation activity, but the cost is a major obstacle Pt in the commercialization of fuel cell technology [4]. A study by researcher A.L. Stepanov possessing platinum nanoparticles has a wide range of properties that can be used for many practical applications.[5] B. Escobar Morales and his team studied the electrochemical properties of carbon-supported nanoparticles of Pt by analyzing the catalytic response of the oxygen reduction reaction. Motivation parameters such as the charge transfer factor and the exchange current density of the catalyst were studied [6]. Satheesh Sambandam and his team studied. Photovoltaic composite nanoparticles Pt /C-TiO<sub>2</sub>for fuel cells, prepared in a non-homogeneous,



interactive manner, using techniques such as cyclic voltammetry. This study confirms the superior stability of these materials against corrosion under polarization conditions [7]. Researchers have made efforts to find cheaper metals than replaceable platinum catalysts being expensive. However, the Pt catalyst is still widely used because of its high catalytic activity and high stability [8].

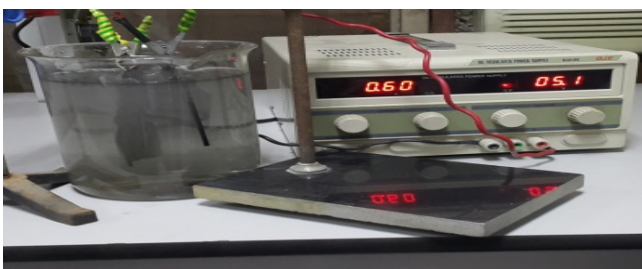
## **2- Materials and methods.**

### **2.1- Prepared Platinum Nanoparticles:**

Platinum Nanoparticles were obtained by chemical reduction of  $H_2PtCl_6$  with hydrazine. 100 mg  $H_2PtCl_6$  was dissolved in deionized water. The solution was stirred by magnetic stirrer during the experiment. The reduction of the metal ions was accomplished by adding hydrazine solution as reducing agent. Platinum precipitate was separated. The precipitate formed by the metallic nanoparticles was washed several times with deionized water, then put in acetone as a suspension. Then, the acetone and water in liquid phase was vaporized in an oven at 120 °C.

### **2.2-Synthesis of catalysts:**

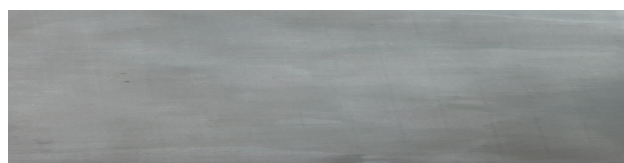
For the purpose of electrical insulation and control of the movement of ions electrons between the electrodes of the alkaline cell, the catalyst was prepared and the electrodes are prepared for this purpose by placing, The desired electrode after attaching it to the negative electrode, the other carbon connected to the positive electrode of the power supply (5.1V and 0.6A) (1 L). The distance between the electrodes is 2.5 mm, the coating solution was added by taking 0.5 g of platinum chloride salt ( $H_2PtCl_6 \cdot 6H_2O$ ) and dissolved in 1 liters of deionized water, Where it is a clear solution yellow color in mixing process to immerse the electrodes almost, and for four hours, until you a black coating layer of platinum catalyst atoms was produced. After the coating was completed, it was cleaned with deionized water and dried. as show in **Fig. 1. (a, b ,c)**.



**Fig. 1a. Electroplating process platinum**



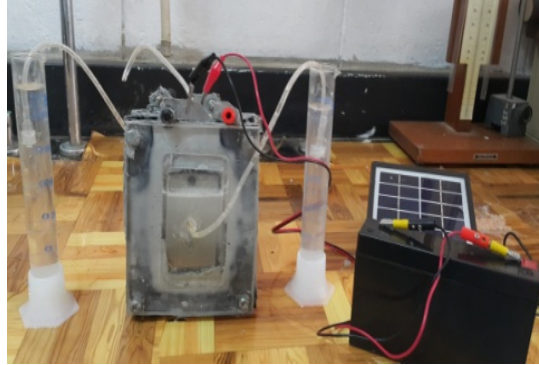
**Fig. 1b. Preparation of Nano platinum**



**Fig.1c. the Membranes**

**2.3-** The electrolysis cell consists of stainless steel plates of type 316 No. 2 isolated from each other, for the purpose of isolating each gas separately (hydrogen and oxygen), including a plate of organic glass. These electrodes are immersed in an electrolyte solution, prepared from distilled water and added to 28% gm of potassium

hydroxide. The outer wall consists of organic glass to prevent leakage of gases ( $14.5 \times 12$ )  $\text{cm}^2$  from the cell, 0,1 cm thick of electrode, and these electrodes were connected to a solar cell operating at 10 volts and a current of up to 2 amp, as show in Fig. (2).

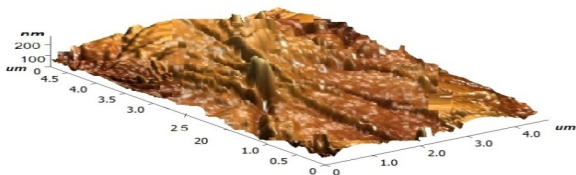


**Fig. 2. The electrolysis cell**

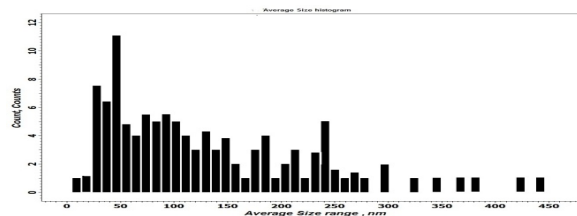
**2.4-** The alkaline fuel cell was manufactured from anode electrodes and cathode. The electrodes were coated with platinum catalysts. The outer wall of the cell consists of organic glass sheets.

### **3- RESULTS AND DISUSSION**

**3.1-** The surface morphology of the catalyst has been verified using AFM studies that are fully focused on the Nano scale characterization. We have studied the surface morphology of the catalytic layers: a sponge-like structure is produced when the current density increases, where Nano crystalline can be seen and distributed throughout the entire surface. As well as Analysis of the morphology of the catalyst Porous under varying current density conditions. In the low current density, the network was obtained very highly spaced, randomly oriented and highly correlated of pores. However, the increase in the current density of small pores requires showing forms, leading to an increase catalyst Porous. It was found that the particle size was 45nm as show in **Fig.3**



**Fig.3 a. Atomic force microscope of Nano platinum catalyst**



**Fig.3b. Histogram of their size distribution of Nano platinum catalyst**

**3.2-** XRD-6000 Shimadzu Japan was used for the purpose of measuring this of crystalline structures formed in the samples. Where the target was  $\text{CuK}\alpha$  radiation ( $\lambda=1.54\text{Å}$ ) in the range of  $2\theta=10-60^\circ$ , We used the Barak law to calculate the distance(d) between the atomic levels.

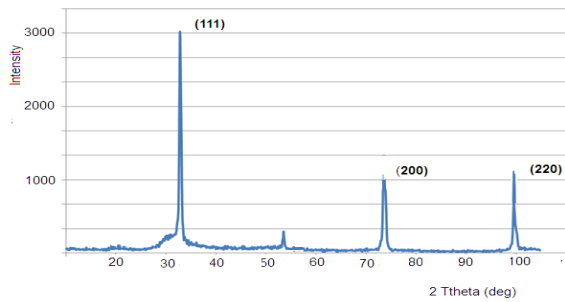
$$n\lambda = 2d\sin\theta \text{----- (1)}$$

Where: diffraction rank equal to (1).

$\theta$  angle of diffraction

$\lambda$  :wavelength of X-rays [9].

Figure (4) demonstrates the XRD profile of the preparation Nano platinum catalysts, Nano crystals; the obtained diffraction peaks at planes (111), (200), and (220), the diffraction peaks show good crystalline nanoparticles and match very well with ideal lattice constants



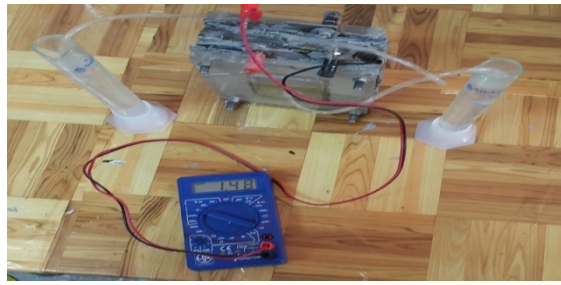
**Fig.4. X-ray diffraction analysis Nano platinum**

3.3-Hydrogen and oxygen can be produced by electrolysis techniques. The flow rates of hydrogen gas have 0.5 L\ min. shows table (1) the dimensions of stainless steel electrodes.

**TABLE (1) the dimensions of stainless steel electrodes**

samples	Width, W(cm)	Length, L (cm)	Thicknes s (cm)
stainless steel electrode	5.5	14	0.1

Manufactured alkaline fuel cell is a tool to convert chemical energy into electrical energy. In this paper, the use of organic glass panels and mesh-mesh Platinum electrodes (2) were applied by an electroplating process , Hydrogen gas has released from the disintegration of water molecules in the electrolyser of water analysis into the cell through the anode electrode to touch the layer of Nano platinum catalyst , which in turn to break up the molecules of hydrogen into atoms , and then to protons and electrons pass through an external load cycle accompanied by the movement of hydrogen ions ( OH-1) from the cathode electrode through the electrolyte solution to the anode pole , when the oxygen molecules break down at the cathode , pole to combine with the electrons traveling through the outer load circuit to form a water molecule again at the anode pole accompanied by an increase in cell temperature Basal to more than 70 ° C, to obtain a power of 1.48 volts and a current of 3.6 A. The amount of energy produced by the alkaline cell depends on the thickness, quantity of the platinum atoms that are catalyzing the hydrogen molecules and converting them into electrons in the form of energy, as well as the purity and quantity of hydrogen supplied to the alkaline cell. The higher the purity, the higher the energy, Oxygen from the other pole (cathode) this increases the energy and efficiency of the cell. In this paper, the operation of the cell using oxygen from the electrolysis system was tested [10] [11].Table 2 show increasing electrical conductivity with an increase in hydrogen flow rate due to the amount of hydrogen gas.



**Fig. 5. The fuel cell**

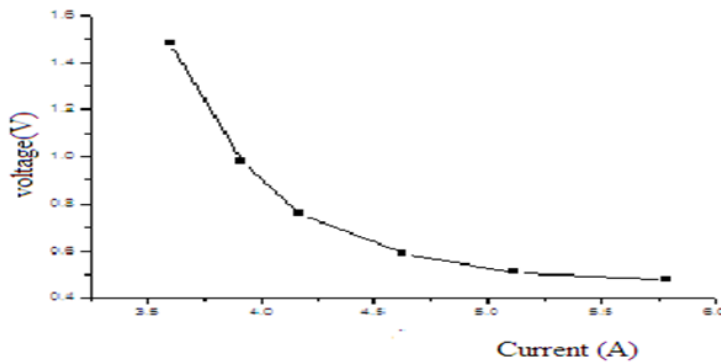
**TABLE (2) Show the relationship between the Electrical conductivity WITH current and voltage.**

Electrical conductivity E.C (S\cm)	Current (A)	voltage(V)
80.27	3.6	1.48
101.8	3.92	0.98
137.97	4.17	0.76
199.29	4.62	0.59
255.5	5.12	0.51
306.46	5.78	0.48

**Not:**  $E C = \frac{I * L}{V * W * T}$  (2)

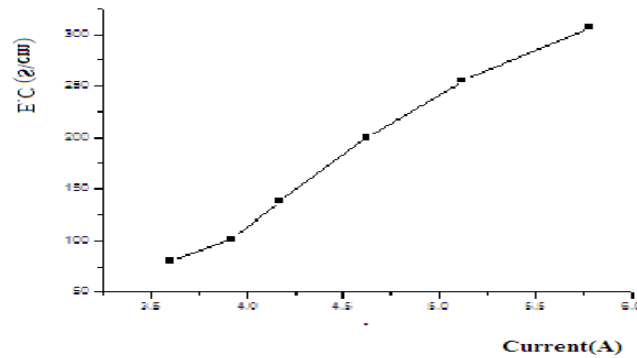
E C electrical conductivity I: current (A), L: sample length (cm) W: sample width (cm), T: sample and thickness (cm)

As shown in Fig. (6) The voltage of fuel cell decreased with the current same flow rate. At 0.5 L/min flow rate of H<sub>2</sub> gas



**Fig. 6. current-voltage at 0.5 L/min flow rate of H<sub>2</sub> gas**

Show in Fig. (7) Electrical conductivity increases with increasing in the current. Same in flow rate of hydrogen and oxygen gases, hydrogen has the highest energy density per unit weight than any other chemical fuel for many applications. It can be converted directly into electricity by fuel cell in an electrochemical process [12].



**Fig.7. E.C. with current at 0.5 L\ min flow rate of H2 gas**

#### **4- CONCLUSIONS**

- We have presented a simple chemical method for preparation Platinum nanoparticles
- In this research, platinum catalysts was synthesized successfully for Membrane for fuel cell application
- Through this study found that the voltage of fuel cell decreased with the current same flow rate. While electrical conductivity increases with increasing in the current.

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# **Estimation of Creep Deformations in rock marl Considering Elasto -ViscoPlastic Behavior**

**Merah Chafia, Hezaimia Ilyes, Taleb Mounia, Haouam Ala**

## **Abstract:**

After excavating an underground space, there is a change in the state of stress and displacement in the surrounding medium compared to the initial state. Over time, the variation in displacement depends mainly on the creep behavior of the hosting rock mass. The duration of exploitation of the mining works and civil engineer is important, this is why for such projects the taking into account of time becomes imperative and the forecast of the irreversible deformations is essential to ensure their perennially and their safety. The present work focuses on the delayed behavior of the marls induced by the creep following the modification of the state of stress. The laboratory tests were carried out on marl from the drillings of the Airbus tunnel (France) at the Laboratory of Rock Mechanics (LMR) at the Federal Polytechnic School of Lausanne (EPFL) and aimed at modeling the creep of rocks; the tests were carried out according two modes, the first is creep under a single loading stage (one stage creep test), the second is creep at several loading stages (multi-stage creep test). The viscoplastic deformation due to single-stage and multi-stage creep is adjusted by J.Lemaitre's law.

**Keywords:** *Creep Deformations, rock marl, Elasto-ViscoPlastic.*

## **1. INTRODUCTION:**

The time-dependent behavior of rock creep concerns continuous deformation under the effects of constant stresses, including deformations, landslides, and failures (Brantut et al., 2013; Yu Zhang et al., 2015). The study of the time dependent behavior of rocks can be of great help in understanding many aspects of rock engineering in civil engineering and mining. It is one of the most important mechanical properties of rock material and represents an important basis for predicting the long-term stability of rock engineering (Yu Zhang et al., 2015). Therefore, it is imperative to consider the effect of time in the stability of geotechnical engineering. Given the delayed deformations, it is considered that the rupture can take place over long periods in many geotechnical and mining projects. Creep is defined as the time-dependent deformation of a material subjected to a constant stress. It is conditioned by the testing conditions (mechanic, hydric, thermal) and the nature of the material (mineralogy, texture, porosity, degree of saturation). Creep tests aim at studying the time dependence on the rock behaviour. They generally consist in imposing a constant

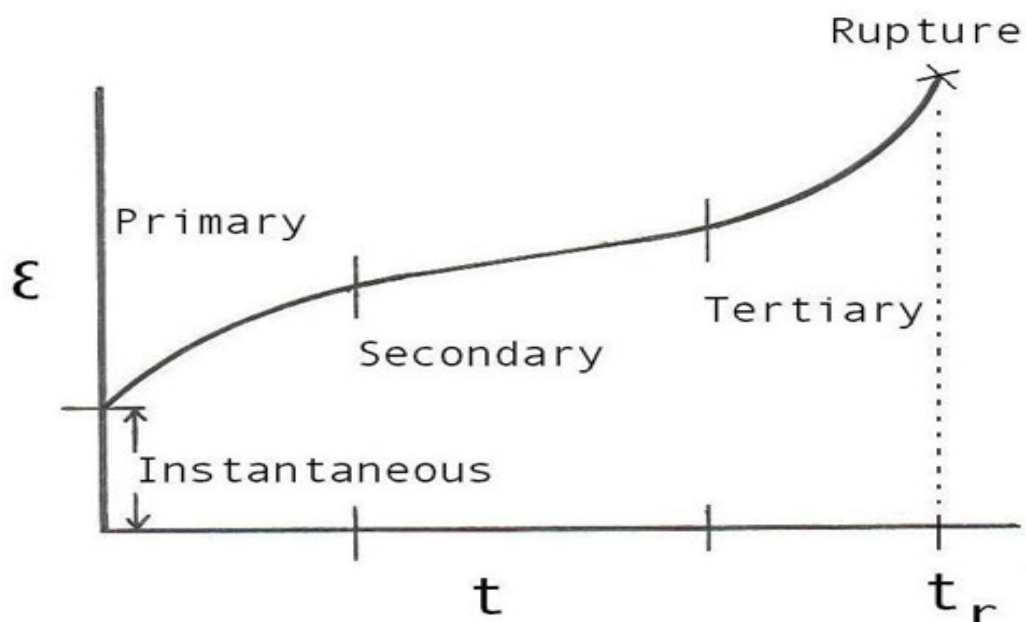
deviatory stress on samples under controlled hydric and temperature conditions and in recording their deformation with time. There fore, it is essential to study the creep properties of rock.

***Causes of creep:***

- Viscosity of the particles.
- Viscosity of the filling material.
- Rearrangement of particles.
- Reduction of mechanical characteristics.
- Generation and propagation of micro cracks.

***Classical Creep Curve:***

The rate of deformation is called the creep rate. It is the slope of the line in a Creep Strain vs- Time curve. Three stages of material response can be observed: primary (transient) creep characterised by a decreasing deformation rate, secondary (steady state) creep with a constant strain rate and tertiary (accelerating) creep characterised by a deformation rate that increases until failure.



**Figure1.Three stages of creep.**

**II- EXPERIMENTS:**

**II-1 Samples:**



Laboratory tests were carried out on seven specimens issued from boreholes AR1 and AR4 of the Arbus tunnel (France). The tunnel is part of the road connection RN134 Pau-Oloron. It crosses the geologic formation of Poudingues of Jurançon. At reception, the paraffined samples were kept in controlled temperature and hygrometric conditions. The samples are homogeneous clayey to silty soft marl, whose characteristics are the following: unit weight of  $21.58 \pm 0.30 \text{ kN/m}^3$ , dry unit weight of  $18.59 \pm 0.19 \text{ kN/m}^3$ , unit weight of solid particles of  $26.49 \text{ kN/m}^3$ , initial water content of  $15.5 \pm 0.6\%$  and degree of saturation near 100%.

**II-2 Description of the experimental procedure:**

Creep was carried out in oedometric cells. Samples of 75 mm in diameter and 19 mm in height are placed in a stiff metallic ring between two porous stones. They are carefully isolated from the outside to avoid any hydric exchange. The axial displacement is measured by a LVDT sensor with a sensitivity of  $1 \mu\text{m}$ .

As for the creep part of the experiments, 3 samples were subjected to a single loading step (i.e. one-stage creep test) and 4 samples to successive loading steps (i.e. multi-stage creep test). The applied stresses are respectively presented in Tables 1 and 2, when the creep is stabilized according to a criterion of  $2\mu/12$  hours.

**Table1. Applied Stress in one stage tests.**

Sample	Stress Applied (kPa)
Sample 1	250
Sample 2	500
Sample 3	1000

**Table2. Applied Stress in multi - stage tests.**

Sample	Stress Applied (kPa)
Sample4	15-60-125-250-500-750
Sample5	15-60-125-250
Sample6	15-60-125-250-500
Sample7	15-60-125-250-500

***III-Model of creep:***

In the interpretation of creep tests, it is usual to model the total deformation of a material as the sum of an elastic strain  $\varepsilon_{el}$  and a viscoplastic strain  $\varepsilon_{vp}$ :

$$\varepsilon(t) = \varepsilon_{el} + \varepsilon_{vp}(t) \quad \text{(1)}$$

### Creep with Lemaitre's law:

The viscoplastic strain can be evaluated using the viscoplastic strain rate  $\dot{\varepsilon}_{vp}$  as defined by Lemaitre:

$$\frac{\dot{\varepsilon}^{vp}}{(\varepsilon^{vp})^m} = A \left( \frac{q - \sigma_s}{F_0} \right)^n \quad (2)$$

- A : the viscosity parameter in  $S^{-1}$ ,
- n : a constant greater than 1 ( $n > 1$ ),
- m : constante ( $(1 - n < m < 0)$ ),
- $\sigma_s$  : the trigger stress threshold of the delayed behavior
- $F_0 = 1\text{MPa}$ .

Reversible deformations are the result of cumulative elastic deformations calculated instantly at each increment of load. This restriction simplifies the equations concerning the delayed behavior, which are expressed only through the second invariant of the stress tensor, q, and the tensor of the viscoplastic strain rates  $\dot{\varepsilon}^{vp}$ .

A constant deviator q the explicit expression of the creep law  $\varepsilon = f(t)$  for an isotropic rock is obtained by integration, by Lemaitre's law, assuming the zero creep thresholds,  $\sigma_s = 0$ . In the axial direction.

$$\frac{(d\varepsilon_1^{vp})}{(\varepsilon_1^{vp})^m} = Aq^n \cdot dt \quad (3)$$

The creep law is then derived by integrating Equation (3) between 0 and 1, form  $m \neq 1$  constant:

In the axial direction

$$\frac{(\varepsilon^{vp})^{-m+1}}{-m+1} = Aq^n \cdot t \quad (4)$$

We can write it:

$$-\frac{(\varepsilon^{vp})^{1-m}}{m-1} = A \cdot q^n \cdot t \quad (5)$$

We pose

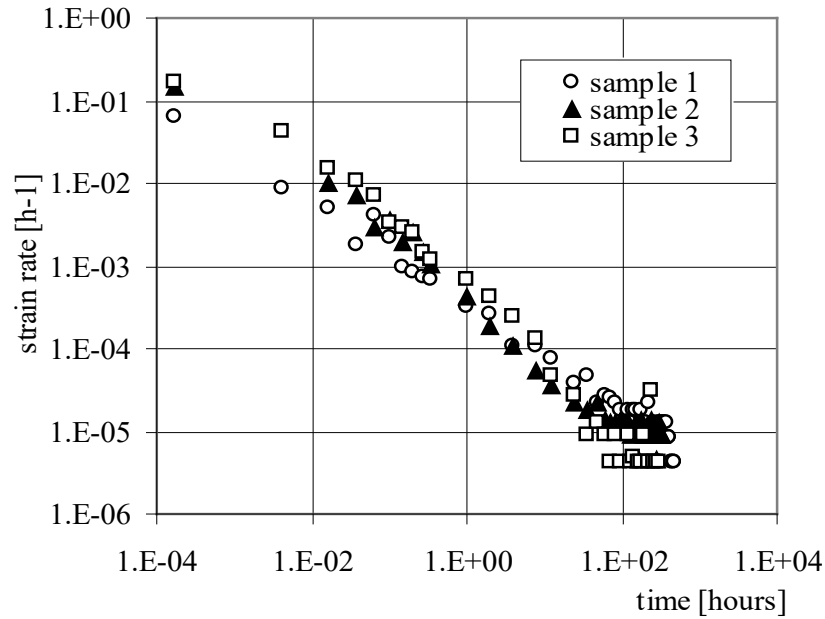
$$\varepsilon^{vp} = a q^\beta t^\alpha \quad (6)$$

Where :

$$\alpha = \frac{1}{1-m} \quad \text{with} \quad 0 < \alpha \leq 1, \quad \beta = \frac{n}{1-m} = \alpha \cdot n \quad \text{eta} = \left( \frac{A}{\alpha} \right)^\alpha$$

**IV-RESULTS:**

The experimental deformation rate of the tested marls decreases up to  $10^{-5}$ /hour (Figure 2). Beyond 170 hours, it becomes constant, which corresponds to the transition from primary creep to secondary creep.

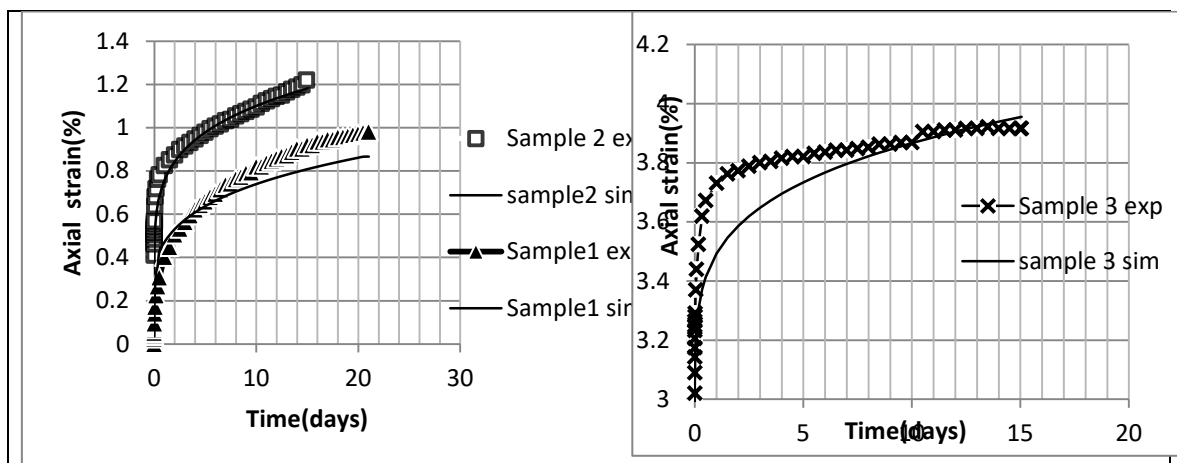


**Figure 2: Experimental strain rate versus time (log-log plot).**

After subtraction to the axial strain measurement its elastic part  $\varepsilon_{el}$  that is assumed to occur almost instantaneously (within the first 15 seconds), the viscoplastic part can be analysed according to equations (1) and (6).

**One stage creep test:**

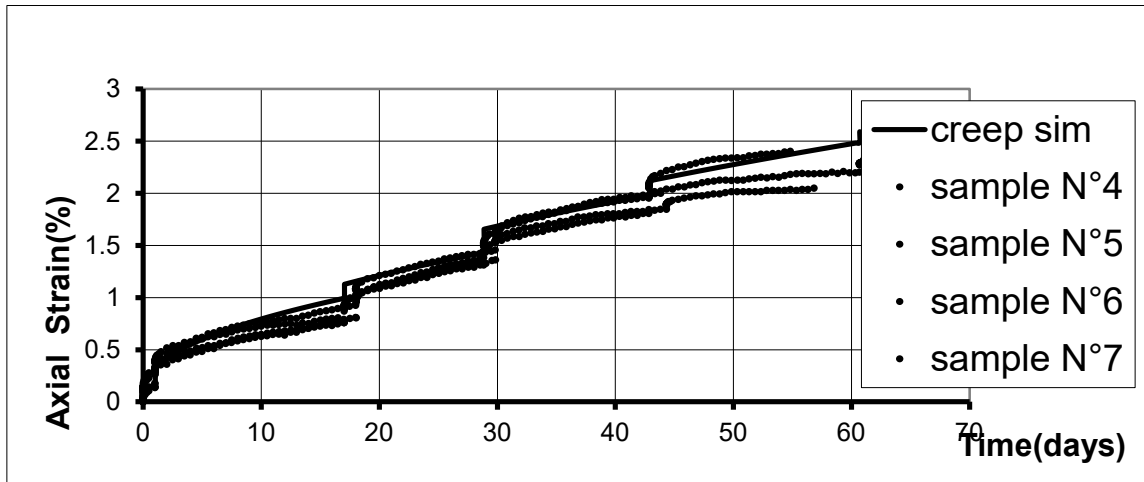
The resulting log-log scale graph for samples 1 to 3 is given in Figure 3. It points out a similar slope for the three data sets and consequently the same exponent  $\alpha$  of time in Lemaitre's law. The best-fit parameter set for the three one-stage creep tests is:  $a = 5.85 \cdot 10^{-4}$ ;  $\alpha = 0.22$  and  $\beta = 0.17$ . The corresponding computed creep curves are plotted as lines and show a good match with the experimental data.



**Figure 3: One-stage creep tests, Evolution of axial strain versus time**

*Multi-stage creep tests*

For multi-stage creep tests an average set of parameters was obtained with the parameters:  $a = 2.96 \cdot 10^{-5} \text{ s}^{-1}$ ,  $\alpha = 0.46$  and  $\beta = 0.26$ .



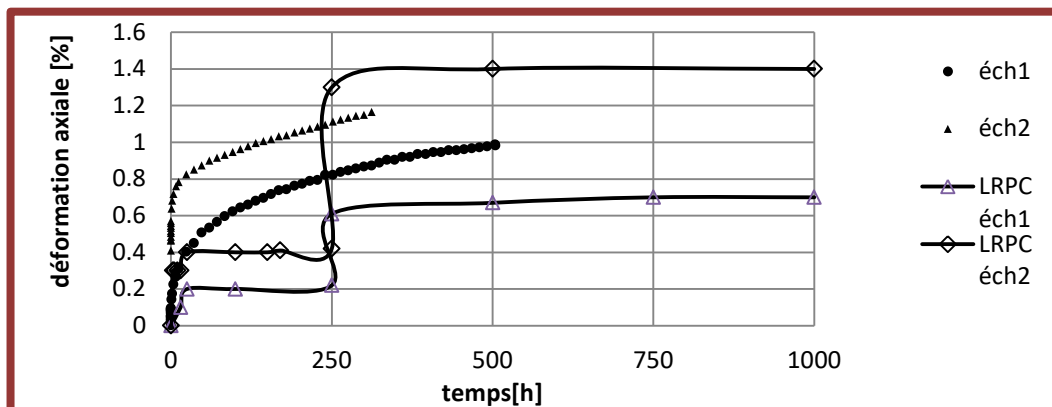
**Figure 4: Analytical simulation of multi-stage creep tests with an average set of parameters. Evolution of the axial strain as a function of time**

••••• experimental creep ----- mean creep

**V-COMPARISON OF THE RESULTS OBTAINED WITH TESTS CARRIED OUT BY J.F SERRATRICE ON SPECIMEN OF THE ARBUS TUNNEL:**

The creep strains measured in this study are in general agreement with experimental results obtained at the LRPC of Aix-en-Provence on the same marls (Serratrice, 2006).

Among the tests carried out at the Aix-en-Provence LRPC, two samples subjected to the mono axial flow belonging to the survey AR4-06, sample G10, which was named LRPC ech1 and LRPC ech2, were considered respectively subjected to 346 kPa and 701 kPa. The results are shown in Figure 5.



**Figure 5: Comparison of creep results with Aix - en - Provence.**

## VI-CONCLUSION:

Lemaitre's law was used to model the creep behaviour of marls from the Arbus tunnel. It is very satisfactory, but the parameters are found different for one-stage and multi-stage creep tests.

- ❖ The parameters of Lemaitre's law  $a$ ,  $\alpha$  and  $\beta$  seem different for single and multi-stage creep.
- ❖ This is explained by the fact that micro-fissures at sub-microscopic scale have a finite propagation speed.
- ❖ If the rate of application of the load exceeds the speed of propagation of cracks, the resistance of the material seems to increase and the deformation decreases. For a slow loading speed such by multi stage micro cracks develop along the load giving a relatively large deformation compared to single-stage loading which is fast enough, exceeding the speed of propagation of defects (micro cracks).
- ❖ In addition, the progressive loading mode for multi-stage and relatively abrupt tests for single-stage tests influences the induced deformation.

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# Colorectal Cancer Epidemiology in Four Medical Oncology Services from the Algerian East during the last decade

Samira NEGRICHI <sup>1</sup>, Salima TALEB <sup>2,3</sup>, Sabiha BOUZBID <sup>4,5</sup>

1: Faculty of Exact Sciences and Sciences of Nature and Life- Department of Living Beings University Larbi Tebessi-Tebessa - Algeria

2: Faculty of Exact Sciences and Sciences of Nature and Life- Department of Applied Biology University Larbi Tebessi-Tebessa - Algeria

3: Laboratory of Nutrition and Food Technology (LNTA) University of Constantine 1

4: Annaba Cancer Center- Teaching Hospital- Annaba

5: Faculty of Medicine- BADJI Mokhtar University- Annaba

## **Abstract:**

Colorectal cancer (CRC) is the second most common cancer, and one of the most common causes of cancer death in Algeria. The aim of the present study was to determine the epidemiological profile of colorectal cancer in the Algerian East, from 2006 to 2016. Cancer registries were started by the anticancer centers of: Batna, Annaba, Setif, and the hospital of Tebessa (provinces in the Algerian East), wherein information was collected from cancer patients who were diagnosed and treated in those services. Data of 12.691 cancer patients has been collected. 1.507 patients were diagnosed with CRC (50,6 % females and 49,3% males). CRC percentage has risen from (1, 53%) in 2006, to (11%) in 2014, the percentage increased to (37%) in 2015 and then decreased to (19.38%) in 2016; (p=0.000). CRC was ranked the first among the digestive cancers and the 2nd after breast cancer. It is the most commonly reported cancer among males. For females, it comes in second place after breast cancer (p=0,000). The mean age of CRC patients is 57, 11 ± 14, 16 years. The prevalence of CRC increased significantly with age for both males and females (p=0,008), the higher percentages were recorded in the age range of (50-59 years (25, 02%) and 60-69 years (24, 95%)). Colon cancer is more prevalent in women while rectal cancer is higher in men; p= 0,113. This study reinforced data from the literature on the nature and spread of colorectal cancer, and revealed the prevalence of CRC and its evolution over the last years in the Algerian east.

**Keywords:** *Epidemiology, Colorectal Cancer, Algerian East.*

## **1. Introduction**

Cancer is one in seven causes of death in the world. It's the second death cause in developed countries, and the third death cause in middle-income and low-income countries (1). It is a result of uncontrolled cell proliferation, when these cells spread in an uncontrolled way; the invasive and migratory power makes them so dangerous which may lead to death (1). Colorectal cancer (CRC) is the large intestine cancer, it develops in the colon or/and the rectum, parts of the digestive system (2). It is a multifactorial disease, it may be caused by environmental factors such as tobacco and an unhealthy diet; and genetic factors such as heredity and race... when these factors act together, the chances to

develop colorectal cancer are higher (2). Colorectal cancer is one of the most common form of cancer in the worlds, in 2012 GLOBOCAN Project reported about 1.3 million new cases and 400 000 deaths (3).In the United states, the death rates decreased for both sexes and in every ethnic group between 2001 and 2010 (4). It has been estimated that 6% of the general population may have colorectal cancer In Europe, and in the United states. In Algeria, colorectal cancer is the most common cancer among men and the second among women, with a median age of 65 and 56 years old successively (5); it represents the second cause of mortality by cancer after breast cancer in women and lung cancer in men in 2015 (6). The aim of the present study is to provide the epidemiological profile of colorectal cancer in the Algerian East, from 2006 to 2016.

## 2. **Materials and methods.**

The current epidemiological study is a descriptive retrospective study covering a period of **10 years** from 2006 to 2016. Conducted between April 2016 and October 2017, this study was realized in the Oncology departments of five different provinces of the Algerian east. These Oncology departments were in the “Centers for Cancer Control” of: Annaba, Batna, Setif; and one public hospital in Tebessa. All cancer cases were collected from the cancer registries of each Cancer Center (from 2006 to 2016). Admission year, cancer localization, age, sex and patient address were recorded. Data entry and analysis were realized on Microsoft Office Excel 2007 and Minitab 13, and coded by cancer localization according to the International Classification of Diseases for Oncology (ICD -3) (7).The results are expressed as a percentage for qualitative variables (Patient provinces, year of admission, cancer localization and sex) and as mean  $\pm$  standard deviation (SD) for quantitative variables (Patient age). The threshold of significance (p-value) is set  $< 0.05$ . The relative frequency of different types of cancer was calculated according to sex and age. Colorectal cancer patients were distributed according to their provinces, cancer topography and by age range.

## 3. **Discussion & Results**

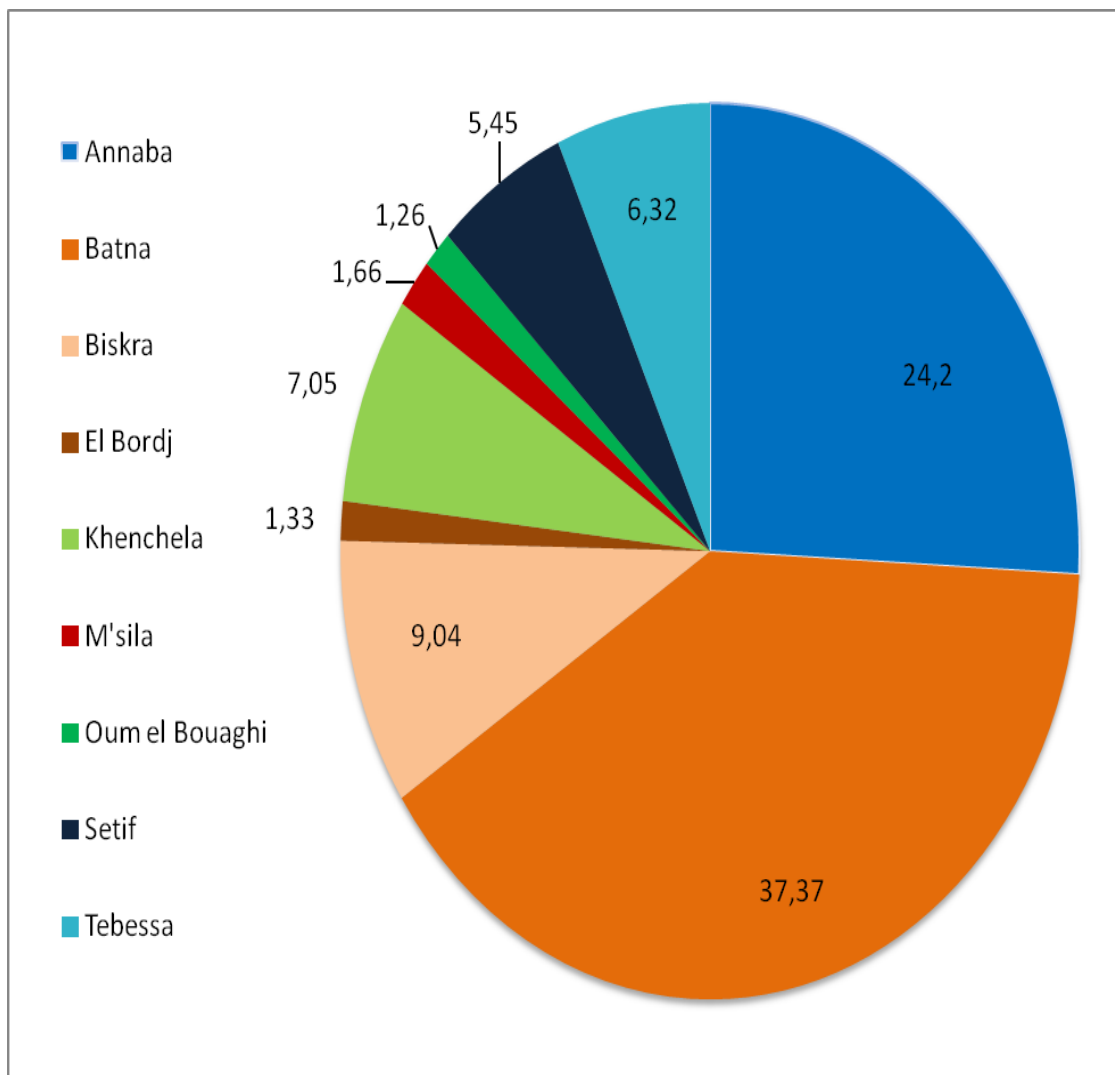
### **Colorectal cancer in the Algeria East**

According to the four medical Oncology services registries, 12 691 cancer cases have been recorded, including 7681 women and 5010 men. Among the 12 thousand and seven hundred cases of cancer, 1 507 (11.87%) patients were diagnosed with colorectal cancer (715 women and 697 men) with a sex-ratio=0.97. The mean age of CRC patients is 57,  $11 \pm 14$ , 16 years old ( $55.5 \pm 15.1$  in women and  $57.8 \pm 14.9$  in men;  $p=0.004$ ). CRC is the second most common cancer for both sexes after breast cancer (30%). It is the most commonly reported cancer among males with a frequency of 14.75%. For females, it comes in second place after breast cancer with a frequency of 9.66% (table1), and the differences are highly significant ( $p=0.000$ ).

**Table1. The most common cancer localization by sex**

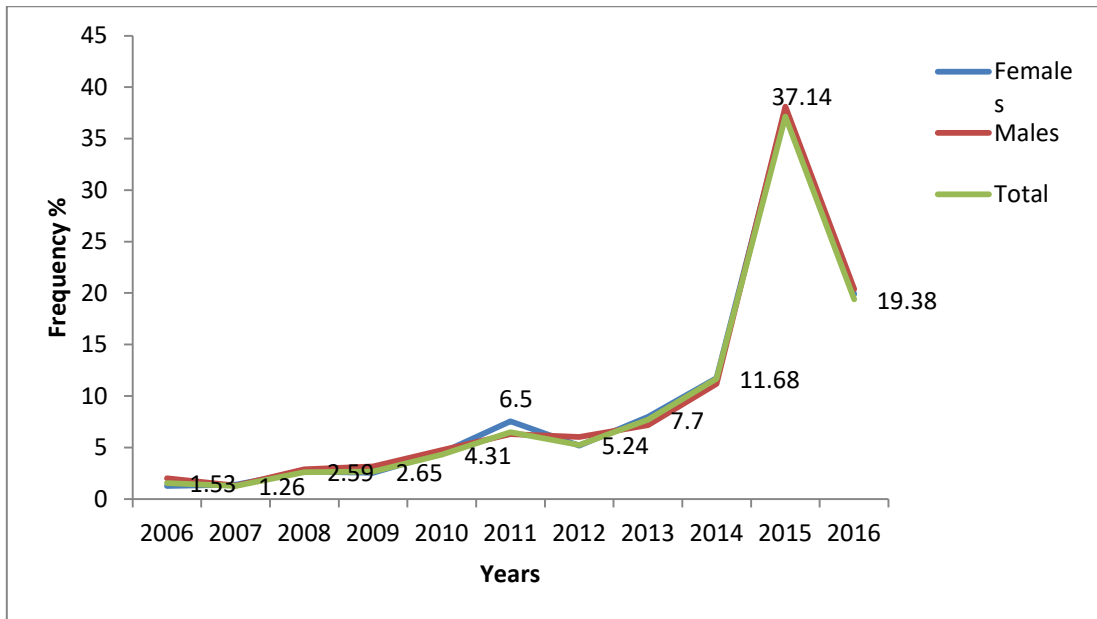
Females (%)		Males (%)	
Breast	50.1	Colorectal	14.75
Colorectal	9.66	Bronchus, lung	13.29
Ovary	4.6	Prostate	9.88
Biliary	3.61	Bladder	8.44
Cervix	3.28	Nasopharyngeal	7.53

The most affected provinces are presented in figure 1. Batna recorded the highest percentage (37%) followed by Annaba (24%), while Biskra, Khenchela, Tebessa and Setif had frequencies between 9% and 5%.



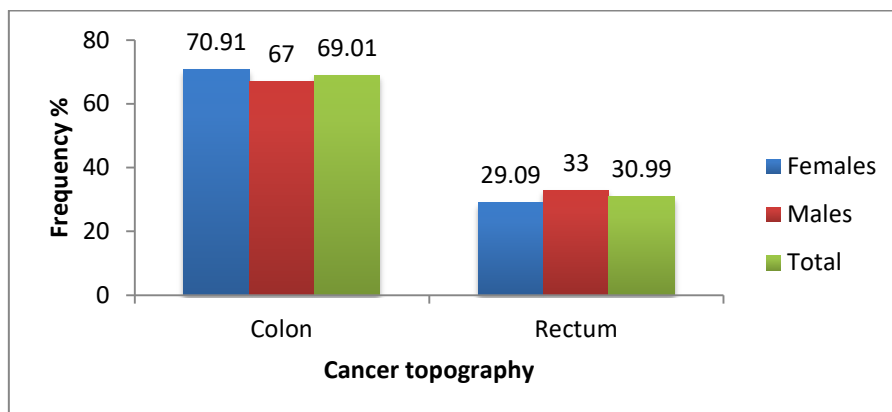
**Figure1. Distribution of colorectal cancer patients by provinces**





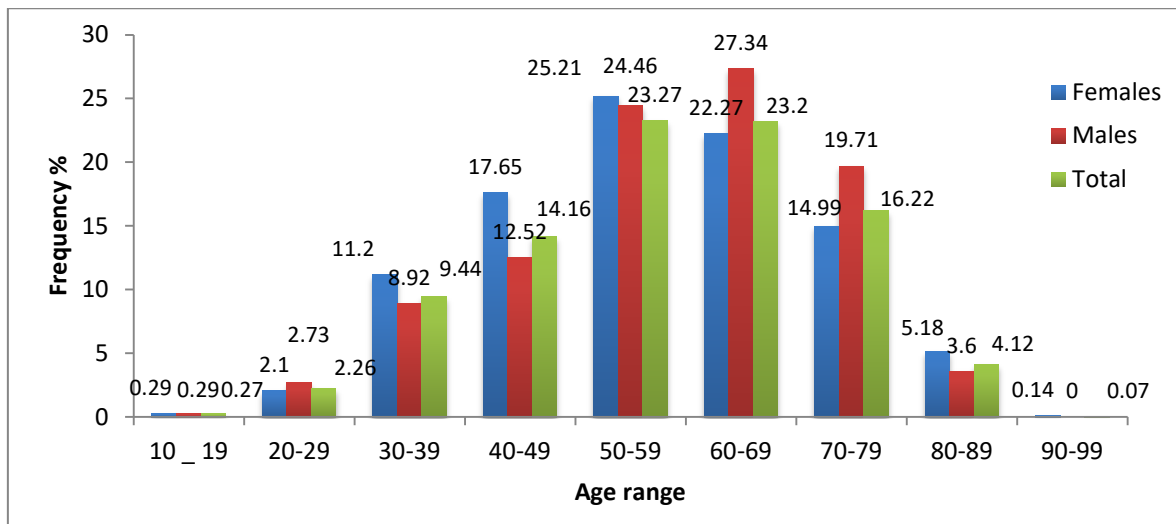
**Figure2. Evolution of the prevalence (%) of the CRC from 2006 to 2016**

The figure 2 shows the annual trend of colorectal cancer rates in the study population between 2006 and 2016. In the total population, rates increase steadily between 2006 and 2014. CRC percentage has risen from (1, 53%) in 2006, to (11 %) in 2014. Then, we observe a rapid increase in 2015 recorded the peak with a rate of 37% then the prevalence decreases in 2016 to get 19% (p=0.000).



**Figure 3. Prevalence (%) of CRC by gender and topography**

The figure 3 shows that colon cancer is more prevalent than rectal cancer (69% vs 30.9%). It is more common in women while rectal cancer is more common in men. . No statistically significant association was observed between colorectal cancer topography and sex (p=0.113).



**Figure 4. Prevalence (%) of CRC by gender and age range**

The prevalence of CRC increased significantly with age for both males and females ( $p=0.008$ ), with a frequency the higher percentages (23%) were recorded in the age range of 50-59 and 60-69 years old (figure 4). The most affected age group in women was 50-59 years old with a frequency of 25%, while the most affected age group in men was 60-69 years old with a frequency of 27%. Colorectal cancer prevalence's decreased after 69 years old.

In the current study, the number of women with cancer was more than the number of men. According to GLOBOCAN 2012, the prevalence of women with cancer exceeds that of men in Africa, Asia and Latina America; while the predominance was masculine in Europe and North America (3). Colorectal cancer is the second most common cancer after breast cancer in our study, this result is the same posted by GLOBOCAN 2012 in Algeria and many other Arab countries such as Tunisia, Sudan, Saudi Arabia and United Arab Emirate (3).

In this study, Batna and Annaba recorded the highest frequencies compared to the other provinces of the East; this result is due to the presence of the Cancer Centers what increases the chances of colorectal cancer patients of these provinces.

The mean age of female patients with CRC was close to the mean age of men. In Hamdi Cherif study, the age of men with CRC was higher than the age of women (65 vs 56 years old) (5).

Colorectal cancer was ranked the first cancer among males and the second among females; and that result is the same as the one found in Jordan (8), but different than the estimation in all Algeria in 2014, where CRC was ranked the second for both males and females after lung and breast cancer respectively (5).

In France, CRC has a high frequency in men (10%) and in women (12%) which is a different result than what we found (9). While, the prevalence are very similar compared to those of the wilaya of Setif between 2001 and 2016 (10), where CRS recorded a frequency of 13.3% among men and 9.8% among women. (In our study, it was 14.7% among men and 9.6% among women).

In Setif, CRC prevalence peaks in 2012 and 2015 among women and peaks in 2012 and 2016 among men (10), in our study the peak was in 2015 for both men and women. The

implementation of the 2015-2019 National Cancer Plan (11) aimed at reducing cancer morbidity and mortality can be the cause for which the CRC rate increased significantly in 2015.

Colorectal cancer is an age-related cancer, in our study its frequency increases steadily with age. In Setif population, the most affected age groups were between 50 to 69 years old in men and women. In the world, and in a general way, the most affected age ranges are between 60 to 74 years old (10). Our results are more similar with those of Setif.

In our study, Colon cancer rates were twice that of rectal cancer, the same result was found in

A cohort study conducted in the United States (12). The embryonic origin of the colon is different than rectum, what has an impact on the pH levels, carcinogenesis pathways, gene expression, the hormone receptors and the environmental factors sensitivity (13, 14).

In our study women were more affected by CRC; while in the United States particularly and in the world generally, men are more affected than women (15). We found that colon cancer was more common in women and rectal cancer was more common among men, and this result has similarities with another study (16). It may be explained by the existence of sexual differences that may be related to gender genetic and molecular interactions with environmental risk factors (15). Estrogen is implicated in upper gastrointestinal tract cancers. In females, estrogen serum levels are higher than in males, from puberty until menopause, what makes females much more exposed to high levels of estrogen than males, whom Estrogen serum levels are low and constant (17, 18).

#### 4. Conclusion

Epidemiology plays an important role in cancer detection and control, this study reinforced data from the literature on the nature and spread of colorectal cancer, and revealed the prevalence of CRC according to sex, age range and topography; it has revealed CRC position and rank among other cancers and its evolution over the last ten years in different provinces from the Algerian east.

#### 5. Acknowledgements

We thank the epidemiologists, the employees and the patients in the four medical Oncology services for their help and services. Conflicts of interest the authors declare no conflict of interest.

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# Studying of Structural, Electrical and Sensing Characterization of $(\text{Fe}_2\text{O}_3)_{1-x} \text{CuO}_x$ Thin Films Prepared by Pulse Laser Deposition Technique

Ghuson H. Mohammed<sup>1</sup>, Maysar A. Salim, Asmaa<sup>2</sup> N. Mohammed Ali<sup>1</sup>, Kadhim A. Adhim<sup>1</sup>  
University of Baghdad, Collage of science, department of Physics<sup>1</sup>  
University of Baghdad, Collage of Engineering, department of Energy Engineering<sup>2</sup>  
Email:ghuson1975@gmail.com  
Email:Kadhim\_Adem@yahoo.com

## Abstract

During this work un doped and doped  $\text{Fe}_2\text{O}_3$  with different contents of  $\text{CuO}$  where ( $x= 0.1, 0.3, 0.5$ ) wt. % were prepared on glass, and p-Si wafer substrates at room temperature using Pulse Laser Deposition (PLD) technique with  $\lambda=1064\text{nm}$ , energy=800mJ and number of shots=500 under vacuum of  $10^{-3}$  mbar. The structure of these films has been examined using X-Ray diffraction (XRD). The results show that the pure and doped films were polycrystalline with strong crystalline orientation (311) direction corresponding to a diffraction angle of  $35.7^\circ$ , this means that this plane is acceptable for crystal growth and it is affected slightly with increasing of  $\text{CuO}$  content. From Hall Effect measurements, it is obtained that all samples have a negative Hall coefficient (n-type) for pure  $\text{Fe}_2\text{O}_3$  films while positive Hall coefficient (p-type) for pure  $\text{CuO}$ . and the doping samples with  $\text{CuO}$  change the conductivity for  $\text{Fe}_2\text{O}_3$  from n-type to P-type for  $(\text{Fe}_2\text{O}_3)_{1-x}(\text{CuO})_x$  films. Finally the variation of operation temperature gas sensor on the sensor sensitivity and recover and respond time have been studied at different concentrations of  $\text{CuO}$ .

**Keyword:** structural properties, electrical properties, gas sensing properties,  $\text{Fe}_2\text{O}_3$ :  $\text{CuO}$  thin films

## 1. Introduction

metal oxide semiconductor thick film gas sensor, surface structure of the film and surface to volume ratio play very important role in sensing performance[1]. There are also known as chemiresistors. The detection principle of assistive sensors is based on change of the resistance of a thin film upon adsorption of the gas molecules on the surface of a semiconductor. The gas-solid interactions affect the resistance of the film because of the density of electronic species in the film [2]. Among this oxide, Iron oxide thin film ( $\text{Fe}_2\text{O}_3$ ) can be used in several fields. It can be employed as, for example: Gas sensors [3] due to its great sensitivity for flammable gases, its fast speed of response and its long-term stability. Photo electrochemical solar cell for solar energy conversion [4] due to its optical band gap ( $E_g = 1.9 \text{ eV}$ ), its high optical absorption coefficient ( $\alpha = 105\text{cm}^{-1}$ ) for  $\lambda > 600 \text{ nm}$  and its ability to present both conductivity type by using an appropriate doping element. Ferromagnetic films have many applications for microwave devices as well as high-density recording media [5]

Some report says  $\alpha\text{-Fe}_2\text{O}_3$ , the most stable iron oxide with n-type semiconducting properties under ambient conditions, is extensively used as gas sensor, catalysts [6].  $\text{Fe}_2\text{O}_3$  is brown or reddish brown and hence can be easily distinguished from the other oxides,  $\text{FeO}$  and  $\text{Fe}_3\text{O}_4$ , which are black. The crystal structure of both of the later oxides is based on the Fcc Bravais Lattice with lattice parameters  $a = 0.4307 \text{ nm}$  for  $\text{Fe}_3\text{O}_4$  and  $a = 0.4307 \text{ nm}$  for  $\text{FeO}$ . It has been reported that  $\text{Fe}_3\text{O}_4$  can be obtained in

polycrystalline thin films only after a certain critical thickness has been deposited which is not ideal for practical device applications. Here we report our investigations of the deposition of Fe<sub>2</sub>O<sub>3</sub> thin films RF sputtered from an iron oxide target. [7] Some papers attribute to gas-sensing properties of  $\gamma$ -Fe<sub>2</sub>O<sub>3</sub> and Fe<sub>3</sub>O<sub>4</sub> rather than to  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub>. The  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> form has been recognized as having minimal gas-sensing response[8]. Copper oxide (CuO) is one of an important semiconducting oxide with a monoclinic structure and direct band gap of 1.85 eV [9]. It has potential applications in solar cells [10], sensors [11], CuO have several advantages: (i) non-toxic nature (ii) availability and abundance of the starting materials, (iii) low production cost, (iv) p-type conductivity and (v) band gaps lie in an acceptable range for solar energy conversion [12].

The goal of this paper is deposited pure and doped iron oxide thin films with different CuO content using simple, inexpensive PLD method and study structural, electrical and sensing properties of Iron oxide thin film which deposition is carried out at room temperature (300 K). Analyzing X-ray diffraction pattern crystal structure and grain size of pure and doped iron oxide with CuO content were estimated. The Hall Effect is measured. Due to the increasing interest in gas sensing materials for sensing gases applications, electrical and sensing properties are studied

**2. Materials and Methods**

**2.1. Synthesis of Thin Films**

Iron oxide (Fe<sub>2</sub>O<sub>3</sub>) with purity (99.99 %) powder and Copper oxide (CuO), with purity (99.9 %) were used to prepped thin films. Bulk Fe<sub>2</sub>O<sub>3</sub>(1-x).CuO<sub>x</sub> samples have been prepared using of the of two material by Grinded and mixed together at a different concentration of ( x = 0 , 0.1 , 0.3 , 0.5) wt % for (10minute), then pressed into pellets with (1.2 cm) diameter using hydraulic piston type (SPECAC), under the pressure of 5 tons/cm<sup>2</sup> for 10 minutes. The pure and composite Fe<sub>2</sub>O<sub>3</sub>(1-x).CuO<sub>x</sub> thin films were prepared by pulsed laser deposition technique (PLD) at  $\lambda = 1064$  nm with energy 500 mJ peak power inside a vacuum chamber of 10<sup>-2</sup> mbar pressure, using double stage rotary pump. The films were deposited on glass and Si substrates at RT. The Nd:YAG was focused on target through the glass chamber making an angle of 45° with the target surface. The substrate is placed above the target at 3 cm distance.

**2.2. Thin Films Characterization.**

The measurement of the thickness (t) was done by optical interferometer method and is given by the following equation [13]

$$t = \frac{\Delta x}{x} \cdot \frac{\lambda}{2} \dots \dots \dots (1)$$

Where x is fringe width,  $\Delta x$  is fringe deviation path and  $\lambda$  is wavelength of laser light. Structural characterizations are carried out using X-ray diffraction (XRD) with an X-ray diffractometer (SHIMADZU 6000 X-ray diffractometer system) which records the intensity a function of Bragg's angle as. The source of radiation is Cu ( $k\alpha$ ) with wavelength ( $\lambda=1.5406\text{\AA}$ ), current (30 mA) and voltage (40 kV). The scanning angle  $2\theta$  is varied in the range of (20 – 60) degree with a speed of 10deg/min. In the case of cubic structure, the lattice constant *a* for Fe<sub>2</sub>O<sub>3</sub> thin films is calculated using the following equation [14]:

$$d_{hkl}=a/\sqrt{h^2+k^2+l^2} \dots \dots \dots (2)$$

Where  $hkl$  are Miller indices and  $d_{hkl}$  is the inter planar spacing given by Bragg's law [15]

$$2d_{hkl} \sin \theta = n\lambda, \dots\dots\dots (3).$$

Where  $n$  is the order of diffraction taken equal unity (first order) ° for CuK $\alpha$  radiation, and  $\theta$  is the Bragg diffraction angle of peak in degree. The grain size  $D$  of the films was calculated by using Scherrer's equation [16]:

$$D=0.9\lambda/\beta\cos\theta \dots\dots\dots (4).$$

Where  $\beta$  is the full width at half maximum (FWHM) corresponding to diffraction angle. To affirm the type of conductivity and its variation with CuO concentration, four-point probe were processed on sheets (1x1) cm<sup>2</sup> for the entire sample.

**2.3 Fabrication of Fe<sub>2</sub>O<sub>3</sub>: CuO Gas Sensor**

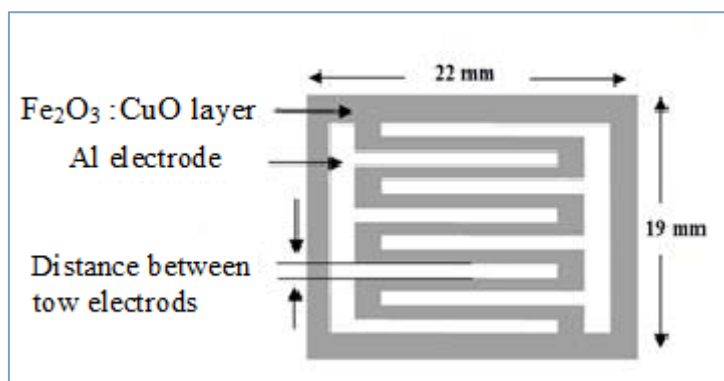
The metal-oxide gas sensor element consists of the following parts (sensitive layer, substrate, electrodes, and heater). The sensitivity toward H<sub>2</sub> gas has been measured under different concentrations CuO. The response time and recovery time of the undoped and doped Fe<sub>2</sub>O<sub>3</sub> successive tests were performed at a bias voltage of 6V and a different operating temperature. In order to fabricate the gas sensor, a special mask needs to be fixed carefully on the surface of Fe<sub>2</sub>O<sub>3</sub>:CuO layer. Interdigitated aluminum ohmic metal contacts were deposited on the Fe<sub>2</sub>O<sub>3</sub>:CuO films by using vacuum evaporation technique. Figure (1) shows the schematic diagram of Interdigitated electrodes of the Fe<sub>2</sub>O<sub>3</sub>:CuO gas sensor. In case of p- type metal oxide semiconductor the sensitivity is defined as the ratio of the change in the electrical resistance in the test gas and air,  $\Delta R = R_g - R_a$  to its resistance in the dry air ( $R_a$ ) [17].

$$S = \frac{R_a - R_g}{R_a} = \frac{\Delta R}{R_a} \dots\dots\dots (5)$$

Selectivity has been determined using equation [18]

$$\text{Selectivity} = \frac{S_{gas} - S_{air}}{S_{gas}} \dots\dots\dots(6)$$

Where  $S_{gas}$  is the sensitivity of gas and  $S_{air}$  is the sensitivity of air.



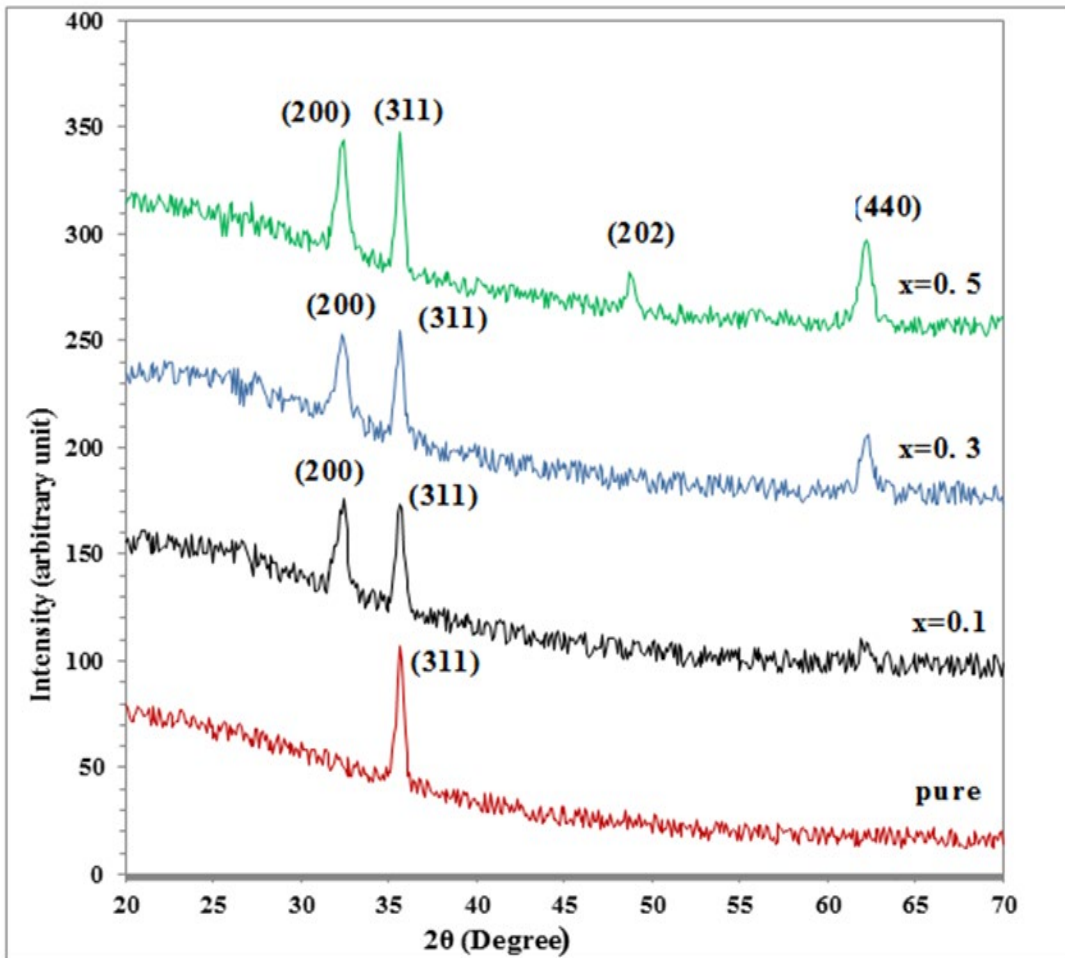
**Figure1. Schematic diagram of interdigital electrodes, for testing Fe<sub>2</sub>O<sub>3</sub>: CuO gas sensor**

**3. Results and Discussion**

**3.1. Structural Properties**

The crystalline structure for (Fe<sub>2</sub>O<sub>3</sub>)<sub>1-x</sub>(CuO)<sub>x</sub> thin films recognized by studying the phase of XRD for that material. Figures (2) shows the XRD patterns obtained for (Fe<sub>2</sub>O<sub>3</sub>)<sub>1-x</sub>(CuO)<sub>x</sub> thin films deposited on a glass substrate with thickness equal to 250 nm at RT and concentration of  $x = (0.0, 0.1, 0.3, 0.5)$  wt. According to the International

Center for Diffraction Data (ICDD), the structure of the thin films showed a polycrystalline hexagonal structure for  $\text{Fe}_2\text{O}_3$  of phase classification Rutile. The analysis verifies the reflection surfaces the reflection surfaces [(311), (220), and (440)] for  $\text{Fe}_2\text{O}_3$  and (202) for  $\text{CuO}$ . The films were crystallized with a strong peak at (311) direction corresponding to a diffraction angle of  $35.7^\circ$ , this means that this plane is acceptable for crystal growth. Table (1) gives the interplaner distance  $d$ , FWHM (Deg.), and crystallite size for the preferred orientation of our samples in comparison with the standard value as given in ICDD card. The values of  $d$  and  $2\theta$  are observed to be nearly similar to that in the ICDD cards as listed in Table (1). The crystallite sizes were calculated using equation (4) and are tabulated in Table (1). It is clear that the peaks are shifted to low angle when  $x$  content increases. It is concluded from these results of XRD that the films structure improved when the films were  $\text{CuO}$  content increased.



**Fig2. X-Ray diffraction for  $(\text{Fe}_2\text{O}_3)_{1-x}(\text{CuO})_x$  thin films at different concentration of  $\text{CuO}$**



**Table (1) Shows the peaks and its Bragg's angle, inter planar distance, and full width half at maximum for  $(\text{Fe}_2\text{O}_3)_{1-x}(\text{CuO})_x$  thin films at different contents of CuO**

X content	2 $\theta$ (Deg.)	FWHM (Deg.)	Int (Arb. Unit)	$d_{hkl}$ Exp. (Å)	G.S (nm)	$d_{hkl}$ Std.	hkl	phase	card No.
Pure	35.7000	0.7010	55	2.5130	11.9	2.5187	(311)	Fe <sub>2</sub> O <sub>3</sub>	96-210-1168
	32.4000	0.6370	46	2.7610	13.0	2.7041	(220)	Fe <sub>2</sub> O <sub>3</sub>	96-210-1168
0.1%wt	35.5000	0.5230	54	2.5267	15.9	2.5187	(311)	Fe <sub>2</sub> O <sub>3</sub>	96-210-1168
	32.4000	0.7210	47	2.7610	11.5	2.7041	(220)	Fe <sub>2</sub> O <sub>3</sub>	96-210-1168
0.3%wt	35.6000	0.5310	59	2.5198	15.7	2.5187	(311)	Fe <sub>2</sub> O <sub>3</sub>	96-210-1168
	62.1000	0.8320	29	1.4934	11.1	1.4882	(440)	Fe <sub>2</sub> O <sub>3</sub>	96-210-168
	32.2000	0.7240	58	2.7777	11.4	2.7041	(220)	Fe <sub>2</sub> O <sub>3</sub>	96-210-168
0.5%wt	35.6000	0.6320	64	2.5198	13.2	2.5187	(311)	Fe <sub>2</sub> O <sub>3</sub>	96-210-168
	48.9000	0.9610	23	1.8611	9.1	1.8672	(202)	CuO	96-721-243
	62.3000	0.5540	41	1.4891	16.8	1.4882	(440)	Fe <sub>2</sub> O <sub>3</sub>	96-210-168

### 3.2 Hall Effect Measurements

The type of charge carrier concentration ( $n_H$ ) and Hall mobility ( $\mu_H$ ), was estimated from Hall measurements. Table (2) illustrates the main parameters estimated from Hall effect measurements for  $(\text{Fe}_2\text{O}_3)_{1-x}(\text{CuO})_x$  films with different concentrations of CuO at room temperature. It is clear from this table that all samples have a negative Hall coefficient (n-type) for pure Fe<sub>2</sub>O<sub>3</sub> films, i.e. Hall voltage decreases with the increase of the current, while positive Hall coefficient (p-type) for pure CuO. When doping with CuO changes the conductivity for Fe<sub>2</sub>O<sub>3</sub> from n-type to p-type for  $(\text{Fe}_2\text{O}_3)_{1-x}(\text{CuO})_x$  films. Figures (3) and (4) show carrier concentration ( $n_H$ ) and Hall mobility ( $\mu_H$ ) as a function of CuO concentration, respectively. It is clear that the carrier concentration  $n_H$  increases with the increasing of CuO content while the Hall mobility  $\mu_H$  showed an opposite manner is deduced from Table (2).

The increase of charge carriers is essentially because of the lowering the potential barrier. The increasing of density of the carriers concentration with increasing CuO content is expected as a result of the substitution doping of CuO creating one extra free carrier in the process and so doping level increases that leads to more dopant atoms occupying lattice sites of Fe atoms resulting in more charge carriers. In contrast with the Hall mobility, it is observed that  $\mu_H$  decreases sharply with the increase of the concentration of CuO. The decrease in the mobility is due to the inverse relation between  $\mu_H$  and  $n_H$  and this behavior is typical of many polycrystalline thin films and is due to the existence of potential barriers in the grain boundaries.

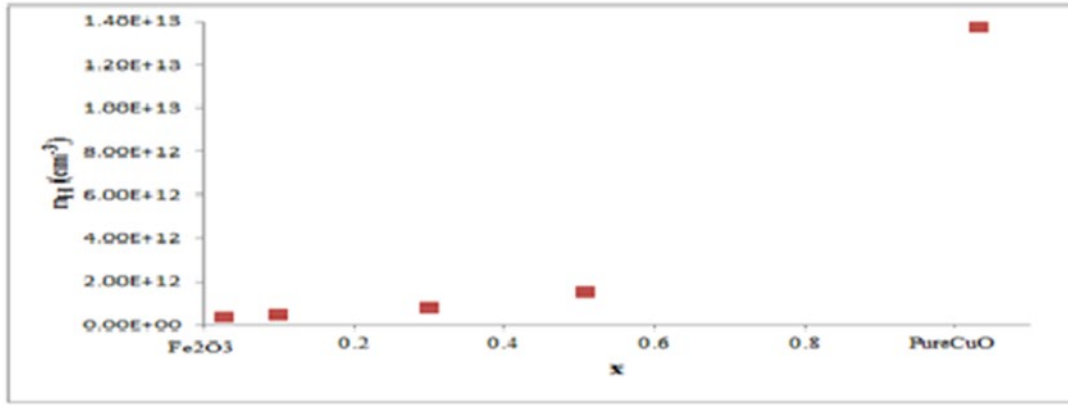


Figure3. Variation of  $n_H$  as a function of Content for  $(\text{Fe}_2\text{O}_3)_{1-x}(\text{CuO})_x$  films at RT and different concentrations of CuO

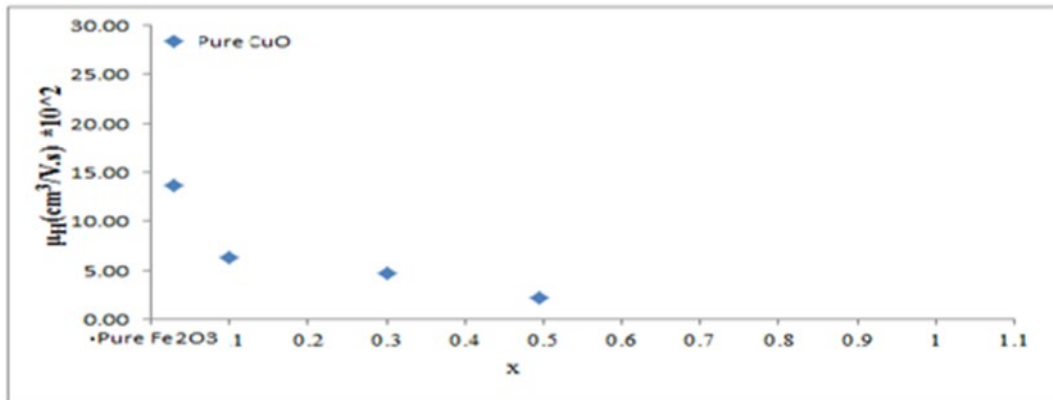


Figure4. Variation of  $\mu_H$  as a function of Content for  $(\text{Fe}_2\text{O}_3)_{1-x}(\text{CuO})_x$  films at RT and different concentrations of CuO

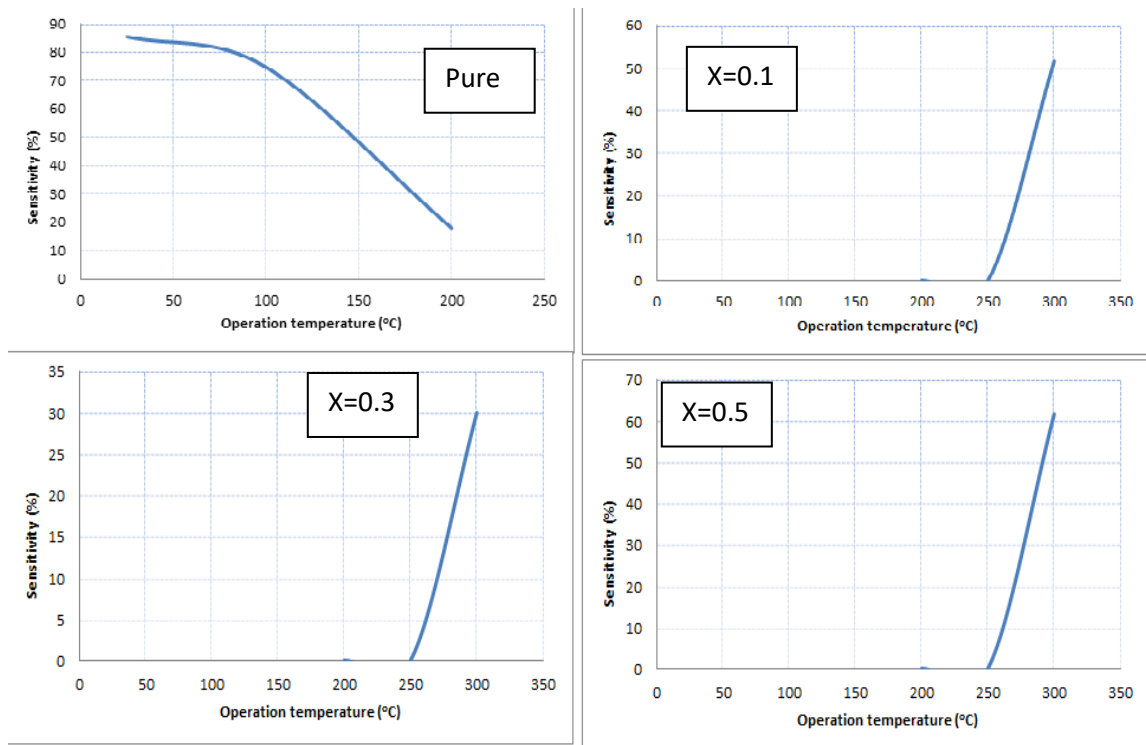
Table (2) Shows the Hall measurements results for  $(\text{Fe}_2\text{O}_3)_{1-x}(\text{CuO})_x$  thin films at different contents of CuO

Content Wt. %	Hall coefficient $R_H$ ( $\text{m}^3/\text{C}$ )	Hall mobility $\mu_H$ ( $\text{cm}^2/\text{V.s}$ )	Carrier concentration $n_H$ ( $1/\text{cm}^3$ )	type of conductivity
Fe <sub>2</sub> O <sub>3</sub>	2.510E+08	1.17E+03	2.48E+10	n-type
0.1	1.34E+07	6.300E+02	4.65E+11	p-type
0.3	8.210E+06	4.75E+02	7.613E+11	p-type
0.5	4.6E+06	1.38E+02	1.580E+12	p-type
Pure CuO	3.28E+05	2.807E+03	1.90E+13	p-type

### 3.3 Gas Sensor Properties

Figure (5): shows sensitivity with different working temperatures for pure Fe<sub>2</sub>O<sub>3</sub> and doped with different concentration of CuO. The results show that the sensitivity of Fe<sub>2</sub>O<sub>3</sub> was higher than the doping. the high sensitivity as due to H<sub>2</sub>chemisorption. The sensitivity was increasing with temperature up to 100 °C, and decreasing in (150 & 200) °C, the molecular motion and diffusion of the gas speed up because of the increase in temperature and the gas absorption and the dissociation rate of the sensor's surface

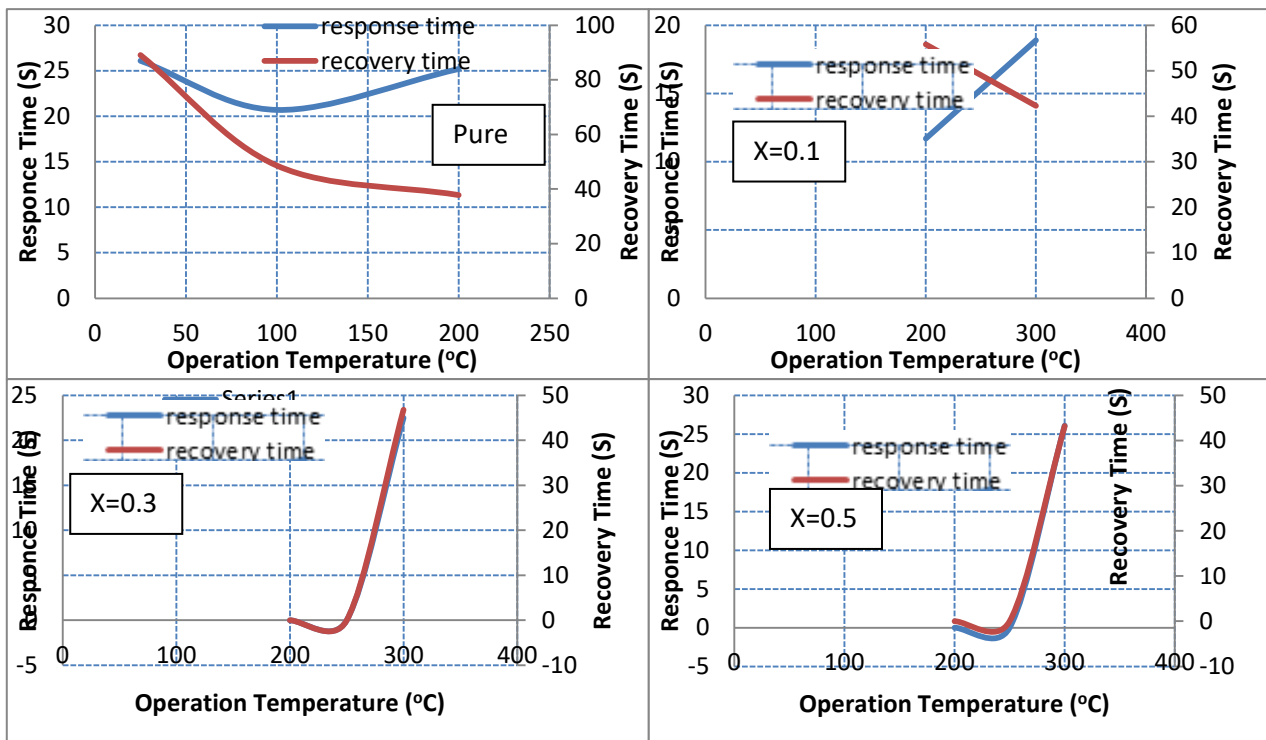
increase so the sensor sensitivity would decrease with the increasing temperature. Higher sensitivity was observed for temperature 200°C, which is considered.



**Figure (5) shows sensitivity as a function of different working temperatures for pure Fe<sub>2</sub>O<sub>3</sub> and doped with different concentration of CuO.**

These are the important parameters for designing sensor for the desired operation. The response time is defined as the time taken for the sensor to attain 90 % of the maximum change in resistance on exposure to the test gas and the recovery time is defined as the time taken by the sensor to get back to 10 % of the value of its resistance at the time of maximum resistance. In present work the response and recovery times are defined as the times required for a sensor to reach 90 % of its full response.

The response time and recovery time of the un-doped and doped Fe<sub>2</sub>O<sub>3</sub> successive tests were performed at a bias voltage of 6V and a different operating temperature. The results are shown in figure (6), shows the variation of response of Fe<sub>2</sub>O<sub>3</sub> to H<sub>2</sub> gas with operating temperature. The gas response is maximum at room temperature for . The response of Fe<sub>2</sub>O<sub>3</sub> to H<sub>2</sub> gas is 25 % at room temperature. In present work, every time prior to exposing the Fe<sub>2</sub>O<sub>3</sub> film to H<sub>2</sub>, it was allowed to stabilize at an operating temperature for 15 min and the stabilized resistance was taken as R<sub>a</sub>. After exposing the film to the Chlorine gas, the changed resistance was taken as R<sub>g</sub>. Chlorine is reducing gas. It reacts with surface oxygen ions of the film. Reduction of film increases the number of free carriers. Therefore resistance of the film decreases with reducing gas



coefficient (n-type) for pure Fe<sub>2</sub>O<sub>3</sub> films, while positive Hall coefficient (p-type) for pure CuO and when doping with CuO it is found that change the conductivity for Fe<sub>2</sub>O<sub>3</sub> from n-type to P-type for (Fe<sub>2</sub>O<sub>3</sub>)<sub>1-x</sub>(CuO)<sub>x</sub> films.

c. For gas sensing measurements, the results show that the sensitivity of Fe<sub>2</sub>O<sub>3</sub> was higher than the doping. The high sensitivity as due to H<sub>2</sub> chemisorption.

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# A SIMPLE VOICE COMMUNICATION USING THE MODULATION OF THE REFLECTED LIGHT

Akram N.Mohammed, Yasir A.Ali  
Email:akram.noori@gmail.com

## **Abstract**

There is no adopt in the importance of the optical communications in scientific civil and military applications because of its simplicity in manufacturing and it's low cost.

The method of optical communication depends upon bearing the light beam the translated information by a method called the light modulation. This method depends upon changing some light properties as frequency, amplitude and pulse duration according to the translating information.

The changes in the first two properties are concerned optically with the analog modulation while the third one concern at most with digital modulation. All past methods are expensive with low efficiency and needs electrical or magnetic fields.

In this technique the source of voice used a source of emitting light at the same time. This was done by using a reflecting microphone to reflect the incident laser beam to the receiver which was a photocell which connected to an audio amplifier. The emitting voice was clear without any type of noise with very high efficiency.

***Keyword:*** Communication by reflection simple technique high quality

## **1. Introduction**

In communications modulations is the process by which some characteristic of a carrier wave is made to vary in accordance with an information-bearing signal wave (The modulating wave)<sup>[3]</sup>. **Theory** There is a fine similarity in many aspects between light and voice waves. One of these similarities what known as Doppler effect. If light or sonic wave with a frequency / incident on a vibrating body (mechanical motion), the reflected wave will has a new frequency  $f \pm \Delta f$ <sup>[1,2,4]</sup> Change in wave frequency if will be if a constant value if the vibrating body has a constant motion, and a variable value if the motion was variant. That change in frequency because of that collision called Doppler Effect.

### **1.1 Types of modulations**

#### **1.1.1 Amplitude Modulation (AM)**

In this system the intensity or amplitude of the carrier wave (light wave) varies in accordance with the modulating signal wave .The modulating field (electric or magnetic) rotate the plane of polarization of the incident polarized wave by an amount depending upon the transmitting signal frequency changes . The output wave passed through another polarizer (which has a plane of polarization parallel to the plane of polarization of the first polarizer) which we call the analyzer. The analyzer will allow some part of the modulated wave to pass through, causing a low transmitting efficiency.

#### **1.1.2 Frequency Modulation (FM)**

In frequency modulation (FM) the frequency of the earner wave is varied in such a way that change at any instance is proportional to another signal that varies with time. This means a change in receiving wave phase. What happen really in Doppler Effect, so it calls also phase modulation

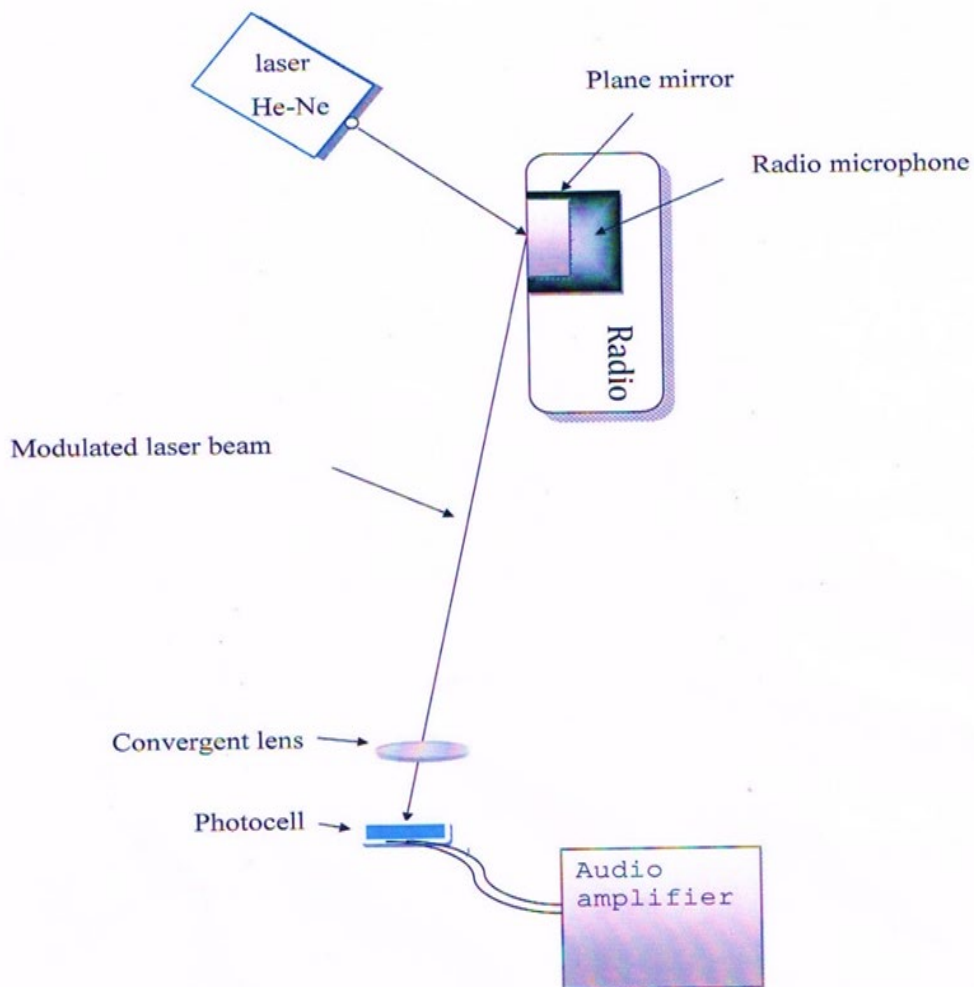
#### **1.1.3 Code Modulation**

Pulse modulation involves modulating a carrier that is a train regularly recurrent pulse. The modulation might vary the amplitude (PAM or Pulse amplitude modulation), the duration (PDM or Pulse duration modulation) or presence of the pulses (PCM or Pulse code modulation)<sup>[3]</sup>.

## 2. Discussion & Results

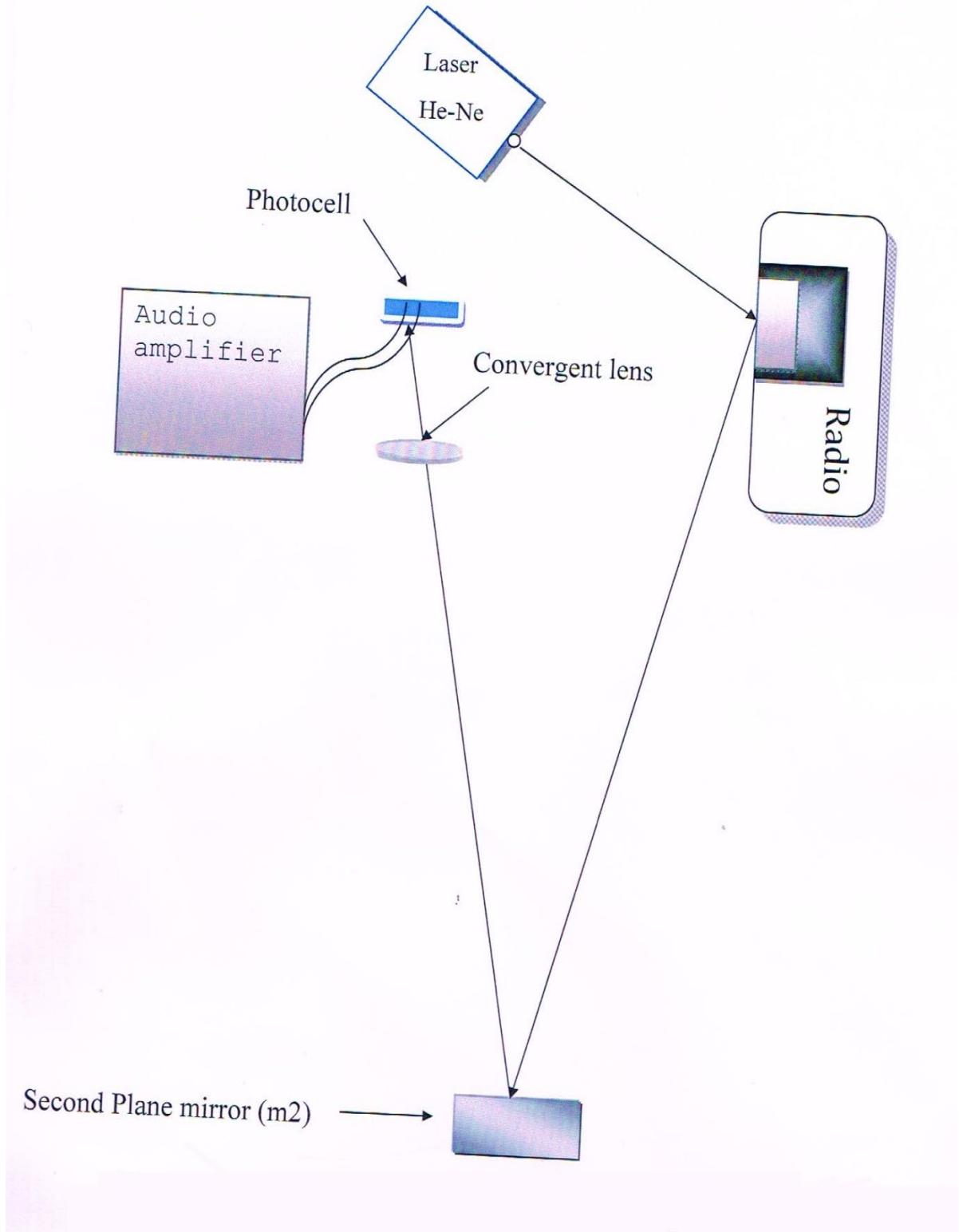
In order to avoid all known problems in acousto-optic (AO) and acoustic electro-optic (AEO) modulations the opt-mechanical technique was used. This technique depends upon making the vibrating body as a source of emitting light. This was done by adhesion a plane mirror on the face of the radio speaker. When the laser beam incident on that mirror it will be reflected to far photodiode.

**Fig1. Show the connected to an amplifier and later to another speaker.**



When the radio work the mirror will vibrate by the same frequency as the microphone do, so the incident laser beam will suffer the same changes in frequency as the speaker done. This will be clear in receiving voice by the second speaker.

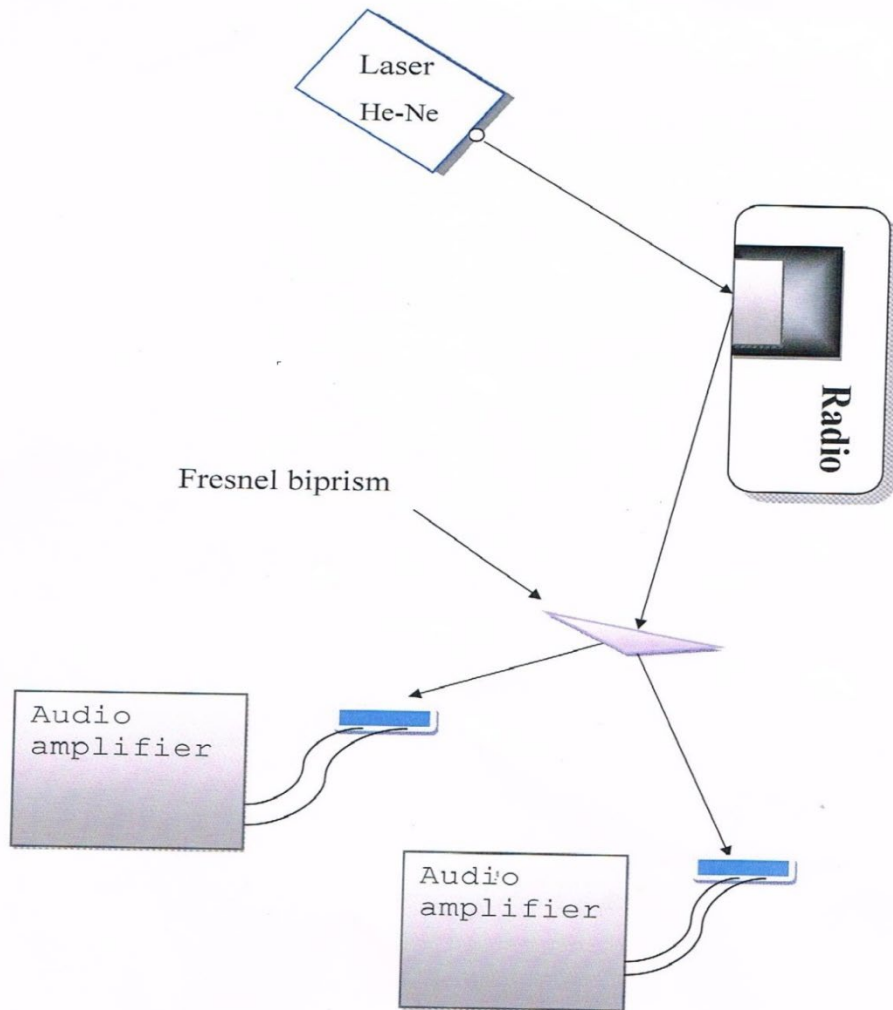
**Fig .2 showing another arrangement of experiment where the vibrating wave incident on another mirror used to change the direction of sending**



There is no change notice in efficiency



**Fig.3** showing the third type of our experiment when we split the laser beam by Fresnel biprism and sending them to two receivers. The receiving wave had a good efficiency



### 2.1. The System Efficiency Calculations

The efficiency is defined as the ratio between the received and the emitted powers. This factor in communication is affected by many factors as fog, rain, snow, scattering, light interference ....etc. All these factors are summed in one term called the attenuation (A). But the main reason that affect the transmitted beam intensity is depend upon the place of work, i.e., in cold countries the main reason that optical communication ranges have been limited to non-commercial telecommunications function is fog (10-100) dB/km attenuation.

In our country the scattering due to dust in our atmosphere [5] In order to measure attenuation which limited the efficiency we have to use Lambert-Beers law as follows:

$$T = \exp(-\alpha_e L) \tag{1}$$

Where:  $T$  = The atmosphere transmittance'

$\alpha_e$  = The attenuation coefficient in  $\text{km}^{-1}$

$L$  = The transmitting range in km

$\alpha_e$  Is the total attenuation factor where

$$\alpha_e = \alpha_{scat} + \alpha_{fog} + \alpha_{rain} + \alpha_{snow} + \alpha_{int.} + \alpha_{smoke} \quad (2)$$

In our country since scattering factor due to dust is the most effected factor we shall take it in our count.

The mathematical relation which used for our research is [6, 7]:

$$T = \frac{I_r}{I_0} \quad (3)$$

Where:

$I_r$  = Received intensity.

$I_0$  = The emitting intensity.

From equ. 1 and equ. 2 we get

$$\alpha_e = \frac{\ln(I_r / I_0)}{L} \quad (4)$$

In general the attenuation is represented as:

$$Attenuation (A_{10}) = -10 \log \frac{I_{rec}}{I_{tran}} \quad (5)$$

For visible and near infrared wavelengths another factor is used to represent the system efficiency. This factor is called visibility (V km).

Visibility is defined as the distance which the transmittance dropped to a value  $\mathcal{E}$  ( $T(V) = \mathcal{E}$ ). The world meteorological organization suggests the value 0.05 for  $\mathcal{E}$  [6, 9]

From equ.4 we have:

$$\alpha_e = -\frac{\ln 0.05}{L} = -\frac{\ln 0.05}{V} = \frac{3}{V} \quad (6)$$

For visible and near-IR, the visibility is given by the semi-empirical formula [6, 10]

$$\alpha_{scatt} = \frac{13}{V} \left( \frac{\lambda}{550} \right)^{-q} \quad (7)$$

Where:

$\alpha_{scatt}$  = The attenuation coefficient for scattering

550 = The standard wavelength for human ordinary visibility (550 nm for yellow)

$q$  Is particle size distribution factor the later studies gave that factor ( $q$ ) the following values:

$$q = \begin{cases} 1.6 & \text{if } V > 50 \text{ km} \\ 1.3 & \text{if } 6 \text{ km} < V < 50 \text{ km} \\ 0.16V + 0.34 & \text{if } 1 \text{ km} < V < 6 \text{ km} \\ V - 0.5 & \text{if } 0.5 \text{ km} < V < 1 \text{ km} \\ 1.3 & \text{if } V < 0.5 \text{ km} \end{cases} \quad (8)$$

For our country since the scattering is the measure affected factor in optical communications equ. 5 became as:

$$\frac{A_{10}}{L} = \alpha_{scatt.} = 0.4343 \alpha_e \quad (9)$$

From equ.7 and equ.8 we have:

$$V = \frac{3}{\alpha_e} \left( \frac{\lambda}{550} \right)^{-q} \quad (10)$$

In general the transmittance efficiency is given as:

$$Efficiency = \frac{I_{rec}}{I_{tran}} \times 100 \quad (11)$$

Table 1 explains measurements in different weathers

Table 1 shows one that the efficiency of the two wavelengths (650 nm and 532 nm) are nearly equal although there great difference in their output powers ( $P_{650} = 100 \text{ mW}$ ,  $P_{532} = 1000 \text{ mW}$ ), the main reason is that the scattering for shorter wavelength is larger than that for longer wavelengths.

While due to wide band of red and near-IR the effect of light interference during Sundays is greater than that their effects in  $\lambda = 532 \text{ nm}$  while in night communications this effect reduced for  $\lambda = 650 \text{ nm}$ . The left column in table 1 explained that fact.

He-Ne laser has very short range because its low emitting power which push us to use another laser *light* sources. Two diode lasers were used ( $\lambda_1=650\text{nm}$ ,  $P=100\text{mw}$ , and  $\lambda_2=532\text{nm}$ ,  $P=1\text{ watt}$ ).

First we checked their efficiency by our system for different distances. These Results are represented in table .1. Then we turn to send our voice through our new system which consisted of a translator and receiver units

The translator units consists of an amplifier (Teli TB-288A type, China) connected to a speaker, mono-internal speaker which holding a plane mirror (our reflector), and diode laser. While the receiver unit consists of an amplifier (Teli TB-188A type, China) with a loud speaker, photo diode, satellite dish which coated by a Nickel layer to focus the reflected light on the photodiode The receiving voice has high range and too clear

**Table1.The system efficiency for different distances**

Distance M	Efficiency at sunny day		Efficiency at clouded and rain day		Efficiency at clear night	
	$\lambda_1=650\text{nm}$	$\lambda_2=532\text{nm}$	$\lambda_1=650\text{nm}$	$\lambda_2=532\text{nm}$	$\lambda_1=650\text{nm}$	$\lambda_2=532\text{nm}$
0	80	80	100	100	100	1.00
30	76	78	100	100	99	99
60	74	76	99	99	98	98
90	72	74	98	98	97	97
120	70	72	96	96	96	94
150	68	70	90	94	95	92
180	65	67	88	90	92	90

### **3. Conclusion**

- Our experiment gives an ability of building a new type of telecommunication. This can be done by using a cordless microphone with the hand speaker emitting information to the speaker-phone includes the plane mirror reflect the laser beam to an optical fiber for (earth linking) or through the space to the receiver. The receiver will receive information by a cordless phone and emit his information by the same way by a system of the same design
- Another possible application as we expect is more important this is sending an ultrasonic wave through a fiber optics to open the closed artery of the hearts. This will need another study above our lab Ability

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# Algerian *Origanum vulgare* Essential oil: Chemical composition, larvicidal activity and effects on biomarker response in the larvae of *Culex pipiens*

The third axis: medical sciences

**Nadia BOUGUERRA<sup>1,2</sup>, Fouzia TINE-DJEBBAR<sup>1,2</sup>, Nouredine SOLTANI<sup>2</sup>**

<sup>1</sup>Department of Natural and Life Sciences, Faculty of Exact Sciences and Natural and Life Sciences, University of Tebessa, Algeria

<sup>2</sup>Laboratory of Applied Animal Biology, University of Annaba, Algeria

**Corresponding Author: Dr. Nadia BOUGUERRA, University of Tebessa, 12000 Tebessa, Algeria**

Nadia Bouguerra Tel: + 770 45 55 09 E-mail: [nadiabougerrabio@gmail.com](mailto:nadiabougerrabio@gmail.com)  
Fouzia Tine-Djebbar Tel: + 663 55 72 73 E-mail: [fouziatine@gmail.com](mailto:fouziatine@gmail.com)  
Nouredine Soltani Tel: + 773 38 76 33 E-mail: [nouredine.soltani@univ-annaba.org](mailto:nouredine.soltani@univ-annaba.org)

## **ABSTRACT**

In the present study, the objective was to assess the chemical composition of the essential oil obtained by hydrodistillation of dry leaves from *Origanum vulgare*, larvicidal activity and their effect on A biomarker of neurotoxicity in fourth instar larvae of *Culex pipiens*, most abundant mosquito species in Tebessa area (East-Algeria). The essential oil yield calculated from the dry matter of the aerial part of the plant was 1.70 %. Its chemical composition has been investigated by GC-MS. The analyses showed that the essential oil of *Origanum vulgare* contained twenty five (25) compounds. The major chemical component identified was carvacrol (77.66 %). Bioassay test done following the World Health Organization standard protocol revealed that this essential oil have exhibited larvicidal properties as they could induce 100% mortality in the larvae of *Cx pipiens* at the highest concentrations. The LC<sub>50</sub> and LC<sub>90</sub> values obtained at 24 hours after treatment were 13.70 and 37.00 ppm respectively. Determination of AChE activity, was carried out on newly moulted fourth instar larvae of *Cx. pipiens*, treated with two concentrations (LC<sub>25</sub> : 8.32 ppm and LC<sub>50</sub> : 13.69 ppm) of *O. vulgare* essential oil. The results show a no significant inhibition of AChE activity. This result could be useful and interesting for the new application in the production of biocides against mosquito.

**Keywords: *Culex pipiens*, *Origanum vulgare*, Essential oil, GC-MS, Toxicity, AChE.**

## **1. INTRODUCTION**

Mosquitoes are one of the most medically significant vectors, they transmit parasites and pathogens, which continue to have devastating impacts on human being (18). Some of the diseases like dengue, japanese encephalitis, filariasis, yellow fever, malaria and chikungunya are spread by mosquitoes alone (38). *Culex pipiens* (Diptera: Culicidae) is the most widely distributed species in Algeria and many countries in the world causing severe morbidity to man and animals (18). The proliferation of these diseases is due to the increasing resistance of mosquitoes to the used conventional insecticides (11). The extensive and indiscriminate application of these insecticides in mosquito contrais caused diverse problems such as environmental pollution, insecticide resistance (27) and harmful effects to non target organisms (5). To prevent proliferation of this arthropod and to improve quality of environment and public health, more attention has been focused on botanicals, which are effective, ecofriendly, biodegradable and inexpensive, and found one of the possible alternatives to synthetic insecticides (36). Approximately, 2000 plant species having a potential insecticidal value, and only 344

plant species showed insecticidal activity against mosquitoes (35). Many plant essential oils show acute toxicity, developmental disruption, repellency, and feeding deterrence against many insect species due to their complex mixtures of monoterpenoids and related phenols (6-40). The present study conducted to determine chemical composition of *Origanum vulgare* essential oil by GC/MS and to assess the efficacy of this essential oil by determining the lethality parameters. In a second series of experiments, we measured its impact on an important biomarker of neurotoxicity (AChE) against fourth-instar larvae of *Cx pipiens*, the most abundant mosquito species in Algeria particularly in Tebessa area (37).

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## **2. MATERIAL AND METHODS**

### **2.1. Plant material and extraction of the essential oil**

The fresh aerial parts of *Origanum vulgare* sample were collected January-march 2016 from (North-Algeria). The air-dried aerial parts of the plant were submitted for 3h to steam distillation, using a Clevenger type apparatus according to the method recommended in the British Pharmacopoeia (9).

### **2.2. Gas chromatography–mass spectrometry analysis**

(GC/MS) analysis were performed with an HP Agilent 2890 plus gas chromatograph (GC) equipped with a HP-5MS column (a length of 30 m × internal diameter of 0.25 mm, and 0.25 mm film thickness) and used the helium as carrier gas.

### **2.3. Mosquito rearing**

*Culex. Pipiens* eggs and larvae were collected from untreated areas located at Tebessa (East-Algeria). Each 20 larvae were kept in pyrex storage jar containing 150 mL of stored tap water and maintained at temperature between 25 - 27 °C. Larvae were daily fed with fresh food consisting of a mixture of Biscuit Petit Regal-dried yeast (75:25 by weight) (34), and water was replaced every three days.

### **2.4. Treatment and insecticidal activity**

Newly ecdysed fourth-instar larvae of *Cx pipiens* were exposed to different concentrations (6.25, 12.5, 25, and 50ppm) for *O. vulgare* EOs according to the World Health Organization standard procedure (4 - 39). Controls were exposed using 1 ml of ethanol in 150 ml of water. Mortality was registered after 24, 48 and 72h of treatment. The mortality percentage obtained was corrected (1). Lethal and sublethal concentrations ; 95% confidence limits (95% CL) and slope of the concentration-mortality were estimated.

### **2.5. Biomarker assay**

The LC<sub>25</sub> and LC<sub>50</sub> at 24h, were applied on fourth instar larvae and its effects examined on AChE activity measured at various times (24, 48 and 72 h) following treatment. The AChE activity was determined using acetylthiocholine as a substrate according to the method of Ellman *et al.* (19) as previously described (23). In brief, larvae heads were homogenized in the detergent solution D. The AChE activity was determined by UV spectrophotometry from the absorbance changes at 412 nm for 20 min.

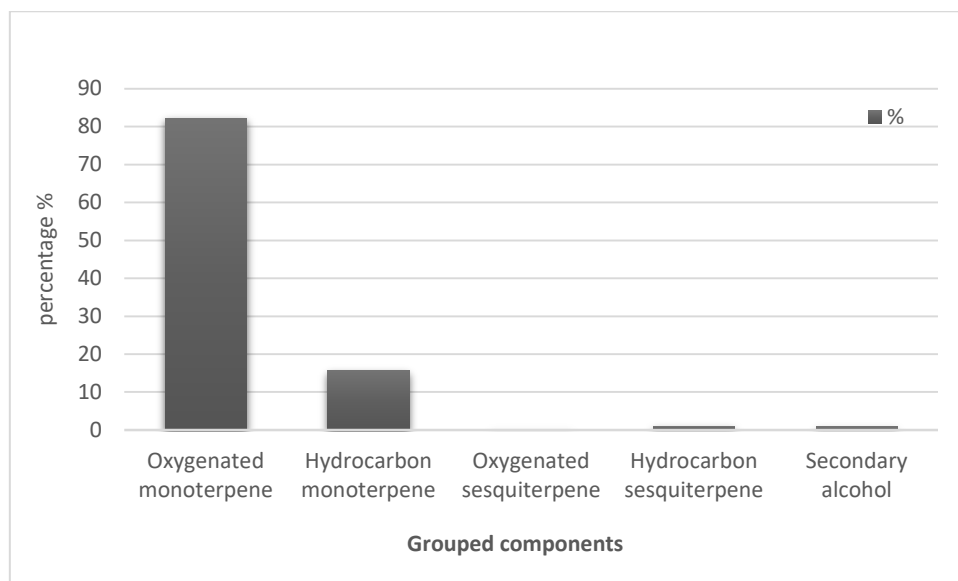
### **2.6. Statistical analysis**

The number of individuals tested in each series is given with the results. Data are presented as the mean  $\pm$  standard deviation (SD). The significance between different series was tested using Student's *t* test. All statistical analyses were performed using Prism v 6.01 for Windows (Graph Pad Software Inc., www.graphpadwith a significant level  $p \leq 0.05$ ).

### 3. RESULTS AND DISCUSSION

#### 3.1. Extraction yield and chemical composition of essential oil

The essential oils isolated by hydrodistillation from the aerial parts of *O. vulgare* was found to be a pale yellow liquid, obtained in yield of 1.70 %. The GC-MS analysis resulted in the identification of twenty five (25) compounds for *O. vulgare*. The major constituents of the essential oils mainly belonged to five chemical groups (Fig.1) : In particular, oxygenated monoterpenes; monoterpene hydrocarbons; sesquiterpene hydrocarbons; oxygenated sesquiterpenes and Secondary alcohol. The dominant components identified was Carvacrol (77.60 %). Our results are in agreement with some other studies (26-21). While, Belhatteb *et al.*, (8) found that the EO of *O. glandulosum* grown in Setif (East-Algeria) contains 29 compounds and the major components were carvacrol (47 %), followed by g-terpinene (13.4 %), p-cymene (11.2 %) and thymol (6.6 %), respectively. The results of Daferera *et al.*, (12) and Hussain *et al.*, (25) showed that thymol was the major component of *O. vulgare* EOs. However, The diversity and variability observed in the chemical composition of the EOs can be explained by, climatic and soil variations, stage of the vegetative cycle, geographical regions, seasonal variation, and the method of extraction (41).



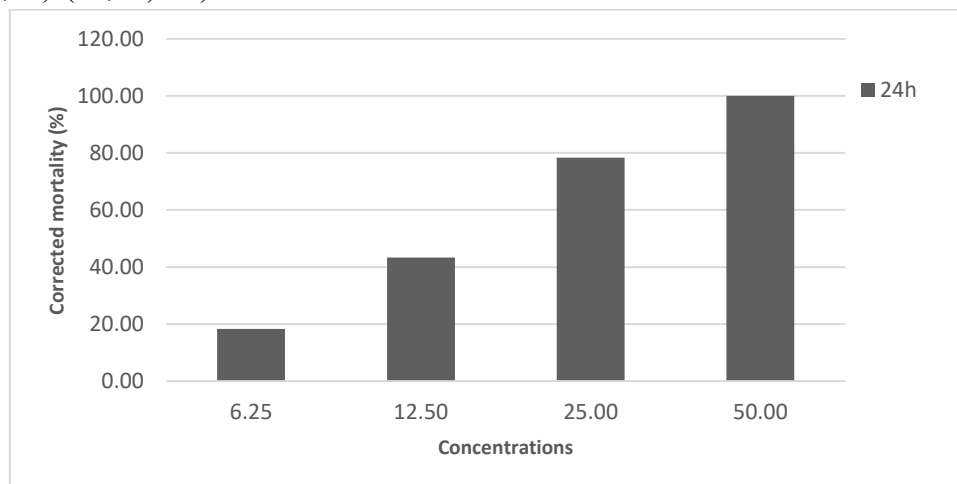
**Figure 1.** Chemical groups of essential oil constituents of *O. vulgare*

#### 3.2. Insecticidal activity

Many plant essential oils exhibit acute developmental disruption, repulsion, food deterrence and lethal insect toxicity (30). This last activity has been studied in relation to the larval stage of mosquitoes (32). In this investigation, *O. vulgare* essential oils were tested against fourth instar larvae of *Cx pipiens*. Our results indicated that essential oils presented an insecticidal activity at 24 hours after treatment against *Cx pipiens*



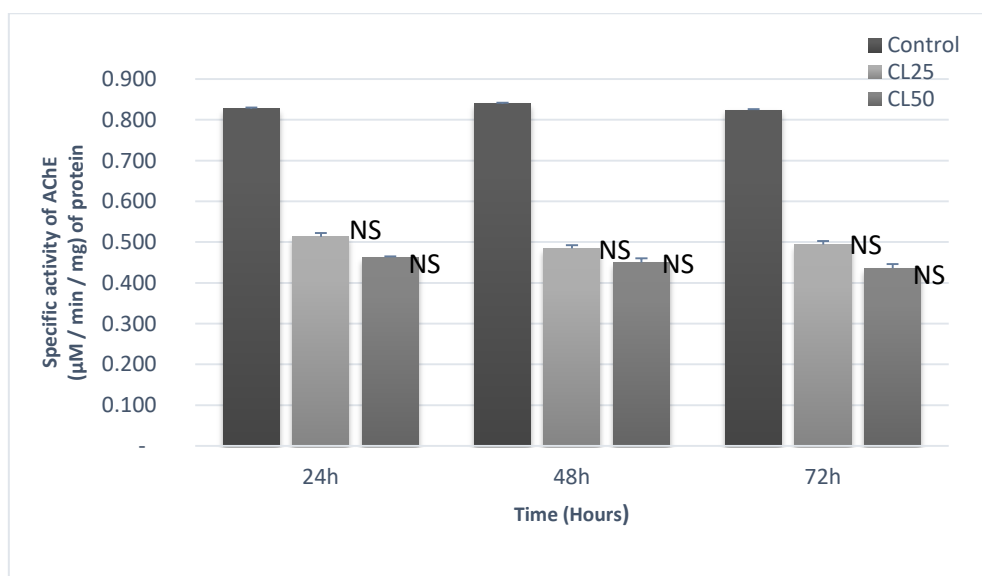
larvae with dose-response relationship (Fig. 2). Similar studies on different species of *Origanum* showed a good effects on mortality of *Cx pipiens* larvae (38-10-15). In addition, previous studies on other Lamiaceae species are in agreement with our study (7-(16,17)-(13,14)-22).



**Figure 2.** Efficacy of essential oil of *O. vulgare* applied on fourth instar larvae of *Cx pipiens* : corrected mortality ( $m \pm SD$ ,  $n = 5$  repeats each containing 20 individuals).

### 3.3. Effect on AChE activity

Acetylcholinesterase is an enzyme that can block the neurotransmitter acetylcholine at the synaptic cleft (20-29). The rise of the acetylcholine concentration in the synapse and excessive neuro excitation cause prolonged binding of acetylcholine (ACh) to its postsynaptic receptor resulting in intoxication, including restlessness, hyperexcitability, tremors, convulsions and paralysis, finally, leading to death (33). In our study, the sublethal and lethal concentration at 24h ( $LC_{25}$  and  $LC_{50}$ ) were applied on fourth instar larvae and its effects examined on AChE at various times (24, 48 and 72 h) following treatment (Fig.3). The present study shows no significant decrease ( $p > 0.05$ ) of the AChE activity in the treated series ( $LC_{25}$  and  $LC_{50}$ ) during the tested period (24, 48 and 72 hours). Our results are similar to those obtained by Al-Sarar *et al.*, (3) showing that EOs of *Mentha longifolia* and *Lavandula dentata* inhibited the AChE activity in *Callosobruchus maculatus* adults. EL Kady *et al.*, (18) found that AChE activity was decreased in *Cx pipiens* and *Anopheles multicolor* after 24 h of treatment for both two bio-insecticides (Spinotoram and Vertemic) and Methomyl. Fenchone and camphor were reported as AChE inhibitors in many species of insects such as : *Sitophilus oryzae*, and *Tribolium castaneum* (2-29). Kostyukovsky *et al.*, (28) found that EOs bind to receptors of AChE and octopamine in insects and was offered the second receptor is the main target for the Eos. The AChE was also inhibited in the treated insects by pulegone and 1, 8-cineole (31). While, Hu *et al.*, (24) reported that 1,8-cineole inhibited AChE activity and caused the accumulation of excessive acetylcholine in the synaptic gap, which might be one of the reasons for killing larval mites of *Sarcoptes scabiei var. cuniculi*.



**Figure 3.** Effect of *O. vulgare* essential oils (LC25 and LC50) applied on fourth instar larvae of *Cx. pipiens* on the activity of acetylcholinesterase (mean  $\pm$  SD.;  $\mu\text{M}/\text{min}/\text{mg}$  proteins; n = 4) (NS : P > 0,05) .

#### 4. CONCLUSION

In the present study, it can be concluded that the essential oils of *O. vulgare* with Carvacol as major compound was found to exhibit potent larvicidal activity against *Cx pipiens* larvae. Moreover, this essential oil presented a no significant effect on AChE. Further studies on commercial preparation of repellent products and field trials are needed to recommend the development of ecofriendly chemicals from this plant based oil for mosquito control and protection against the bites of haematophagous insects.

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# Studying Structural, Optical and Electrical Properties of (CdO)<sub>1-x</sub>(AgO)<sub>x</sub> thin films Prepared by Pulse Laser Deposition (PLD)

Ghuson H.Mohammed\*, Noha. H. Harb\*\*, Ahmed Saleh Ahmed AL ali\*, Ban S. Ismael\*

\*Physics Department , College of Science, University of Baghdad, Iraq.

\*\*Physics Department, College of Science for Women, University of Baghdad Iraq

## **Abstract:**

Pure CdO thin films doped with different concentration of AgO (0, 0.1, 0.2, 0.3, 0.4) % wt deposition on glass substrates using a PLD method. The crystalline structure of CdO doped AgO thin film at room temperature was determined by X-Ray diffraction analysis. The pure films and doped was polycrystalline. Strong directional high (110) and increase affected slightly with increasing concentration of AgO. The results of the optical tests showed determent by optical microscopy of wavelengths (300-1100) nm, transmission and energy gap for all deposited increases with increasing of AgO contents while absorption coefficient is decreased. The electrical conductivity measured for films on thickness (250) nm. The analysis of the d.c. conductivity decreases when the concentration of AgO increases.

**Keywords:** Cadmium oxide, Conductivity, Pulse Laser Deposition

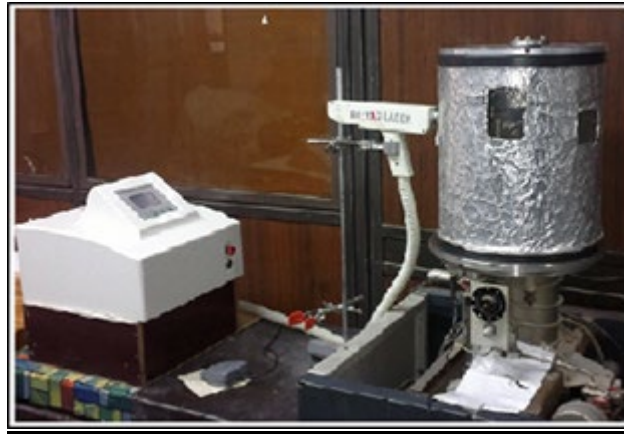
## **1. Introduction**

Thin film is a major contribution to the study of semiconductors and many physical and chemical properties have been identified to determine their use in various applications [1]. The film is said to be thin if its thickness is less than 100 nm [2]. There are many varieties of considerations to the selection of a specific technology for the deposition of thin. There are many deposition processes and techniques thin films such as vacuum evaporation, plasma processes, chemical vapor deposition (CVD), pulsed-laser deposition...etc. [3]. Pulsed laser deposition was used for growing thin films since mid-1960 [4]. When the pulsed laser beam is focused on the target surface, it absorbs the electromagnetic beam and evaporates the target material [5]. The materials evaporation that are prepares in this method are very exciting and varied. Plume plasma like to the rocket exhaust and he expands away from the target with a strong forward-directed velocity distribution of the different particles. In plod vacuum chamber is a vacuum or background gas like oxygen [6, 7]. The Cadmium oxide has absorption and emission elevated from II to VI set of semiconductors [8]. CdO semiconductor n-type with band gap of 2.5 eV[9]. Silver has been valued throughout history for many of its properties that are useful to humans .There are different phases of silver oxide including Ag<sub>2</sub>O, Ag<sub>3</sub>O<sub>4</sub>, Ag<sub>4</sub>O<sub>3</sub>, and Ag<sub>2</sub>O<sub>3</sub> [10]. The interaction with oxygen and with different crystalline structures. Thermos observable and stable phases are Ag<sub>2</sub>O and addition, we can found widely studies of thin films owing to their wide range of applications [11]

## **2. Material and Methods**

CdO from Nano shell Company mixed together with and different concentration of AgO (0, 0.1, 0.2, 0.3,0.4 ) wt%, mixed together by a gate mortar for one hour. The hydraulic piston type (SPECAC) using to made pellets with (1cm) diameter and (0.2 cm) thick beneath pressure of

(5 tons) for (60 sec) and sintered temperature (500 C) for 3 hours. Glass slides used for deposit of  $(\text{CdO})_{1-x}(\text{AgO})_x$  thin films. The deposition experiment into a vacuum chamber generally in  $(10^{-3}$  mbar) Using laser beam Nd:YAG in power 800 mJ with at 1064 nm , repetition frequency (6 Hz), for 500 laser pulses. Figure (1) shows the pulsed laser deposition. In order to study the UV-Visible near IR absorption spectrum by using optical measurements and the (SHIMADZU 6000 X-ray diffractometer system) measurement structural properties. Mask is put on glass substrates to deposit the aluminum using sensitive digital electrometer type keithley (616) and electrical conductivity measurement by electrical oven.



**Figure. (1) The Pulse Laser Deposition (PLD)**

**3. Results and discussion**

The crystalline structure for  $(\text{CdO})_{1-x}(\text{AgO})_x$  thin films recognized by studying the phase of XRD for that material. Figure (2) shows the XRD patterns obtained for CdO and different concentration of AgO (0, 0.1, 0.2, 0.3,0.4 ) wt%, deposited on a glass substrate with thickness equal to 250 nm at RT . The results of the pure thin film and doped show the is a polycrystalline hexagonal for CdO of phase classification Rutile. Agree to the International Center for Diffraction Data (ICDD. The analysis verifies the reflection surfaces the reflection surfaces [(311), (202),(400) and (404)] for CdO . The films were crystallized with a strong peak at ((222),) direction corresponding to a diffraction angle of  $38.509^\circ$  for Cdo: AgO thin films, this means that this plane is acceptable for crystal growth. Table (1) gives the interplaner distance d, FWHM (Deg.) and crystallite size.. The values of d and  $2\theta$  are observed to be nearly similar to that in the ICDD cards and the crystallite sizes were calculated using scherre equation [12].

$$D = \frac{0.94\lambda}{\beta \cos\theta} \dots \dots \dots (1)$$

Where (D) the crystallite size,(  $\lambda$ ) wavelength, ( $\theta$ ) the degree of the diffraction peak, and ( $\beta$ ) full width half maximum.

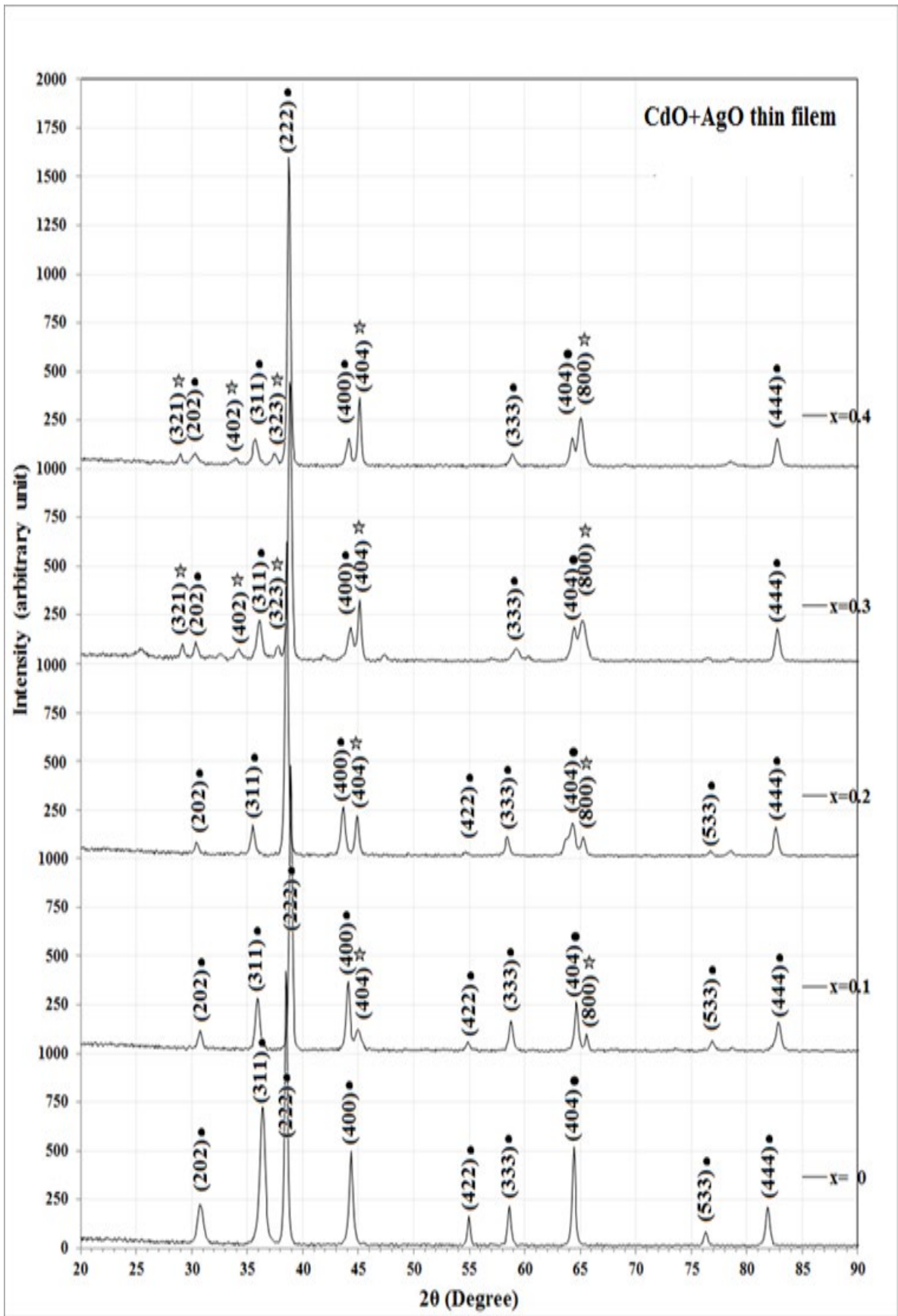


Figure.( 2) The XRD patterns for CdO<sub>1-x</sub>AgO<sub>x</sub> thin films deposited by PLD.



**Table .1 Represents the results of XRD indicate grain size the diffraction angle for CdO<sub>1-x</sub>AgO<sub>x</sub> thin films**

Xwt	2θ (Deg.)	FWHM (Deg.)	d <sub>hkl</sub> Exp.(Å)	G.S (nm)	hkl	d <sub>hkl</sub> Std.(Å)	Phase	Card No.
AgO=0	36.3660	0.5149	2.4685	16.2	(311)	2.4656	CdO	96-900-2123
	38.5095	0.2567	2.3359	32.8	(222)	2.3607	CdO+AgO	96-900-2123
	44.3498	0.4113	2.0409	20.9	(400)	2.0444	CdO	96-900-2123
	64.4096	0.3430	1.4454	27.4	(404)	1.4456	CdO	96-900-2123
	30.7650	0.3722	2.9039	20.7025	(311)	2.8912	CdO	96-900-2123
	35.9403	0.4036	2.4967	30.2762	(222)	2.4656	CdO	96-900-2123
AgO=0.1	38.9018	0.2784	2.3132	23.3620	(400)	2.3607	CdO+AgO	96-900-2123
	44.0658	0.3670	2.0534	14.1018	(404)	2.0444	CdO	96-900-2123
	58.7646	0.3722	1.5700	23.2438	(404)	1.5738	CdO	96-900-2123
	64.6529	0.4046	1.4405	33.6475	(800)	1.4456	CdO	96-900-2123
AgO=0.2	30.4320	0.4042	2.9349	19.1754	(311)	2.8912	CdO	96-900-2123
	35.4973	0.4352	2.5269	29.9739	(222)	2.4656	CdO	96-900-2123
	38.5443	0.2809	2.3338	21.0499	(400)	2.3607	CdO+AgO	96-900-2123
	43.6377	0.4067	2.0725	24.3611	(404)	2.0444	CdO	96-900-2123
	58.4264	0.4041	1.5783	16.7627	(404)	1.5738	CdO	96-900-2123
	64.2854	0.5599	1.4479	23.3223	(800)	1.4456	CdO	96-900-2123
AgO=0.3	30.3860	0.4345	2.9393	14.1304	(402)	2.8912	CdO	96-900-2123
	34.2071	0.5885	2.6192	16.9145	(311)	2.5616	CdO	96-900-0618
	36.0947	0.4942	2.4864	38.6395	(323)	2.4656		96-900-2123
	36.9968	0.2169	2.4278	27.1144	(222)	2.4424		96-900-0618
	38.8345	0.3108	2.3171	14.6606	(400)	2.3607	CdO+AgO	96-900-2123
	44.2961	0.5853	2.0432	27.5833	(404)	2.0444	CdO	96-900-2123
	59.2262	0.7101	1.5589	19.0063	(404)	1.5738	CdO	96-900-2123
	64.3939	0.4941	1.4457	13.2155	(800)	1.4456	CdO	96-900-2123
AgO=0.4	82.7695	0.4626	1.1652	26.4623	(321)	1.1803	CdO	96-900-2123
	30.3120	0.5875	2.9463	15.8203	(402)	2.8912	CdO	96-900-2123
	33.8957	0.5252	2.6425	15.9486	(311)	2.5616	CdO	96-900-0618
	37.4456	0.4334	2.3998	30.3054	(222)	2.4424	CdO	96-900-0618
	38.7474	0.2780	2.3221	19.6904	(400)	2.3607	CdO+AgO	96-900-2123
	44.1087	0.4355	2.0515	30.1956	(404)	2.0444	CdO	96-900-2123
	58.8917	0.5257	1.5669	23.3897	(404)	1.5738	CdO	96-900-2123
	64.2562	0.4012	1.4484	17.8181	(800)	1.4456	CdO	96-900-2123

**Figure(3) Shows the transmittance spectra for pure CdO samples doped with**

different AgO content, it can be observed that the transmittance increases with increasing  $\lambda$  for all prepared thin film. Also the transmittance increases with increasing of AgO.

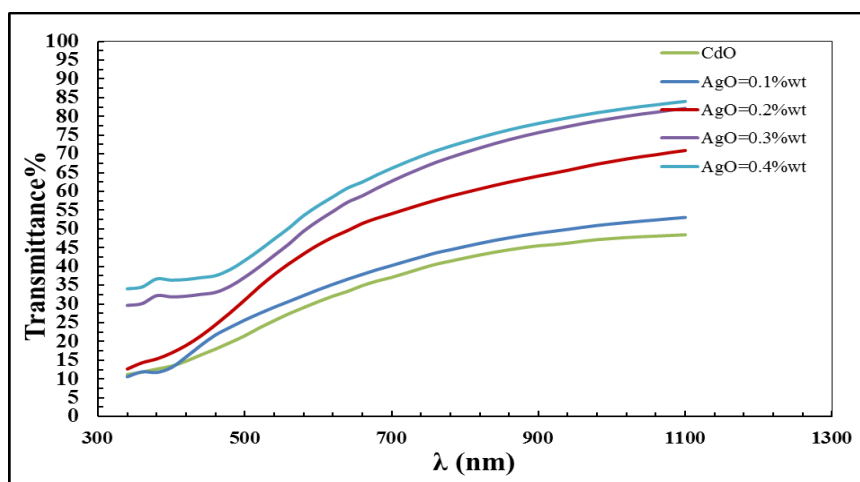


Figure (3) Transmission spectra for  $\text{CdO}_{1-x}\text{AgO}_x$  thin films

Figure (4) shows absorption Coefficient spectra for  $\text{CdO}_{1-x}\text{AgO}_x$  Thin Films. One can see from these figures that the absorption coefficient is a strong absorption at the short wavelength region between 300nm -500nm and sharp edge on the long wavelength side from 500nm–1100nm. The wavelength shorter in absorption coefficient high values of  $\alpha$  ( $\alpha > 10^4$ ). The transition is allowed direct when  $\alpha$  decreases with increasing of wavelength and decreases with increasing of AgO content. The results are same in the previous mention that the transmission is increased with increasing of x content.

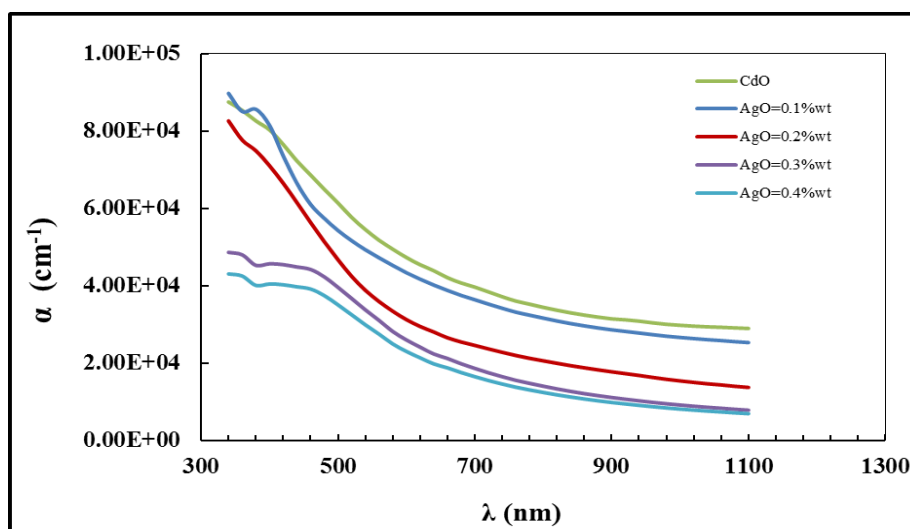


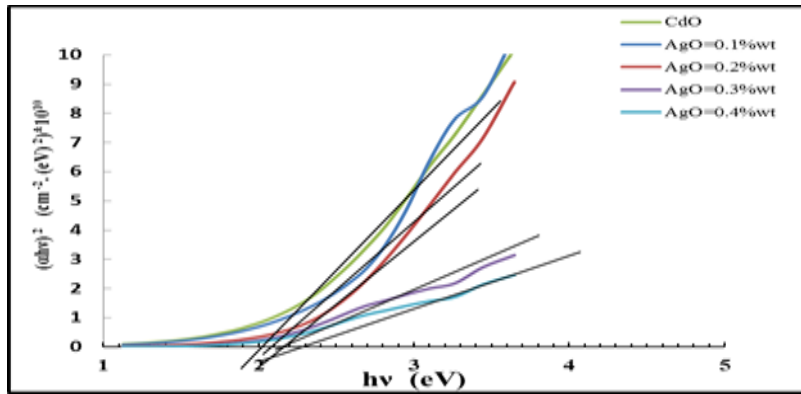
Figure (4) Absorption coefficient spectra for  $\text{CdO}_{1-x}\text{AgO}_x$  thin films

The value of optical energy gap ( $E_g^{\text{opt}}$ ) for all thin films on glass substrata determine by using Tauc equation [13].

$$\alpha(h\nu) = B(h\nu - E_g)^r \dots \dots \dots (2)$$

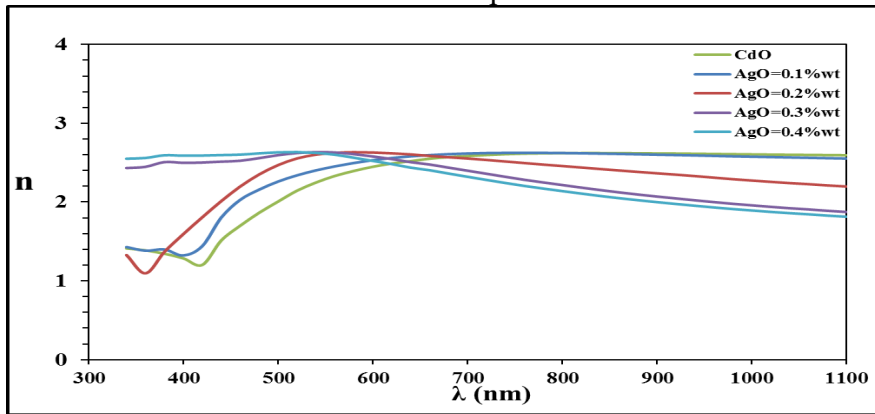
Where: ( $B$ ) is constant involving the properties of the bands, ( $\nu$ ) frequency of incident photon, ( $r$ ) is a constant depending on the nature of transition.

The optical energy determined by using the extrapolation of the portion at  $(\alpha h\nu)^2 = 0$ . Figure (5) show that the value of  $E_g$  increases with increasing of AgO content.



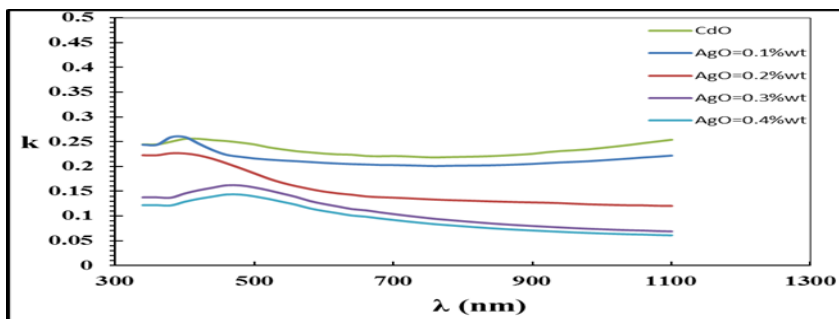
**Figure (5) Optical energy gap vs. photon energy for CdO<sub>1-x</sub>AgO<sub>x</sub> thin films**

Figure (6) show the refractive index increases with increasing of content of AgO and this behavior is due to the increase the energy gap. It is found from these figures, that the behavior of refractive index is nonsystematic and the first region of refractive index increases with increasing wavelength, second region exceeding the wavelength decreased in the refractive index of the films depended on concentration value.



**Figure(6). Refractive index spectra for CdO<sub>1-x</sub>AgO<sub>x</sub> thin films.**

Figure (7) shows the extinction coefficient (k) for CdO thin film and at different AgO content on RT temperature. Extinction coefficient (k) decreases when increases doped because depends absorption coefficient.



**Figure (7) Extinction Coefficient spectra for CdO<sub>1-x</sub>AgO<sub>x</sub> thin films.**

Figures (8) and (9) show real and imaginary dielectric constant spectra for

CdO<sub>1-x</sub>AgO<sub>x</sub> thin films at room temperature ,the values  $\epsilon_r$  and  $\epsilon_i$  from equation [14].

$$(n - ik)^2 = \epsilon_r - i\epsilon_i \dots \dots \dots (3)$$

Where

$$\epsilon_r = n^2 - k^2 \dots \dots \dots (4)$$

And

$$\epsilon_i = 2nk \dots \dots \dots (5)$$

It is clear that  $\epsilon_r$  and  $\epsilon_i$  for CdO<sub>1-x</sub>(AgO)<sub>x</sub> films decreases with increasing of the content.

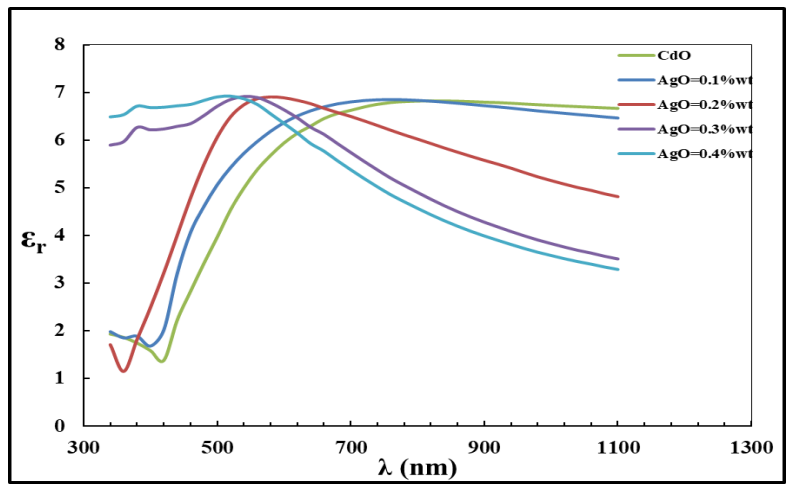


Figure.(8) The real part of dielectric constant spectra for CdO<sub>1-x</sub>AgO<sub>x</sub> thin films

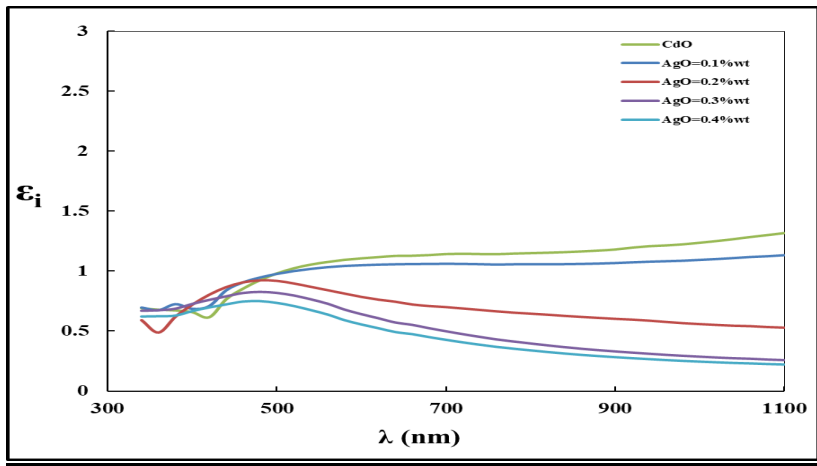
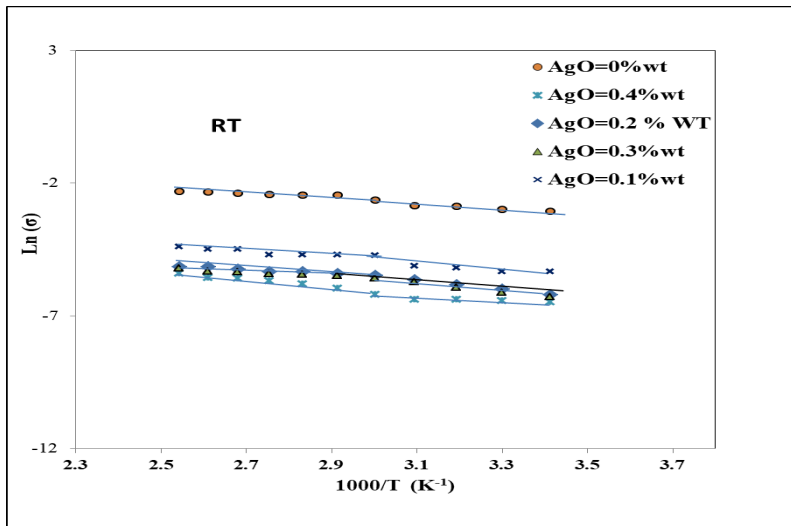


Figure.(9) The imaginary part of dielectric constant spectra for CdO<sub>1-x</sub>AgO<sub>x</sub> thin films

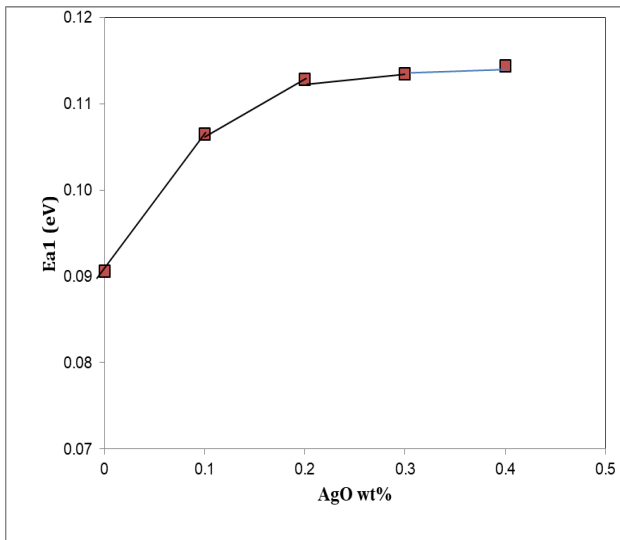
Figures (10) show the variation of DC conductivity with reciprocal temperature for pure and doped CdO films with AgO deposited by pulses laser on glass substrates with different doping ratio (0, 0.1, 0.2, 0.3, and 0.4%) room temperature were carried out in the temperature range 373-473K .



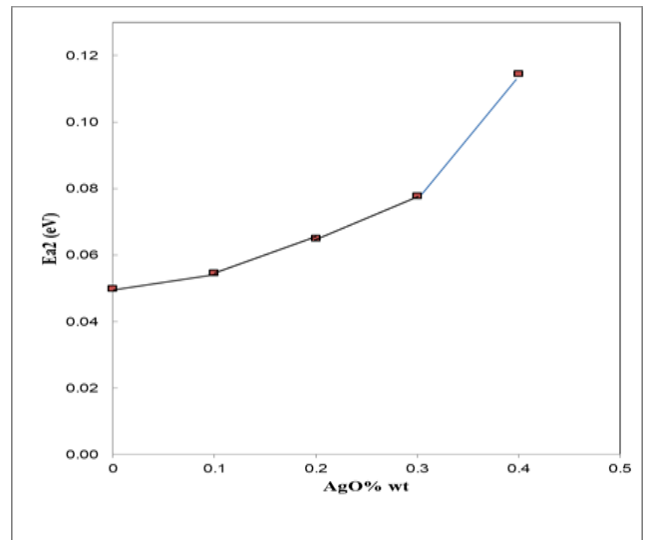
**Figure.(10 )Variation of Ln ( $\sigma$ ) with reciprocal temperature for as deposited CdO films**

**With different AgO dopant ratio (0, 0.1, 0.2, 0.3 and 0.4) % wt.**

**Figures (11, 12) shows that two activation energies  $E_{a1}$  and  $E_{a2}$ . From d.c measurement we can see that the conductivity decreases with the increase of the AgO content, the decreasing of conductivity with doping is due to the creation of impurity levels inside the band gap, which leads to decrease carrier's concentration.**

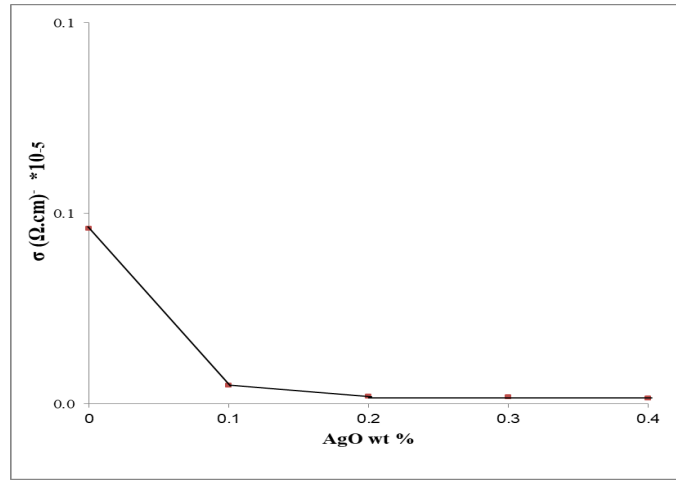


**(a)**



**(B)**

**Figure (11) Variation of DC activation energies  $E_{a1}$  and  $E_{a2}$  with reciprocal temperature for as deposited CdO films with different AgO dopant ratio ( 0, 0.1, 0.2, 0.3 and 0.4) % wt.**



**Fig (12) Variation of DC Conductivity at room temperature with reciprocal temperature for as deposited CdO films with different AgO dopant ratio (0, 0.1, 0.2, 0.3 and 0.4) % wt.**

**Table (2): The D.C conductivity for CdO films with different AgO ratio ( 0, 0.1, 0.2, 0.3 and 0.4) % wt.**

X( wt)	$E_{a1}$ (eV)	Range (K)	$E_{a2}$ (eV)	Range (K)	$\sigma_{RT}$ ( $\Omega \cdot \text{cm}^{-1}$ )
0	0.0906	293-373	0.0499	373-473	4.60E-02
0.1	0.1065	293-373	0.0545	373-473	4.76E-03
0.2	0.1128	293-373	0.0650	373-473	2.02E-03
0.3	0.1134	293-373	0.0778	373-473	1.84E-03
0.4	0.1144	293-373	0.1145	373-473	1.52E-03

#### 4. **Conclusion**

The fabricate  $(\text{CdO})_{1-x}(\text{AgO})_x$  thin films at room temperature on a glass substrate by pulse laser deposition technique at different concentration of AgO ( $x= 0, 0.1, 0.2, 0.3, 0.4$  ) wt.%. The structural properties of the prepared thin Films showed that are high quality polycrystalline and exhibited (222). Thin film have allowed direct transition and the optical energy, refractive index increases and real part dielectric constant with increasing concentration of AgO, While the Extinction Coefficient decreases. The d.c conductivity at temperature range (373-473)K decreases with increasing of the CuO.

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# **“Bionic; Biomimicry, Biomorphism, and Biophilia Architecture; the revolution of green building conceptual approach”**

Dr. Ayman Abdelazim Ibrahim Melouk  
NKY Architects & Engineers

[Amlok07@gmail.com](mailto:Amlok07@gmail.com)

## **Abstract**

“When we look at what is truly sustainable, the only real model that has worked over long periods of time is the natural world.” A biologist Janine Benyus - the President of the Biomimicry Institute. People have natural needs for contact with nature basic in fact of their physical and mental healthy life, their productivity and wellbeing. Reaching their needs from nature life originates in the existing built environment since long history is part of recalling “biologic design”. All people have improved in a natural not artificial or human constructed world. While, our senses, our emotions, and even our intellect developed in close association with nature. How architecture can get us in touch with nature and environment?

Off course, people in modern life living and sharing each other in constructed building, spending on average 90% of our time. This atmosphere become the built environment where we. Unfortunately, lot of these new buildings and cities also have become places of comprehensive environmental damage and increasing separation if not banishment from nature life.

Biological Biomimicry is the imitation of the models, systems, and elements of nature for the purpose of solving complex human problems; biomimicry Biomorphism, and Biophilia in architecture and manufacturing is the practice of designing buildings and products that simulate or co-opt processes that occur in nature. Countless analogies can be found in the architecture of all ages. The examination and application of nature’s materials, the symbolic or structural transfer of natural form, the interrelation of the edifice with the environment, all these aspects have been considered by builders at all times.

**Keywords: Bionic Architecture; Biomimicry Architecture, Biomorphism Architecture, Biophilia Architecture, Green Building.**

## **1. Introduction**

Steve Jobs, 2011 said: “*I think the biggest innovations of the 21st century will be at the intersection of biology and technology*”<sup>1</sup>. Majority of people recognize the potential for relevant lessons to be learned from nature, at the same time conceding both the limitations of such lessons and our need to be selective. Humans have always looked to nature for design inspiration and bionic can be a powerful concept and a practical tool in the development of new. And all successful environmentalists are recognizing when lessons from nature are relevant and valuable. Of course, they exhibit one or more physical (structural, mechanical, electrical, thermal and magnetic) or chemical (adhesive, reactive, catalytic and non-reactive) properties that are optimized for a particular application. The main problem for this research is about the relationship between

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<sup>1</sup> Walter I., Steve Jobs. (October 24th 2011) - Simon & Schuster



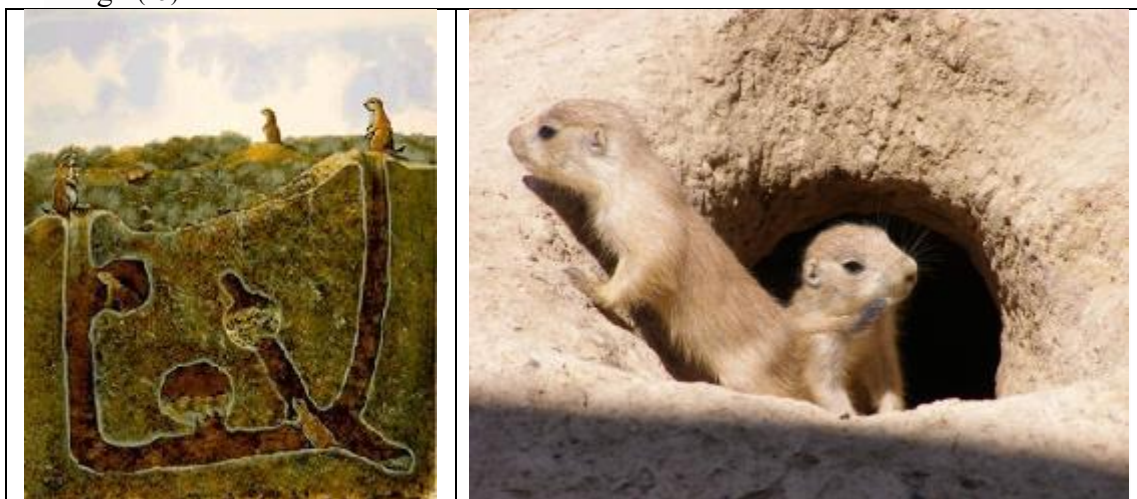
organic architecture way of thinking including all sub definitions belong to the Biological phenomenon and the conceptual approach for sustainable green buildings to reach the characters of highly building efficiency of maximizing comfort way of life to the users in terms of interpreting nature and applying natural principles into the design process. The research leads us to questions, such as;

1. For how much deep could the nature effect on the conceptual approach of sustainable buildings?
2. Can Architects consider using nature as a source of inspiration? And,
3. How can they follow this approach since their studying time up to their professional life through practical production introduced or shared by them?

Naturalism principals could effect on improving highly performance green building procedures and users behavior. This research discusses the dialogue between Biological behavior through nature life and Sustainable Architecture conceptual approach. To gain a new sustainable architecture thinking methodology by mimicking nature from the beginning of a new Architects thought during their academic years, and guiding architects to exhibit the use of Bionic innovation. This research focuses on the relations between Biological systems and Architecture and to classifying organic Architecture under umbrella of Green Building conceptual approach.

## 2. **Defining the fields**

From the earliest life of human being, nature plays a central role relationship with humanities specifically when it comes to imitation and metaphor. Thousand years of nature experiences, systems and structures motivating and inspiring architects, engineers and scientists to discover wisdom of innovations and natural technologies.(10) This inspiration of biological systems always assist humans in changing their expectation towards; “nature innovation of ORGANISM, BEHAVIOR and ECOSYSTEM”. These three naturalism categories sharing each other with five biomimetic technologies categories such as; *form, material, construction, process* and *function*. Those five categories effect “ORGANISM” to be included by mimicking organisms, “BEHAVIOR” to be referred to imitating organism’s behavioral aspect, and “ECOSYSTEM” to be emulated in architectural design.(15)



**Fig. 1** Prairie dog and its habitat as part of ecosystem with perfect ventilation and sustainable environment

To give a specific example regarding these type of inspirations, and as a successful

Experiments; USC architect Doris Kim Sung<sup>2</sup> wants to make buildings that automatically respond to changes in the environment. “For a long time, my work has examined why architecture is static and nonresponsive, and why it can’t be more flexible like clothing,” Sung said. “Why do we have to adapt to architecture rather than architecture responding to us? Why can’t buildings be animated?” For this reason, Sung with lot of experiments and huge spending time, she discovered a new characteristic of some type of material that had never before been used in architecture: a metal alloy that responds automatically to changes in air temperature and heat. This material with its behaviour usually used for the coil in a thermostat, “thermo-bimetal” is made of two sheets of metal armoured together. Each metal expands at a different rate when heated, curling as the temperature rises and flattening when cooled. In other hand, the chances for any construction building are widely, especially since thermo-bimetal is not just completely zero-energy but actually reacts to changing environmental conditions.

### 2.1. Green Building Approach

The highest benefits gained by green buildings are to be integrated as a “whole systems” approached for the design, construction, and operation of buildings. All these systems merge all resource of water and energy efficiency, conservation of materials, and indoor air quality. A green building definition focuses on the environmental impact of the building, and does not involve how the building affects, and interacts with, its surroundings and inhabitants. This definition mentioned by Kibert (2008, p.8); “healthy facilities designed and built in a resource-efficient manner, using ecologically based principles”. But this definition does not involve how the building affects, and interacts with, its surroundings and inhabitants.(1)



Fig.2 Samuel Beckett Bridge-Dublin by Santiago Calatrava’s- inspired by traditional Irish harp



Fig.3 Astralia cite de espace Toulouse imitating natural habitat

### 2.2. Bionic or Organic Architecture

Over the years nature has inspired many designers in the various design fields. simulate nature has been a common subject for long ago in almost every kind of art, social and science fields and now is resorted to in an abundant disciplines including architecture, sculpture, painting, interior architecture and industrial design etc. This concept of thinking is used to find answers to design problems through monitoring, analysis and modeling the characteristic behavior of materials and forms in the nature. In its diversity, nature has

<sup>2</sup> <https://www.archdaily.com/505016/when-biology-inspires-architecture-an-interview-with-doris-kim-sung>

provided an opportunity for designers to solve design problems through new approaches. Biomimetic has increasingly been employed in architecture and engineering.(21,28)



<p><b>Fig.4 Downland Gridshell Building- Sussex,UK -designed by Buro Happold and Edward Cullinan- organic biophilic form</b></p>	<p><b>Fig.5 Council House 2-Melbourne, Australia- designed by Mick-Pearce- Biomimcing the ecological tree's cover</b></p>
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### 2.3. Learning from NATURE

Humans have developed civilizations, sciences and technologies from trial and error since the dawn of history. As it mentioned before, it's agreed that one of the intelligent inspiration design way of thinking is to study nature, and endeavor to understand the ways in which it has developed to give the main name of environmental challenges. This way of thinking has been become "biomimetic", while the first appeared to this word in the 1950s by Otto Schmitt (Schmitt, 1969). Meanwhile, sustainable development approach is moving to a new level where buildings are making cumulative to nature, increasing supporting nature's work rather than meddlesome with life-sustaining ecosystems. Nature has been offering tremendous ideas and inspirations to designers and all branches for creating a beautiful type of architecture.(22)

### 2.4. Biomimicry is the future?

"Biomimicry from bios which means life, while mimesis meaning is to imitate", "Biomimicry implies conscious forethought, an active seeking of nature's advice before something is designed". The conclusion of combining between those two meaning gave us a new word with lot of studies about "nature's best ideas". So, the beginning of the story is how to imitate these nature designs? Scientist tried hard to find out through all type of since by preparing a close studies to these nature and made lot of researches in different environments on our earth at day and night through difficult conditions, these processes lead us to solve human massive problems since his born up to the last minute of his/her life. For example; studying a leaf to invent a better solar cell is a unique example which is called "innovation inspired by nature." The main meaning for this sentence is that nature, imaginative by necessity, has already solved many of the problems tussling with. All type of life such as; animals, plants, and microbes are the perfect engineers. Biomimicry is a new way of viewing and valuing nature which has lot of real opportunities to change way of life in near future for all mankind and all generations. It introduces an era based not on what we can extract from the natural world, but what we can learn from it. (9,10)

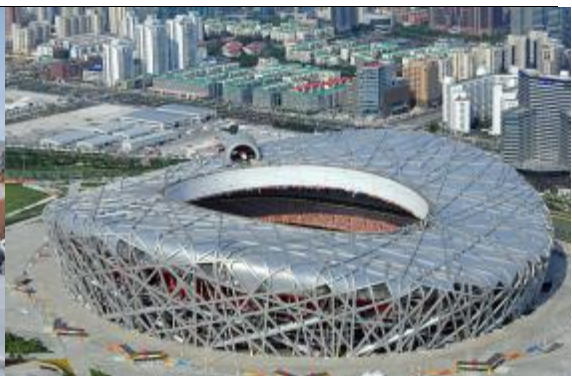


**Fig.6 Energy Park and Energy storage building- Heidelberg, Germany- redesigned by LAVA- inspired by geometries in nature like leaves, spider webs, and reptile skins.**

**Fig.7 Moscow Circus School- a competition won by Maryam Fazel and Belinda Ercan- Inspired by the forewings of insects—called elytra.**

### 2.5. Sustainability and Biomimicry

Inspiration from wonderful and intriguing systems of nature is nowadays becoming a subject of research and development and technologies driving force in architecture, resulting in majestic works of architecture. Biomimicry or "nature technology" has broad range, biomimicry contributes, both practically and philosophically, to many of the eco-design paradigms devised in the last 30 years, including the Natural Step, Natural Capitalism, Cradle to Cradle, Ecological Design, and Living Building Challenge. It is about solution refined and developed by nature. Biomimicry uses nature's models and then emulates these forms, process, systems, and strategies to solve human problems – sustainably to give solutions more sustainable. Today, the search for biomimetic applications has developed into a scientific discipline and biomimicry are now the subject of systematic study uses an ecological standard to judge the sustainability of our innovations. For any sustainable building design, need to consider structural efficiency, water efficiency, zero-waste systems, thermal environment, and energy supply. Janine Benyus (Benyus, 1997) founder and president of the Biomimicry Institute and author of the book "Biomimicry: Innovation Inspired by Nature" talks about the experiences which human beings had gained by observing the natural world as a source for ideas. Living organisms showcase flexibility in their form and positions. Living processes are interesting to interpret for they are non-linear phenomena.(5)



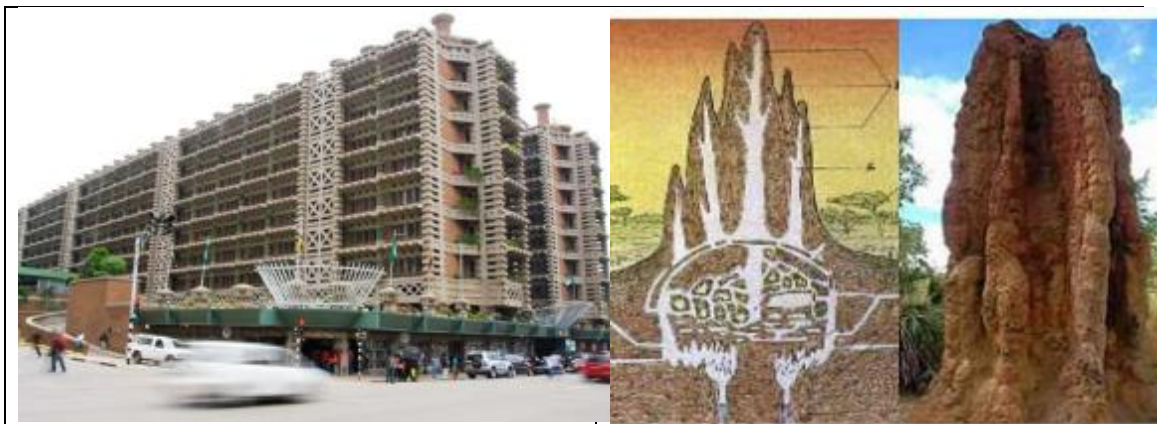
**Fig.8 Birmingham New Street Station-transport hub UK- designed by AZPML- inspired by geometries of motion and the distortion of perception**

**Fig.9 The Olympic stadium- Beijing,China- designed by Herzog and De Meuron, imitating the example the structure of a bird's nest**

### 2.6. Biomimicry in Architecture

Biomimicry promises to be game-changing in fields from materials science to building construction to all branches in all entire life. Majority of architectural process have lot of great difficulties of the 21st century, such as: substantial amelioration in the efficacious use of resources, shifting from a fossil-fuel to a solar industry, and changing from linear to closed-loop systems for managing the flows of energy and materials. Through several bionic examples from life, some of this innovation can be biomimetics in architecture,(28) such as;

**2.6.1.** The Eastgate development<sup>3</sup>, designed by Mick Pearce's vision for the Eastgate centre in Harare, Zimbabwe, lot of scientists concern with one of important issue for all internal buildings such as; passive-cooling systems which is inspired by termite mounds. This type of unique natural technology has lot of secrets bio-thermal innovation we can learn from and also show us clearly how such biologic thinking can be applied to buildings and settlements.



**Fig.10**The Eastgate development Tunnelling- Harare, Zimbabwe - designed by Mick Pearce- inspired by Ant termites are masters at creating air exchange systems to ventilate their mounds

**2.6.2.** The sea sponge features<sup>4</sup> seems like a lattice-like exoskeleton of hexatinellid and it made up of siliceous spicules that look like tiny six-blade propellers. This pile together to build a strong, cylindrical, lattice-like exoskeleton that, because the spicules are made of silicon, appears glassy, traps natural ambient light, and glows. in 2004 lord Foster completed a fascinating example of biomimetic architecture using the main idea of sea sponge, located in 30 St. Mary Axe in London's financial district, fondly nicknamed The Gherkin and The Swiss Re Tower, with 180 meters tall, holds 40 floors, and its steel exoskeleton dons stripes of navy colored, diamond-shaped pre-fabricated glass panels. They call the exoskeleton an organic scaffold. Flexible Silica (silicon) form on the intersecting points of the lattice to "lamine," or reinforce the overall structure, allowing it to flex under stress, without damaging

<sup>3</sup> <http://www.bbc.com/earth/story/20150913-nine-incredible-buildings-inspired-by-nature>

<sup>4</sup> <http://www.bbc.com/earth/story/20150913-nine-incredible-buildings-inspired-by-nature>

the core lattice. Two offset lattices allow the outermost structure to flex under stress without compromising structural integrity. The diagonal lattice absorbs bending and torque stress on the exoskeleton. Also, Venus Flower Baskets gather nutrients from water by filtering water through spaces in the lattice. Flagella found on the inside walls of the Venus Flower Basket swirl the water upwards. In other creatures, the tail-like structures of flagella propel animal sperm during mating. The steel exoskeleton of the building allows opening windows to inter natural light and fresh air to penetrate the structure. The building's curves allow wind to easily whip around its shape. (Rectangular buildings deflect wind down, blasting anyone at street level on a windy day.) Also, vents at street level harvest wind by sucking it in and swirling air upwards. Beams radiate from the center of the structure to support each floor. A hole in each floor called an atrium exposes the beams. This cuts the air conditioning bill by 50%.



Fig.11 The Gherkin and The Swiss Re Tower- London, UK- designed by Norman Foster, inspired by Sea Sponge air ventilation system

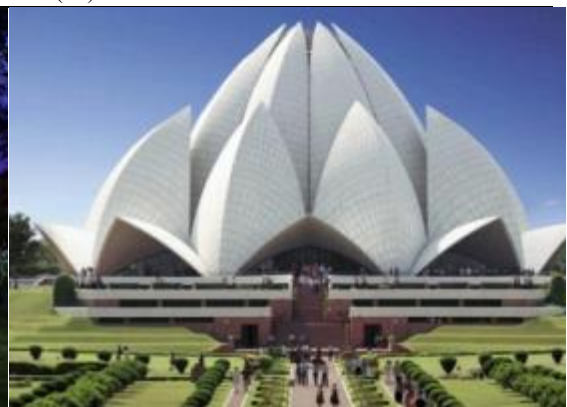
## 2.7. Biomorphic Architecture

Biomorphism is a type of thinking understanding the deep meaning, the mechanism and the form of nature. After that, going forward to extract organic forms, the outline shape and structures and combining them in a bionic design concept. Biomorph is one of the subjects in the architectural approach that has a main concern for the environment natural issues, in which this approach was born from the idea of the importance of nature and enhancing the environment, including climate. One of the main important regarding how we can mimicking is through the shape, material, structure, location and mechanisms in the universe. All these items can be used as the basic idea formed in the design of architecture through a process of collaboration between humans and nature itself. The history of Biomorphism is started during the Art Nouveau and Surrealism period which suggests that it is not only shape that matters, but also patterns and mechanisms that are derived from biological models that are of

interest (Hugh, 2003). Therefore, accurate language becomes an opportunity in shaping understanding and better enables the environment to come forward into experience (Mugerauer, 2000). It was suggested that designers use the word “biomorphic” (Feurstein, 2000) when describing environmental designs that merely mimic the appearance of natural forms. Architecture biomorphic design presenting visual biomorphic shapes, structure, and systems which are not straight, radical and special, but still on the composition, installation and the correspondence of what has been followed from the nature living systems. The main target to minimize the problems of sustainability in architecture global, Biomorphic issue-based ecology and metaphor, which is both have a common approach to the design process forms the basis of analysis of other associated forms and making an architecture to takes into account ecological solutions as well as "green architecture" themed nature. Solving the relationship between the form of organic and sustainable architecture which is exist, but it is not a mutual relationship. On the other hand, both of these tow architectures concept are part of sustainability survival system. For example, designer can raise the benefits of energy efficiency as part of responsible towards the environment by using Architecture biomorphic. This type of high energy quality will benefit the building itself and the environment for the expected future. From this point of view, Biomorphic architecture is not only presented in terms of shape, but also presented the sustainability of such nature.(20)



**Fig.12** Curved shell house- designed by Javier Senosiain - inspired by sea shell



**Fig.13** Lotus Temple- Delhi, India- designed by Fariborz Sahba - inspired by lotus flower shape

### 2.7.1. National Taichung Theatre<sup>5</sup> designed by Toyo Ito in collaboration with

Cecil Balmond which became a new landmark of Taiwan. The Architects drew inspiration from the formation of rocks, caves and the transience of water. Toyo devised an ideal construction technique taking in account its complexity. And used prefabricated steel cage and was filled with concrete to achieve curved walls. To promote energy efficiency, the building has employed unique air control and heat dispersion technology during daylight hours adjusts its settings as per the number of persons in the theatre. At night, we use a natural ventilation system to maintain the appropriate climate conditions. This aesthetic building promotes a symbiotic relationship between humans and the natural world by using

<sup>5</sup> <http://en.npac-ntt.org/>

simple horizontal and perpendicular variations to create a changed space. On the building's exterior, you can see many light blue circles. Like air holes allowing the theater to breathe during the day, the rays of light allow natural warmth and light to pour in. At night, yellow light permeates the environment of the theater inside and out. To protect the curved wall surfaces from fire, there is a special water screen system, which can immediately douse flames and smoke, scatter crowds and assist in firefighting measures. All safety precautions have been taken for both the building and the crowds who attend our theatre.



**Fig.14 National Taichung Theatre- Taiwan- designed by Toyo- inspired by the formation of rocks, caves and the transience of water.**

2.7.2. Kunsthaus Graz<sup>6</sup> is an exhibition center for contemporary art, the building exhibits Austrian and international art from 1960 onwards. It becomes an instrument of art communication, and a contemporary piece of Austrian art itself. Also the new Kunsthaus Graz acts as an interface between past and future, creating a productive tension between tradition and avant-garde. Despite its out of place appearance amongst the surrounding baroque landscape, the building itself was well received and has found its place within the city as being a gift for the future, the Kunsthaus functions as a bridgehead at a point where the past and the future meet. Kunsthaus Graz is shown as the trademark of a city struggled to achieve a productive dialogue between tradition and the avant-garde. The interplay between the new biomorphic structure on the bank of the Mur and the old Clock Tower on the Schlossberg creating a unique purpose to urban planning. While the building's interior is meant to inspire its curators as a black box of hidden tricks, its outer skin is a

<sup>6</sup> <https://www.museum-joanneum.at/en/kunsthaus-graz/architecture>



media façade which can be changed electronically. Its BIX media façade was designed by realities: united and constitutes a unique fusion of architecture and media technology that transforms the plexi-glass building into a large screen in the middle of the city.



**Fig.15 Kunsthaus Graz museum- Graz, Austria - designed by Peter Cook and Colin Fournier- The building's innovative complex double-curved geometric façade- an enormous biomorphic shell defined as "friends alien".**

## **2.8. Biophilic Architecture**

Environmental damage one of the main issues like waste and pollution, or excessive use of resources like energy and water has lot of concern to be deducted by sustainable design. The massive effective damages is part of reconnecting human being with nature in the modern built environment essential to their needs for health and productivity through life time, no matter the environment site location or climate changes. For this point of view, Architects looking for connecting their way of thinking and natural eco systems by using part of a new concept in architecture called “Architecture biophilic”.(26,33) The socio-biologist, Wilson in his book “Biophilia” popularized in 1984 the concept of the biophilic human being by utilizing the term “biophilia” to describe his deep feelings of connection to nature during a period of exploration and immersion in the natural world. Wilson defined biophilia as “the innate tendency to focus on life and lifelike processes”. Architecture biophilic is fighting for increasing; human health, ecology and sustainability precepts, such a integrate part of architectural formation which must be in optimal proportion with other buildings material. However, biophilic architecture must have a regional dimension with regard to environment and culture inspired by designs found in nature. It offers an exciting opportunity to achieve environmental, moral, social and economic benefits. According to this understanding, Biophilic design concept looking for creates a good habitat for human being in the modern built environment which satisfies their ingrained need for advantageous contact with nature.(31) Biophilic design has eccentric answers for providing essential needs humanities, such as;

- Increasing productive and satisfaction when people move to facilities with natural light, restored landscapes, and other biophilic features.
- Contacting with nature increasing the meaning of faster recovering for People from major illnesses and medical problems.
- Even children in their education life to reach higher test scores, being less absent, and showing better attention, the designer should be care with greater natural lighting, access to the outdoors, and fewer artificial materials.



**Fig.16 pixel façade building- designed by Oliver Thomas and keyan rahimzadeh- the façade system is based on our instinctive desire for nature**



**Fig.17 Central park building-Broadway,Sydney- with green walls on the exterior of a high-rise**

**2.8.1.** Parkroyal on Pickering<sup>7</sup> exemplifies Singapore’s stated goal of becoming a “City in a Garden” designed by WOHA’s design team. They takes architecture and landscape integration to a whole new level of inspiration to create “hotel-as-garden” by incorporating the same greenery within and around the Parkroyal Hotel. WOHA designed a unique integration of the local tropical ecosystem and the city fabric to increase the concept of biophilic approach by elevated area of green space consists of a large platform bridges the towers and provides a private park space, featuring tall palm trees, shrubs, a flowering understory, a waterfall, and hanging vines every four-stories, curvilinear “sky-gardens” wrap the front of the hotel in local tropical plants. This design creates over 49,000 ft<sup>2</sup> of green space, doubling the growing potential of the site. The visual connection with nature is reinforced through the extensive use of indoor living plants. Hanging gardens adorn this back facade, providing the public at large with a view to elements of nature, living systems, and natural processes.



**Fig.18 Parkroyal on Pickering- Singapore City, Singapore - designed by WOHA- inspired by the landscape of the adjacent Hong Lim Park**

**2.8.2.** BIQ House in Hamburg-Germany<sup>8</sup> the world's first algae zero-carbon apartment complex building built for the International Building

<sup>7</sup> [www.terrapiing.com](http://www.terrapiing.com)

<sup>8</sup> <https://www.iba-hamburg.de/projekte/bauausstellung-in-der-bauausstellung/smart-material-houses/biq/projekt/biq.html>

Exhibition (IBA) designed by joint venture between Splitterwerk Architects, ARUP, Colt International and Strategic Science Consult. The concept of the design is to create a green facade-cum-algae farm by using a radical new theory on how we will live in the near future. This theory depends on bacteria, microalgae which can produce more biofuel per hectare than alternative crops. By marking the first time algae-reactors have been fully integrated into the fabric of a building. On the south-east and south-west facades, there is a second skin of hollow glass panels containing micro-algae farms. Here, the algae floats around basking in the sunlight which hits the structure, while being fed on a diet of carbon dioxide and nutrients by a network of pipes. Photosynthesizing and growing, the algae-pulp can then be periodically harvested and fermented in an external biogas plant to generate energy. Aside from producing energy and performing the usual job of heat and sound insulation, the facade is characterized by other valuable traits. Heat from excess sunlight, not needed by the algae, is collected and can be stored in brine-filled boreholes, to be used for space and water heating. In addition, the algae provides adaptive shading throughout the year; the more intense the sunlight gets, the more algae grows inside the facade and the more shade is provided.



### 3. **Conclusion**

Although many scientist consider that Biomimicry is an alternative solution, while all researches directing us to an amazing conclusion that; by Biomimicry humanity will live in harmony with nature and in the future we will be able to decrease disease by increasing the comfort zone for people and step by step it will be some kind of “life style” very soon.

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# Improvement of Surface Hardness and Wear Coefficient for Blend PMMA/PLA Reinforced Bio-Ceramic MZT

Abothur G Mohammed<sup>1</sup>, Zainab AL-Ramadhan<sup>1</sup>, Ali M Al- Muhana<sup>2</sup>

1- Department of Physics, College of Education, Al-Mustansiriyah University, Bagdad - Iraq

3-Department of Microbiology, College of Medicine, University of Kufa, Iraq

E mail: [abothur7899@gmail.com](mailto:abothur7899@gmail.com); [khalidahk.abbas@uokufa.edu.iq](mailto:khalidahk.abbas@uokufa.edu.iq)

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## Abstract

In this work, the polymer mixture was synthesized by mixing 50% of PMMA and 50% of PLA using the mixture method to obtain a homogeneous mixture of materials. The ceramic powder of zinc oxides, magnesium and titanium nanotubes were prepared with 1: 1: 1 ratio using the effective mechanical mix. The ceramic ball mill was used with a rotational speed of 350 rpm and the tubular furnace was used for thermal reaction at 1300°C for a three-dimensional system. where the composition of the compound MZT were MgO = 20%, ZnO = 40% and TiO<sub>2</sub> = 40%). The polymer mix PMMA/PLA were reinforced by percentage of MZT (3%, 5%, 7% and 10%). Ultrasonic waves were used to obtain a homogeneous mix and regular distribution of the polymer mixture. Use of X-ray technology, scanning electron microscopy and energy dispersion technology to study crystalline structure, shape and granular size in addition to the ceramic system percentage components. The pin-on disc technique was used to test the susceptibility of the measured aggregate to resist wear under dry sliding motion, such as wear, as well as calculation of hardness, theoretical density and practical density. The results showed a significant improvement in wear at different times (5,10,15) min , and a significant improvement in hardness where the MZT added to the polymer was increased. The results were explained by the Matlab charts. Present study also determined the absorption of the simulated solution of body fluids and water after submerging it for one month and calculating the surface hardness of the submerged and non-submerged. Laboratory results showed an improvement in the surface hardness of the submerged models in the body fluid, while the surface hardness of the submerged samples decreased in water. The results were interpreted based on the practical density before and after the immersion test. The conclusion is to develop and improve the PMMA / PLA-MZT system used in biomedical

**Keywords:** Polymer mix, bio-ceramics, energy dispersion, screw technique on disc

## 1. Introduction

Polymer science has seen great development in recent years, entered into the details of everyday life and replaced many traditional materials in various fields. The importance of these materials in many uses is due to their mechanical and chemical properties. As a result of this industrial and technological development, the need to find alternatives to high quality, light weight and other characteristics has emerged in general for adoption in various industrial and military applications[1]. Composite materials can be defined as the material resulting from the merging of two or more substances with certain bases to obtain new materials with distinct physical properties that differ from the properties of the constituent material. Composite materials consist of the matrix, the continuous phase, and the reinforcement material[1]. The human skeleton may be damaged by injuries, traumas, infections, tumors or age-related changes resulting in significant loss

of bone mass and volume [2] Bone substitutes should, as a minimum requirement, show high biocompatibility and adequate mechanical strength. Various bone diseases such as bone fractures, osteoporosis, osteoarthritis, and bone cancers commonly present urgent clinical needs for bone regenerative materials [3]. Among new kinds of materials, hydroxyapatite, which is the main ingredient of bone, has been widely used [4]. Calcium carbonate is an ideal bone repair product based on its excellent biodegradability [5]. The biochemical composition of bone is precisely composed of two major phases at the nanoscale level namely, organic and inorganic as a good example for a composite. These phases have multiple components which consist of, in decreasing proportions, minerals, collagen, water, non-collagenous proteins, lipids, vascular elements, and cells . An overall composition of the bone is given in Table 1. Selection of a starting material, which will somehow mimic a naturally-existing one, is one of the most important points and crucial elements in biomaterials development. Material bio mimetism is one of those approaches, where restoration of an organ's function is assumed to be obtained if the tissues themselves are imitated . However, some of the biopolymers can be selected from within a group of biomimetic materials, since they already exist, and have particular functions in the human body [6]. As e.g. a poly(lactic acid) (PLA) and Poly(methyl methacrylate), PMMA, of the most widely used polymers, have characteristic properties including its very high level of optical clarity, stiffness and resistance. With such properties it has been seen in a variety of applications, many of which are as an impact resistant replacement of glass and within the biomedical industry [7].

**Table 1. The biochemical composition of bone**

Inorganic Phases	Wt%	Bioorganic phases	Wt%
Calcium Phosphates (biological apatite)	~ 60	Collagen type I	~ 20
Water	~ 9	None-collagenous proteins	~ 3
Carbonates	~ 4	Primary bone cells	Balance
Citrates	~ 0.9	Other traces	Balance
Sodium	~ 0.7		
Magnesium	~ 0.5		
Other traces	Balance		

Generally, certain polymers feature good mechanical behavior which could be improved by mixing them with various types of materials this study aims to investigate the tribiological behavior of these polymer composites, in-on-disc wear tests were conducted on the universal tribometer where the pin is held in permanent contact with a rotating disc [8]. Heat-curing acrylic resins are frequently used in temporary prosthetic-base materials, provisional prosthesis, and orthodontic removable appliances such as retainers and functional appliances. Used (PMMA/PLA) generally in temporary

prosthetic-base materials due to its optical properties, biocompatibility and aesthetics . On the other hand, they reduce water absorption, polymerization shrinkage and coefficient of thermal expansion. Bonding of organic and inorganic phases by coating the fillers with a coupling agent results in the formation of a strong covalent bond. This is a key factor in terms of good mechanical properties of compositidental and bones. Because there are few papers that study about addition of nano hydroxyapatite, this study tries to fill this gap [9]. In this research, mechanical properties of nano HA-reinforced PMMA/PLA cement were investigated by studied the bioactive ceramics materials of the MgZnTiO4 this called nano composite MZTwear rate of the test samples was assessed from the weights of the worn out materialduring the wear experiments. The weight loss of the test samples was recorded in all the wear experiments and from which thewear rate was estimated by using the following equations[10]:

$$W_r = \Delta m / L \dots\dots\dots(1) \quad W_v = \Delta m / L\rho F \dots\dots\dots(2)$$

Where:  $\Delta m$  = weight loss (%),  $W_r$  = wear rate (g/cm) ,

$W_v$  = wear volume (mm<sup>3</sup>/Nm),  $L$ = Sliding distance (m) .

## **2. Practical Part**

### **2.1. Matrix Material:**

Poly(methyl methacrylate), PMMA, is one of the most widely used polymers its characteristic properties including its very high level of optical clarity, stiffness and resistance. And Poly(lactic acid) (PLA), , has outstanding advantages of other polymers.

### **2.2. Reinforcing Material:**

powder Magnesium, zinc and titanium a nanometer size. In this work, the effective mechanical mixing method was used for the purpose of preparing the system for bioceramic (MgO, TiO<sub>2</sub>, ZnO) by a molar (1: 1: 1), which is MZT.

### **2.3. Method of Preparation:**

In this work method was used for effective mechanical mixing, for the purpose of preparation of the system ceramic bio triple (MgO, ZnO and TiO<sub>2</sub>) by Molar (1: 1: 1). Note that all these materials have a similar granular size ranging from (32-45) nm. The method of effective mechanical mixing is summarized by using a certain number of balls of ceramic, mixed with a certain amount of tri composite powder, any (every 20 ball need 5 grams of powder). The mixture is placed in an electric mixer, at 350 rpm for 6 hours continuously. For the purpose mixing of the three powders. After this process, the tri mixture is reactivated using an electric oven designed for this purpose. The tri mixture is placed in a ceramic flask, then burned and reacted at a temperature of 1300 ° C. Then leave the powder in the oven until the next day to get the MZT compound. X-ray diffraction technique was used as fig (1). To determine the size and the resulting shape, the scanning electron microscopy technique was used as fig (2). In addition, energy dispersion technology was used to determine the percentages and to identify the impurities involved in the composition of the bio-ceramic compound as fig (3). The polymer mix was reinforced by a percentage of this compound with an increase starting from 3%, 5%, 7% and 10%. The ultrasound technique was also used for the distribution and dispersion of the ceramic bio-powder within the polymer mixture consisting of 50%



of PMM and 50% of PLA. The screw method was used on a disk for the purpose of testing the validity of the prepared polymer overlay to resist the wear and tear resulting from the high speed dry skid movement. The rotor disk was used at a distance of 6 cm with a speed of 2950 rpm and a constant load of 10 Newton and different times (5,10,15) min. The surface hardness test using a micro-hardness scale In addition, the theoretical density was calculated, and calculate the density of the practical Using Archimedes method and dimensional method as table(2) .

**Table2: Theoretical density and Practical density with the ratio MZT**

<b>The ratio</b>	<b>Theoretical density</b>	<b>Practical density</b>
0%	1.19	<b>1.134296</b>
3%	1.2941	<b>1.121428</b>
5%	1.3635	<b>1.1363</b>
7%	1.4329	<b>1.19041</b>
10%	1.537	<b>1.121792</b>

#### **2.4. Water and Simulated Body Fluid (SBF)**

The samples were prepared in three groups. The first group was submerged in a solution similar to the body fluid. The second group was submerged in water. The third group was left immersion and the surface hardness was calculated using a Vickers hardness device. The samples were immersed in the first and second group for 30 days away from sunlight.

### **3. Results and Discussion**

Hardness is a measure of material resistance to plastic deformation. was calculated the hardness of the composite material of the results of the work at increases the percentage nanocomposite increases a hardness as fig (4) shows. A wear test is one of the most important tests to study the mechanical properties of engineering materials in some applications and uses. The wear debris generated by of the wear is measured in terms of wear. The resulting fig (5),(6),(7), (8) and (9) showing the relationship between rate wear , specific wear volumetric wear, and the coefficient wear with time. The three-time test results show that the body weight lost with PLA / PMMA. It has decreased after strengthening bio-ceramic powder MZT and all percentages were confirmed due to the good properties of this bioactive powder. Additionally, the powder inhibits the formation of crack propagation In the polymer mixture.

It can be said that the decrease in the amount of debris Due to increased MZT in the polymer PMMA/PLA.

#### **3.1. Effect of test variables in the behavior of wear**

Scientific results showed that wear (Volumetric, specific and wear coefficient), depends on loading, sliding speed, distance sliding and the hardness of the gyro disc, which results in large changes to the sliding sliders (sample and disc).

#### **3.2. Effect of slip time in wear behavior**

The practical results indicated that the debris and wear rates of all types of polymer material (PMMA / PLA) and its compounds depend on the slip time. The polymeric material, which is not supported by a wear rate of  $(1.0754 * 10^{-7} \text{ g / cm})$  at a sliding

time of 5min. The cause of the initial plowing of the values of the surface protrusions, where the polymer mix accompanied by debris scattered on the iron turntable due to the high speed of the turntable (2950 rpm). As well as with increased slip time, increasing the contact area between the sample and the surface of the disk called Real Contact Area.

### **3.3. Asorption of Material**

Table (3) and (4) shows the percentage values of the absorption of a solution similar to the body fluid and the values of surface hardness before and after immersion. Figure (10) shows the relationship between surface hardness before and after immersion with the percentage of absorption. The increase in the percentage of the material in the ceramic powder has significantly improved the surface hardness of the submerged samples In the solution similar to the body fluid and the reason is due to the stability of volume and increase the mass of samples increase sequential percentage of ceramic powder, resulting in an increase in the volumetric density of all samples and close all the pores on the surface of the solution and solution Yen layer of it. While the second group samples submerged in water, the surface hardness decreased significantly due to the large size of the samples and the decrease in the volumetric density due to the opening of the pores in the surface of the models. Figure (11) shows the relationship between the surface hardness before and after immersion in water with the percentage of absorption. Figure (12) shows images of the light microscopy of the layer of the white precipitate of the body-like solution in the first group samples. The prepared mixtures supported by the triple ceramic powder are considered to be compensatory substances for bones and teeth and their brutality.

**Table 3: Experimental SBF Absorption Values.**

<b>Sample Code</b>	<b>Weight before test(M1) (mg)</b>	<b>Weight after test(M2) (mg)</b>	<b>Volum e of sample cm<sup>3</sup></b>	<b>Absorption M2-M1 /V mg / cm<sup>3</sup></b>	<b>Surface Hardiness MPa Before</b>	<b>Surface Hardiness MPa After</b>
<b>PMMA/PL A</b>	1.78	1.87	1.65	0.05	21.8	32.1
<b>3%MZT</b>	1.83	1.87		0.024	40.1	47.3
<b>5%MZT</b>	1.96	1.99		0.018	52.3	58.8
<b>7%MZT</b>	1.92	1.93		0.006	83.4	91.4
<b>10%MZT</b>	1.94	1.94		0	98.3	104.3

<b>Sample Code</b>	<b>Weight before test(M1) (mg)</b>	<b>Weight after test(M2) (mg)</b>	<b>Volume of sample cm<sup>3</sup></b>	<b>Absorption M2-M1 /V mg / cm<sup>3</sup></b>	<b>Surface Hardines s MPa Before</b>	<b>Surface Hardiness MPa After</b>
<b>PMMA/PL A</b>	1.78	1.89	1.73	0.062	21.8	19.6

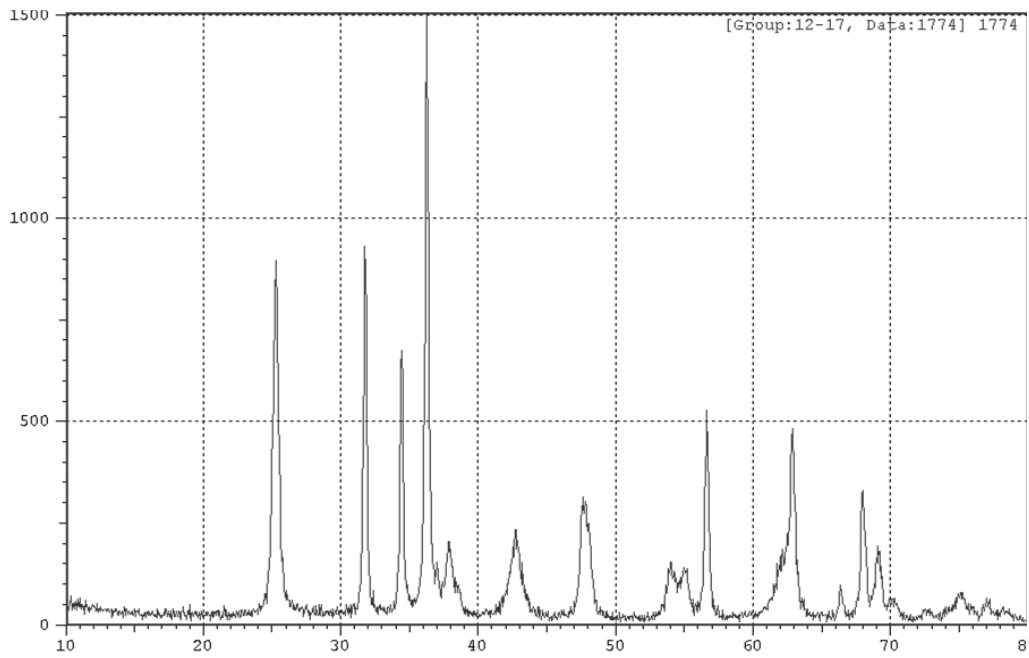
<b>3%MZT</b>	1.83	1.85	1.79	0.0111	40.1	33.9
<b>5%MZT</b>	1.96	1.98	1.81	0.011	52.3	46.7
<b>7%MZT</b>	1.92	1.95	1.87	0.016	83.4	67.9
<b>10%MZT</b>	1.94	1.96	1.93	0.010	98.3	76.4

**Table 4: Experimental Water Absorption Values.**

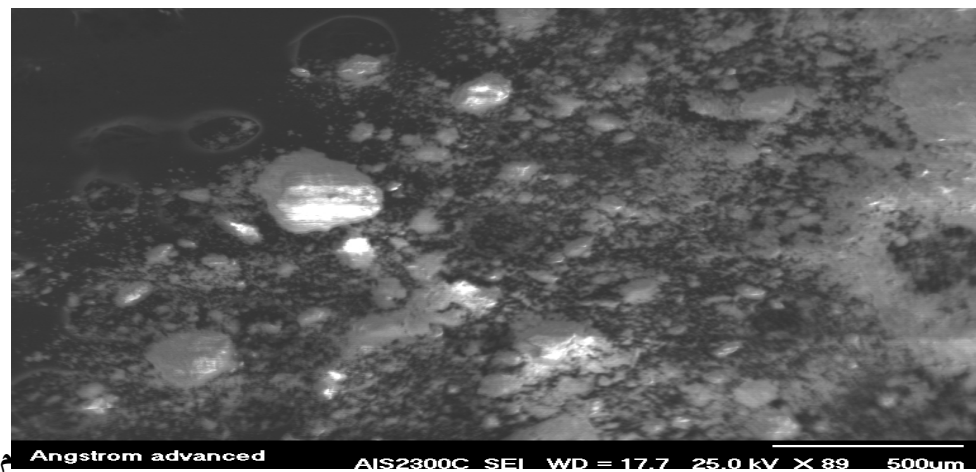
**Conclusion**

Develop and improve the PMMA / PLA-MZT system used in biomedical: 1. Mechanic, resistant to wear and friction with high hardness.

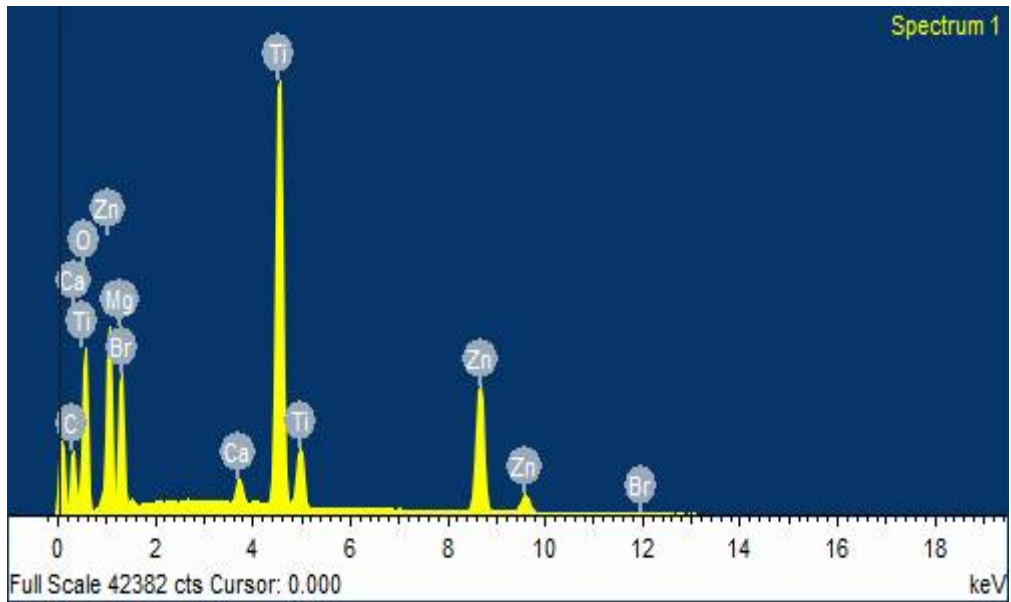
2 - therapeutic, bone and tooth compensation is an antibiotic for cancer.



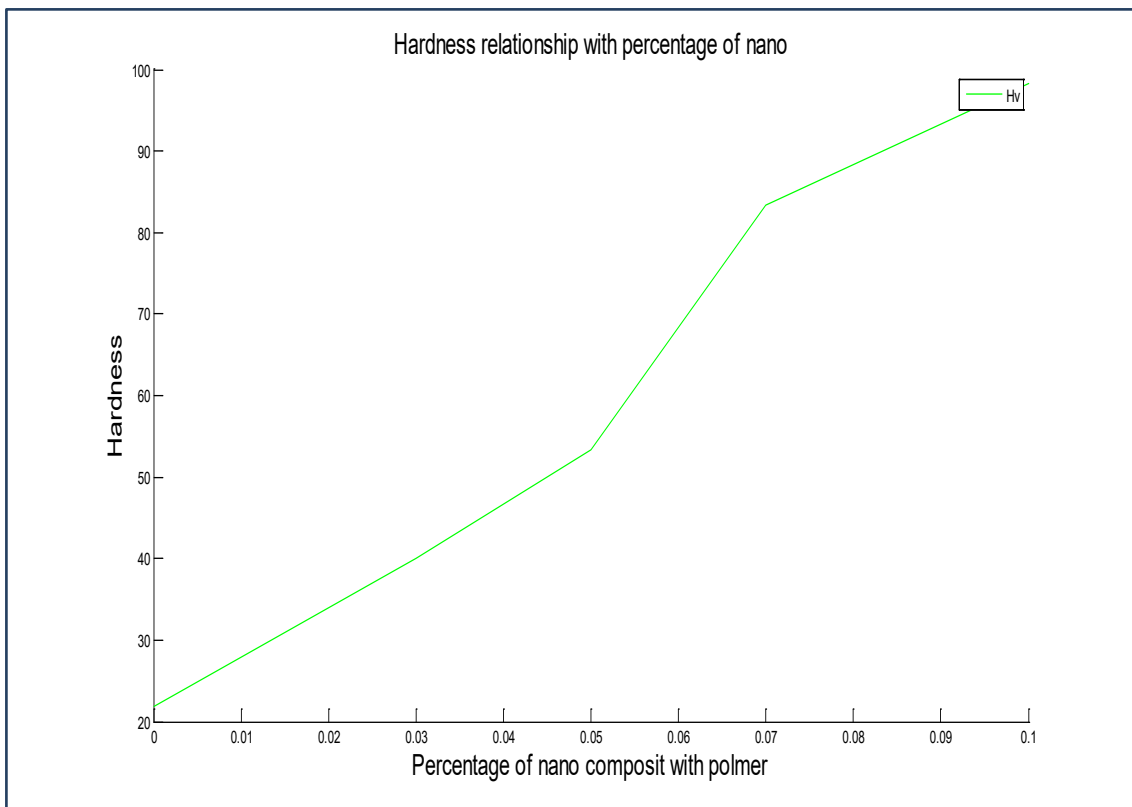
**Fig1: X-ray diffraction for MZT**



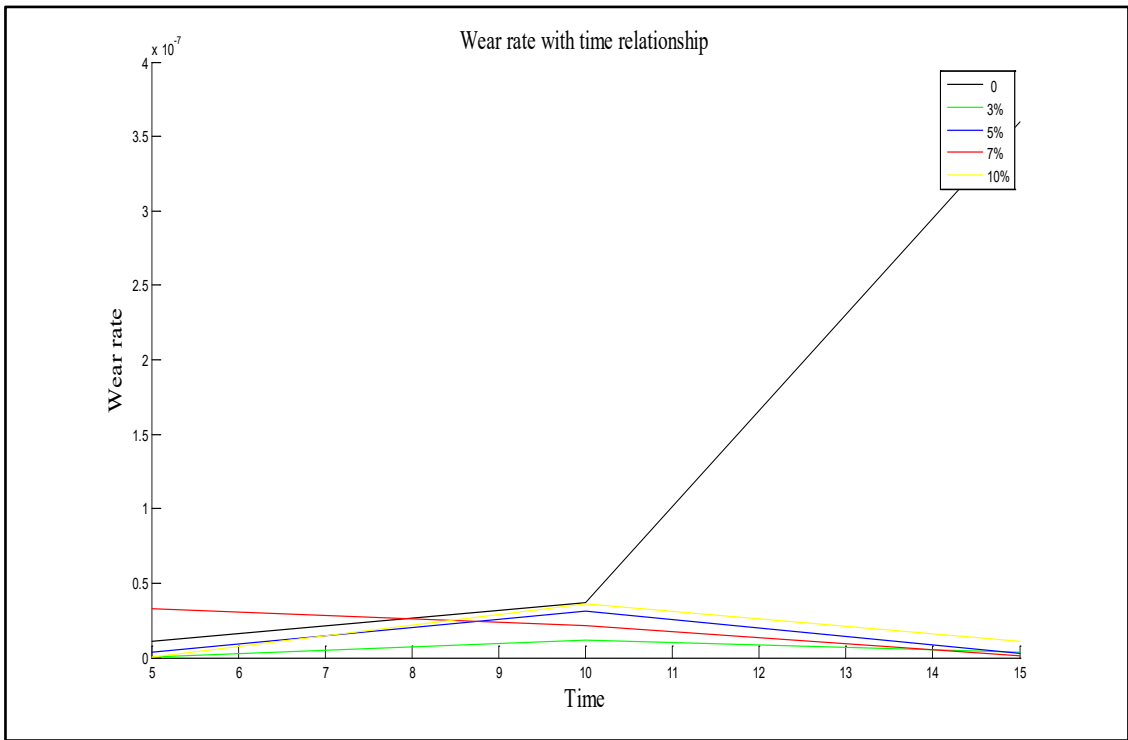
**Fig.2: SEM Image of MZT**



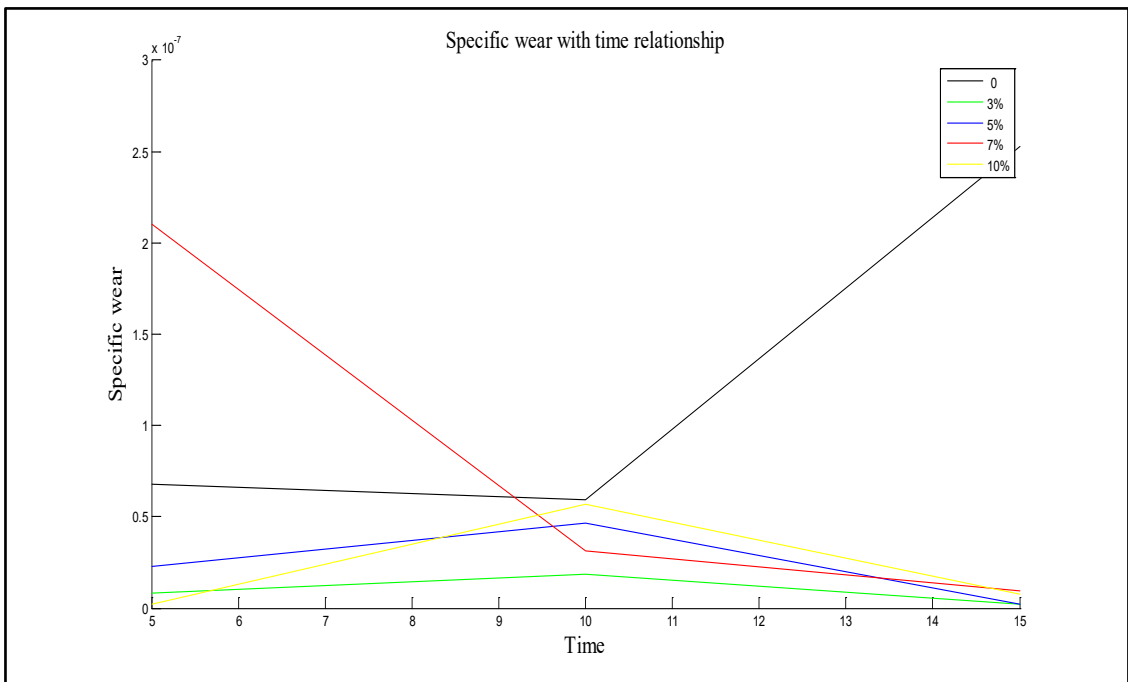
**Fig.3: EDX – Spectrum Analysis of MZT.**



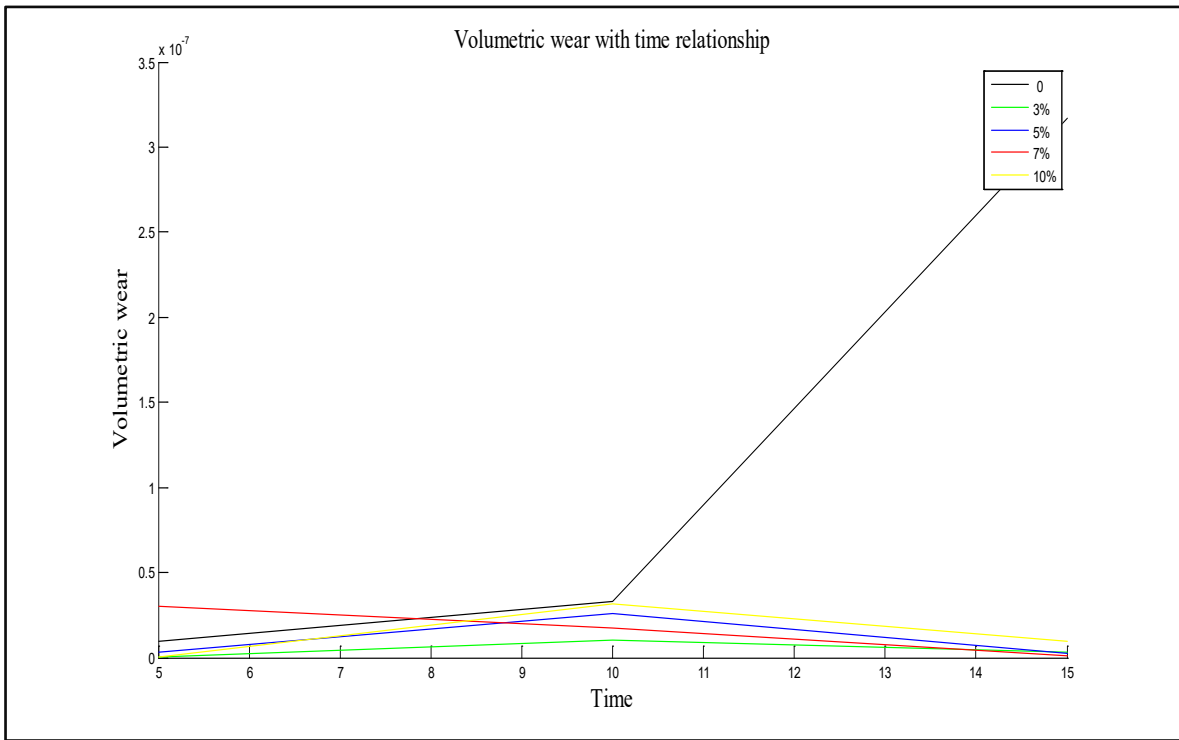
**Fig 4: The relationship of hardness with the polymer nanocomposite (MZT)**



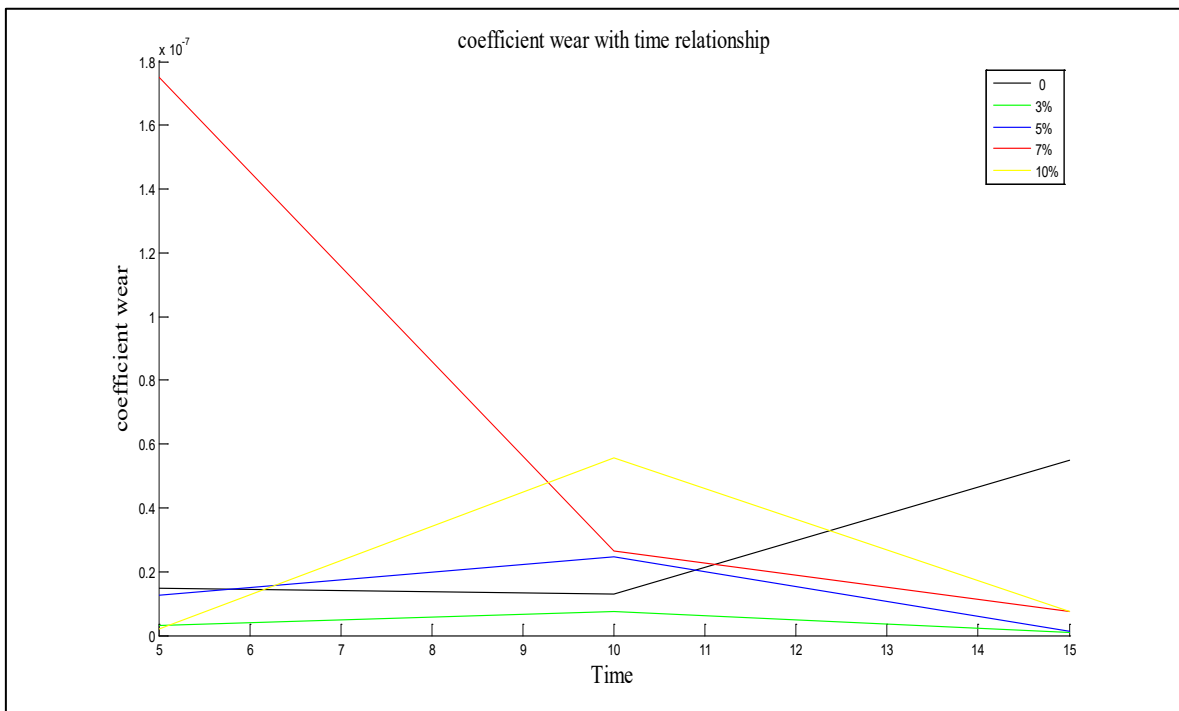
**Fig 5: The relationship wear rate with time**



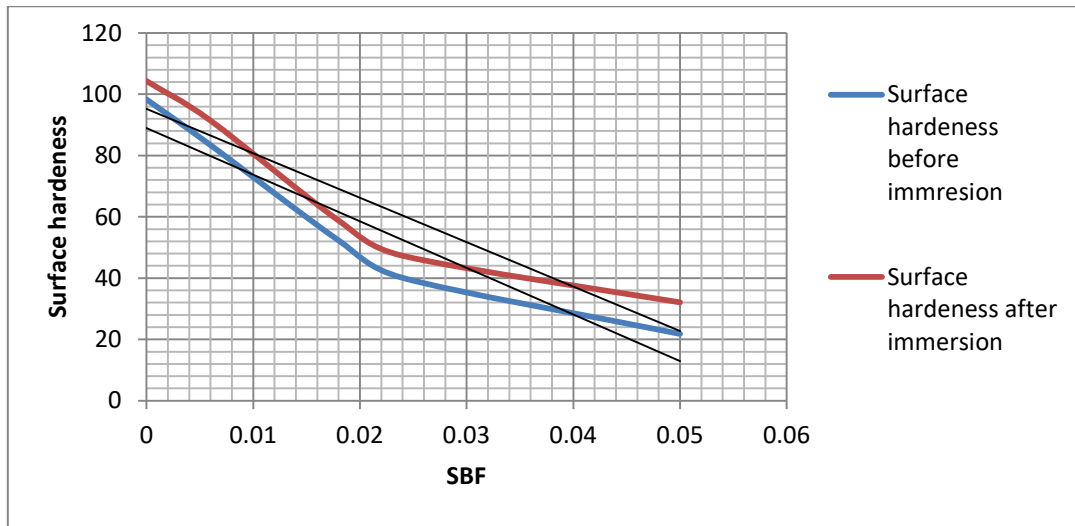
**Fig 6: The relationship wear specific with time**



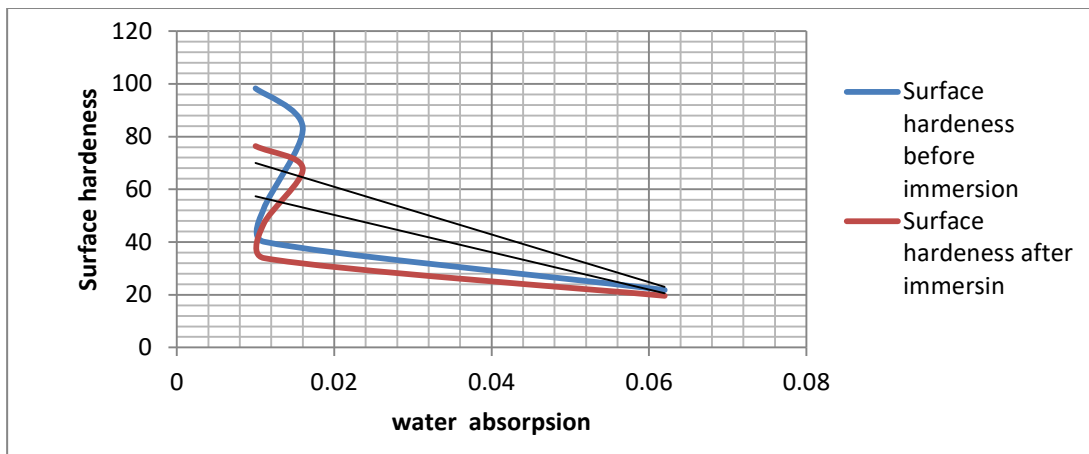
**Fig 8: The relationship wear volumetric with time**



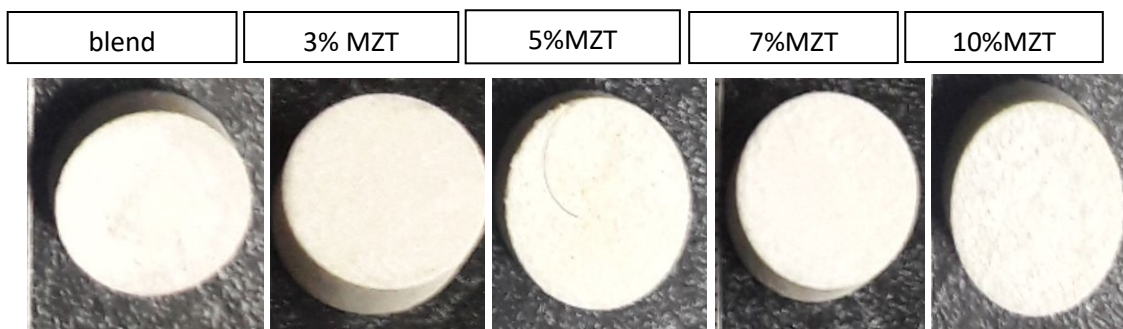
**Fig 9: The relationship coefficient wear with time**



**Fig.10: Experimental Values of Surface Hardness with absorption (SBF) , blue curve before immersion , red curve after immersion.**



**Fig.11: Experimental Values of Surface Hardness with absorption (Water) , blue curve before immersion , red curve after immersion.**



**Fig.12: Images of Nanocomposites after immersion in SBF.**

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" ابداع النموذج المركب في الربط ما بين النظرية والممارسة في العملية التصميمية "



### المستخلص:

تعاني عمارة اليوم من انفصال واضح ما بين المؤسسات الاكاديمية التي تسعى الى غرس القيم الانسانية في العملية التصميمية وما بين الجانب التطبيقي في سياقه الاكاديمي والمهني انعكس سلبا على نتاج العمارة . فتراوحت النظرية ما بين كونها خطاب للممارسة لتطرح نماذج فكرية غير مختبرة أو طرح لأفكار تطبيقية للمقارنة بين المواقف لنفس القضايا. فتعددت نظريات العمارة بجانبها المفاهيمي والتطبيقي لتخلق حالة من التناقض والمضاربة فيما بينها دون أن تسجل هيمنة لأحدها على الاخر مما ادى إلى طرح مفاهيمي غزير مقارنة بالطرح النظري على الجانب التطبيقي والذي ادى بالتالي الى توليد فجوة واضحة فيما بينهم . يهدف البحث الى تحقيق اعلى قيمة للابداع في العملية التصميمية و ايجاد علاقة متوازنة ما بين النظرية بجانبها المفاهيمي والتطبيقي وارتباطهما بالواقع وبذلك حددت فرضيات البحث ب :

- امكان النموذج المركب في الربط ما بين النظرية بجانبها المفاهيمي والتطبيقي في العملية التصميمية .
- تتحقق اعلى قيمة للابداع في النموذج المركب من خلال تداخل الجانب البحثي بالعملية التصميمية .

ولتحقيق هدف البحث والتحقق من فرضياته اعتمد البحث منهجا تحليليا وصفيا في رصد وتحليل النماذج المعمارية عبر تاريخ العمارة، ولغرض الاستفادة من التجارب وجوانب الابداع في منهجها التصميمي. وتوصل البحث الى مجموعة استنتاجات من اهمها إن الفكر الابداعي هو الذي يستطيع ان يحقق التوازن ما بين الجانب التحليلي والجانب الشعوري في العملية التصميمية ويحقق الارتباط فيما بينهما حين يقترب من الواقع وهذا يتحقق عبر النموذج المركب الذي يتكون من دورات متكررة من ثلاثية التحليل-التركيب- التقييم في العملية التصميمية والذي يعتبر مفتاح الحل في ربط العملية البحثية بالجانب التصميمي وربط النظرية بجانبها المفاهيمي والتطبيقي بارض الواقع .

الكلمات المفتاحية: المفاهيم، الأفكار، الجانب التحليلي، الجانب التركيبي ، النموذج المركب

# "Creativity of synthesized Model in Linking Theory and Practice in the Design Process"

**Prof.Dr.Ibrahim Jawad Al-Yousif.**  
University of Technology,  
Architectural Engineering Dep  
123367@uotechnology.edu.iq

**A.L Nada Azzam Mahmood**  
.AL- Nahrain University  
Architectural Engineering Dep  
nadaazzam@eng.nahrainuniv.edu.iq

## **Abstract:**

Today's architecture suffers from a clear separation of academic institution with its interest in sustaining human values in the design process from the practical domain which reflected negatively on architecture. theory of architecture as a result , ranged from being a practical discourse producing untested intellectual models or proposing practical ideas to compare attitudes of the same issues. Multiple architectural theories presented both of themes and paradigms to produce a state of competition and speculation among themselves without registering dominance over one another presents a gap between conceptual presentations as paradigms compared to the theoretical theory on the practical side as themes. The research aims to reach to the optimum creativity value in the design process and finding a balanced relationship between theme and paradigm in the design process and with their relationship to reality, the research hypotheses identified as:

- The possibility of the composite model in linking the theory with its theme and paradigms aspects in the design process.
- Achieves the highest value of creativity in the composite model through the overlap of the research side of the design process.

To achieve the research objectivity and to verify hypotheses, the research adopted analytical and descriptive approach to monitoring and analyzing architectural models standing on the experiences and design creativity through history of architecture. The research reached a set of conclusions, the most important of which is that synthesized model consisting of cyclical triangulation among analysis -synthesis and evaluation of the design process is the key factor in mixing research with design and linking theory of both theme and paradigms with practice.

**Keyword: concepts, thoughts, Analytical view, the structural view, synthesized Model**

## **1- المقدمة:**

النظرية هي نظام أو نسق فكري تفسر ظواهر موجودة في الواقع. وتقوم النظرية التي تتأثر بمعطيات الواقع بالكشف عن هذه الظواهر واضحة مدركة أو مخفية. وقد تكون النظرية صائبة أو خاطئة، فهي ذات ابعاد فكرية قد تكون واضحة أو غامضة ضمن منظومة تواصلية قابلة للتعريف والتعميم. تعددت خصائص النظرية المعمارية عبر تاريخ العمارة لتكون وصفية، تكديبية أو اثباتية أو نقدية. كما تعدد المدخلات ما بين فلسفة، فن أو فكر وتأثيرها في تشكيل النظرية وارتباطها بالجانب الشكلي التعبيري والمعياري المتبع في الانحياز نحو الذات أو الموضوع فتغلب الجانب الذاتي الذي اتسمت به الممارسة المعمارية على الجانب النظري مما أثر على مصداقيتها وعموميتها فكان التغيير أكبر للنظرية على حساب ثباتها حيث خضع الجانب الموضوعي إلى الجانب الذاتي فيها. (خليل وآخرون، ص 13). والنظرية في العمارة هي خطاب يصف الممارسة حيث تطرح كيت Nesbit في مقدمه كتابها theorizing new agenda : تتكون النظرية في العمارة، من نظريات مفاهيمية paradigms متمثلة بالمدارس

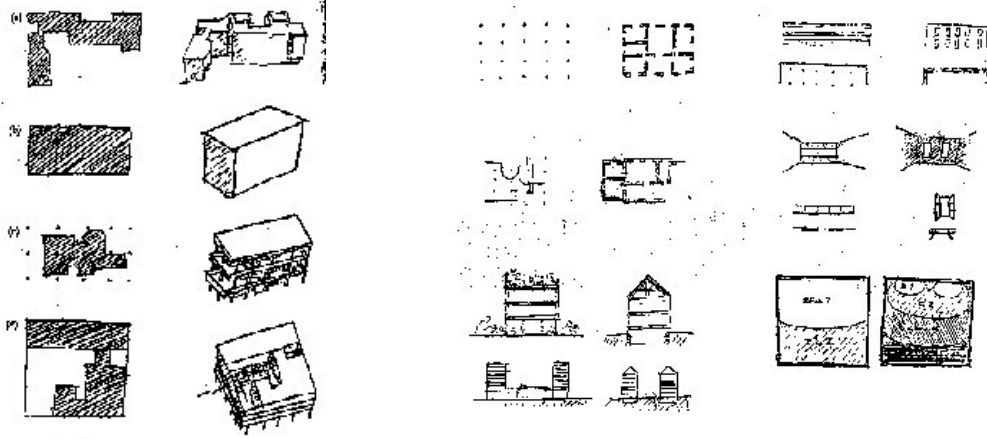
الفكرية كالبنوية والانثوية والتفكيكية ونظريات تطبيقية themes تمثلت بالتطور التقني والتكنولوجي، الاخلاق البيئية والسياسية وموقف الجسم في العمارة، الخ.  
(Nesbit,kate,1996,p.5)

اعتمد البحث على طبيعة العمارة الحاضرة التي سميت ب الحداثة - ما بعد الحداثة - التفكيكية لغرض دراسة طبيعة العلاقة ما بين النظرية بجانبها المفاهيمي والفكري التطبيقي في العملية والمنهج التصميمي الخاص بكل حركة ومعرفة جوانب الابداع في كل منها لاعتمادها واخذ الدروس والعبر لتغذية العملية التصميمية مستقبلا لذلك اعتمد البحث المحاور التالية: حيث تناول المحور الاول العلاقة ما بين النظرية والممارسة في الحركات المعمارية عبر تاريخ (الحداثة - التفكيكية - ما بعد الحداثة ) ودراسة طبيعة العلاقة التي تعاملت بها بغية تشخيص مواطن الخلل في المنهج التصميمي والاسباب التي ادت إلى الفصل ما بين النظرية بجانبها المفاهيمي والممارسة في المنهج التصميمي. في حين تناول المحور الثاني التعرف على مفهوم الابداع في العملية التصميمية للتعرف على جوانب الابداع في العملية التصميمية وصولا إلى النظرية التكاملية للإبداع التي تربط ما بين النظرية بجانبها المفاهيمي والممارسة بجانبها التطبيقي في العملية التصميمية في حين تناول المحور الثالث التعرف على المنهج التصميمي والذي يحقق النظرية التكاملية للإبداع عبر اماكن المنهج العلمي الجديد (النموذج المركب) في العملية التصميمية.

## 2- المحور الاول: النظرية بالجانب المفاهيمي مقابل النظرية في الجانب التطبيقي:

تتنوع العملية التصميمية ما بين كونها فعل تقني لحل مشكلة معينة في الواقع أو فعل جمالي حدسي أو كليهما لذلك فهي تعتمد على أنظمة متعددة لتقصي الحقائق ادت إلى اختلاف المدارس الفكرية فاختلفا يعود إلى طبيعة الحركة من التطبيق إلى النظرية أو العكس فالحداثة مثلا تقوم ببناء نظرياتها وتقوم بصياغة مفاهيمها النظرية عبر المشاهدة واكتشاف مشاكل الانسان والمجتمع فهي بذلك ممارسة تطبيقية تعتمد على الاستقراء في بناء مفاهيمها فهي بالتالي عملية استقرائية تعتمد على المنهج التجريبي ولعل من ابرز الامثلة هي نظرية النقاط الخمسة، المتمثلة ب: الاعمدة الحاملة، الحوائق السقفية، والمخطط الحر، والنوافذ الافقية، والواجهات الحرة. (Le Corbusier & Jeanneret, 1929, p.128) لأعمال رائد الحداثة لكوربوزيه، الذي بنيت تصاميمه وفقا لاحتياجات الفرد الأساسية، ولتصبح تلك النظرية: قانونا للعمارة الحديثة، عندما جمعت ما بين تطور تكنولوجيا المواد والبناء بالتوازي مع السياق الاجتماعي واهميته في المدينة؛ ونتيجة بحث لسنوات من الكتابة والتصميم الاختبار والبناء، حيث تطورت النقاط الخمس من خلال العملية التصميمية وتشكلت بعد مرور 12 سنة من الممارسة التصميمية. ولتظهر النظرية المعمارية فيها من خلال ارتباط مباشر بالجانب التطبيقي. (Hauberg, Jørgen, 2014, p.6). ويشير الشكل (1) إلى مزايا نظرية النقاط الخمسة إلى نتاجاته: منزل لاروش جينيريت-Maison La Roche، فيلا شتاين Villa Stein، فيلا في قرطاج Villa at Carthage؛ وفيلا سافوي و Villa Savoye .

شكل (1) الرسومات المقارنة لأعمال ليكوروبوزيه توضح مزايا نظرية النقاط الخمسة وتطبيقاتها



المصدر: (<http://www.geocities.com/rr17bb/LeCorbusier5.html>)

إن الممارسة الاستقرائية التي بنيت على أساسها تصاميم الحدائثة جاءت نتائجها بأساس نظري متين، أفاد منها حقل العمارة حتى يومنا هذا. إلا إن سبب فشل وموت عمارة الحدائثة هو ليس بناؤها الفكري، وإنما نتاجها المادي الذي عبر عن انفصال العلاقة ما بين النظرية والتطبيق، ويعود ذلك إلى ترجمة المبادئ النظرية والاسس المفاهيمية إلى اطر عمل جامدة وقوانين صارمة اتسمت بالتجريد لتتفصل عن الالاسس النظري الذي بنيت على اساس الاحتياجات المتغيرة في كل مكان وزمان. فالنظرية في الجانب المفاهيمي كانت تستبدل الحتمية بالحدس وتعتمد على المنطق الاستقرائي لتشتق فيها النظريات منطقيا من خلال تحليل الحقائق. (Groat & Wang, 2013, p32). أما النظرية في جانبها التطبيقي themes فقد كانت حتمية استنباطية تستبعد دور الحدس وتعتمد على الحتمية العلمية وتفترض ان العلم هو المصدر الوحيد للحقيقية والتي تكون متكاملة ومستقلة عن النظرية كنموذج بل هيلير Hillier et al عام 1972 حيث شخّص نموذج للتصميم المنهجي يدمج اكبر قدر من العوامل ضمن مجال قابل للقياس بهدف استبدال "الحدس وقواعد الإبهام بالمعرفة وطرق القياس (ibid, p.33). كذلك فقد استخدم لكربوبوزيه نظرية المودولور في تصاميم أبنيته، وأصبحت ثلاثية فتروفايوس معيارا لتصاميم عمارة اعتمدت على الحتمية العلمية. ولعل الاحادية التي انتجت البساطة في عمارة الحدائثة كانت أساسا فكريا ومبدأ راسخا في نتائجها نتج عنها البساطة المفرطة إلى حد التجريد والاختزال كما نتج عنها مفردة الهيمنة والتفرد لطرف واحد على حساب الاخر (Nesbit, 1996, p.10). فهي رؤية مادية للنموذج العقلي الاختزالي اظهرت نتيجة لذلك نماذج واحدية الخط ترى ان المعرفة تتقدم نحو نقطة واحدة ويتم الحكم على هذه المعرفة من مقدار اقترابها أو ابتعادها عن تلك النقطة كما أدى ذلك إلى نماذج اختزالية تكون عملية التلقي فيها موضوعية وعقل الانسان فيها كيان سلبي يسجل كل ما ينطبع عليه من معطيات بشكل الي اتسمت بالبساطة وشمولية التفسير والواحدية ودرجة عالية من التأقين، ولتستبعد الامكان الانساني وتحيله إلى ما دونه من المادة (المسيري ، ص158) فاتسمت العملية التصميمية بكونها خطية من التحليل متجسدة بجانبها النظري إلى التركيب متجسدة بجانبها التطبيقي . جدول(1)

جدول(1) يوضح ارتباطات النظرية بجانبها النظري والتطبيقي في فكر الحدائثة

النظرية	نماذج نظرية في الجانب المفاهيمي paradigms	افكار نظرية في الجانب التطبيقي them
المنهج	تجريبي استقرائي	عقلي استنباطي
النموذج الفكري	احادية الفكر /نموذج اختزالي	وضعية حتمية علمية
المحرك الابتدائي	النظرية على اساس الواقع	قوانين ومعايير تصميمية

أما التفكيرية فقد أكد جاك دريدا أن كل فكرة أو مفهوم هو بناء أو تركيب يشكك بالمفاهيم الثنائية المقبولة يبدأ عملها من الخارج إلى الداخل فيعتمد على تعرية الحافات والمتضادات والافتراضات غير الحصينة التي تبني نص ما ويتجه إلى محاولة لإزاحة أكثر عمومية للنظام. امتاز الجانب البحثي المفاهيمي بالمنطق الاستنباطي في تفكيكها للفكر الاصولي وتفكيك العلاقات وتجزئتها فهي تعتمد على اللغة الشكلية الظاهرية للنص المعماري وبسبب كونها ذات أساس لغوي تغلب عليه الجانب التطبيقي متمثلاً بالتركيب syntheses فيها على الجانب النظري. وتعاملت بشكل اساسي مع البنى الظاهرة للنص في العملية التصميمية لتؤدي إلى نتائج شكلية لا تمت إلى الواقع بصلة وهذا يعود إلى انفصال الجانب البحثي المفاهيمي عن الجانب التصميمي التطبيقي فهي سعت إلى انعدام الجانب النظري وضربت جميع المفاهيم المعتمدة فموت المفهوم وموت النظرية هو الاساس الفكري للتفكيرية. (Nesbit,1996,p 15) ومما يجدر الاشارة إليه إلى أن الحداثة لم تتعمد الفصل ما بين التطبيق والنظرية في حين ان التفكيرية عمدت إلى ذلك فالحداثة اتجهت نحو الواقع في بناء مفاهيمها أما التفكيرية فانصلت عن الواقع باهتمامها بالشكل وان الشكل هو المهم. بالنتيجة فان التجريد الحاصل للأشكال في الحداثة والتجريد الحاصل في التفكيرية أدى إلى عمارة بعيدة عن المجتمع واحتياجاته. فالنظرية بجانبها المفاهيمي كانزراح المعاني جاءت نتيجة انزراح الاشكال عن مركزيتها في البنية اللغوية. جدول(2)

### جدول(2) يوضح ارتباطات النظرية بجانبها النظري والتطبيقي في الفكر التفكيرية

النظرية	نماذج نظرية في الجانب المفاهيمي paradigms	أفكار نظرية في الجانب التطبيقي themes
المنهج	عقلي استنباطي	عقلي استنباطي
النموذج الفكري	احادية الفكر /نموذج اختزالي	وضعية حتمية علمية
المحرك الابتدائي	الممارسة على اساس البنى الشكلية	هدم النظام
اليات انتاج الشكل	تهديم النظام – الازاحة	

المصدر: الباحث

حركة ما بعد الحداثة جاءت بتعدد مفاهيمي لمجالات العلوم المختلفة ساهمت في تشكيل النظرية النقدية لعمارة ما بعد الحداثة التي تميزت بالتعقيد والتناقض الذي لا يقوم على الاختلاف كما هو الحال في التفكيرية. وأما على وحدة الاضداد بهدف التطور، فتعدد القضايا التي تتنافس في أهميتها مع عدم وجود هيمنة لقضية فردية واحدة أو وجهة نظر مفردة والذي مثل سمة التعددية وتعرفها Nesbit بأنها نقد ثقافي نابع من البنى الاجتماعية المهيمنة على طبيعة النقد. ففي عام 2005 ظهر المذهب الواقعي أو الواقعية realism للتركيز على واقع العمارة كبناء يشجع الممارسة pro-practice، وظهور البراغماتية المدعومة بالتوجهات الفلسفية لتركز على دور التجربة والخبرة، التي اعطت الأمل للتطبيقات العملية لنتائج ملموسة على ارض الواقع لتتلائم مع التوجهات المحببة من صفة التجريدية الملازمة للنظريات المعمارية منذ الستينيات من القرن الماضي. (ibid, p 15) جدول (3)

فنظرية ما بعد الحداثة وأن كانت في بدايتها تهدف إلى تعدد المعاني إلى أنها اتسعت إلى أكبر من ذلك لتشمل قضايا متعددة ودخول فروع مختلفة إلى حقل العمارة ما بين علمية وإنسانية أدت إلى تشكيل النظرية. النقدية فالنظرية النقدية بجانبها المفاهيمي انعكست على النظرية من خلال الأفكار في جانبها التطبيقي الذي ركز على دور التجربة والخبرة ومفهوم الحياة اليومية لتركز على واقع الانسان وتمثل الفكر التطبيقي للنقدية.

### جدول (3) يوضح ارتباطات النظرية بجانبها النظري والتطبيقي في فكر ما بعد الحداثة

النظرية	نماذج نظرية في الجانب المفاهيمي paradigms	افكار نظرية في الجانب التطبيقي themes
المنهج	(تجريبي-عقلاني) / (استقراءي-استنباطي)	(تجريبي-عقلاني) / (استقراءي-استنباطي)
النموذج الفكري	فكر تعددي / نموذج تفسيري	معياري
المحرك الابتدائي	الممارسة على اساس الواقع	المجتمع
اليات انتاج الشكل	مشاركة المجتمع - ربط الممارسة بالواقع	
المصدر: الباحث		

### 3- المحور الثاني: مقياس الابداع في العلاقة ما بين النظرية والممارسة للحركات المعمارية:

يشير "رأفت علي" في كتابه ثلاثية الابداع المعماري في أن الابداع في العمارة على أنواع: الابداع المادي والابداع الفكري والابداع النفسي. فأما الابداع المادي فيشير إلى إبداع الطبيعة والفراغ المعماري يقابله الابداع الانشائي. وأما الابداع الفكري فيشير إلى دور العقل والجانب العقلي في الابداع فهو إبداع مفاهيمي. في حين يعبر الإبداع النفسي عن الاحساس والمشاعر فهو يعبر عن الجانب الحسي للإنسان فهو إبداع فني. (رأفت، علي، ص3).

في حين يشير "عيسى حسن" إلى إن هنالك طرازين أو جانبين للإبداع اعتمادا على الجانب الذي يستخدمه العقل في التفكير فهناك إبداع تأملي تخيلي فهو حدسي يعتمد على الحدس والالهام، والآخر منهجي منظم فهو طراز منطقي يعتمد على التطور المنطقي للأفكار (عيسى، حسن، 1990، ص30). نرى بذلك إن جزء من نظريات (الابداع) تذهب باتجاه تطبيقي بينما يتحرك الجزء الآخر باتجاه المفاهيم. فالعمارة بطبيعتها عملية إبداعية ومن صفات نواتجها هو الاحتمالية فهي افتراض ودور الباحث أو المصمم هو في ابراز أحد تلك الممكنات ضمن العملية الفكرية بما يتلائم مع واقع المفكر أو الباحث، فإمكانه في اظهار جوهر الموضوع يأخذ مجالات متعددة ومختلفة باختلاف الموقف الفكري الذي يتبناه الباحث. فالموقف الفكري يعتمد على المنهج الذي يتبعه المصمم، استنادا إلى طريقة التفكير، كما أشرنا لها، فالحدثة وفقا لذلك هي عملية استقرائية تتبع المنهج العقلي في التفكير، ويمكن رؤية إبداع الحدثة من خلال المفاهيم التي تم اعتمادها ولعل من ابرزها هي النظرية الوظيفية القائلة بـ "إن الشكل يتبع الوظيفة"، وهي نظرية علمية وفكرية تحكم على الأعمال من وجهة الأداء والكفاءة، ويحكم على صحة الأشكال بمقدار صلاحيتها لهذا الأداء (Jørgen Hauberg, 2014, p63)، ومن ابرز روادها كوربوزيه الذي أكد على أهمية البحث والتحليل العلمي في إنتاج عمارة ترتبط بالحياة، فالوظيفة بذلك تفرض شروط محددة على الشكل المعماري، في حين تركز النظرية الوظيفية على أهمية المنفعة والمتانة في العمل الإبداعي. بالتالي يجب أن يكون الجمال حصيلة لهذين الهدفين. كما اعتمد في عمله على تحرير الاشكال من أي قيود سواء كانت قواعد رياضية أو مبادئ هندسية واعطى اولوية للفراغ وطريقة تشكيله من الداخل إلى الخارج فأهمية الفراغ في تأدية الوظائف التي يراد اشغالها لخدمة الانسان فكان الشكل ركز على الاشكال البسيطة والاولوية. فمثلا فيلا سافواي (ibid, 2014) (p64 شكل2) طبق فيها مقولته الشهيرة المنزل مأكنة للعيش فكانت تعبر عن الامكانيات التصنيعية في ذلك الوقت لإعطاء الكفاءة القصوى للبيت واعتمد على المساقط الافقية المفتوحة لتوفير امكانية التنقل بين الفراغات وتوفير متعة التجول داخل المنزل ورؤية المشاهد المتنوعة. فكرته البسيطة تجلت في إعادة التفكير في وظيفة العمارة الأساسية، بكونها تساهم في جعل الحياة اليومية للسكان أسهل وأكثر عملية.

## Villa Savoye: Le Corbusier شكل (2) فيلا سافوي

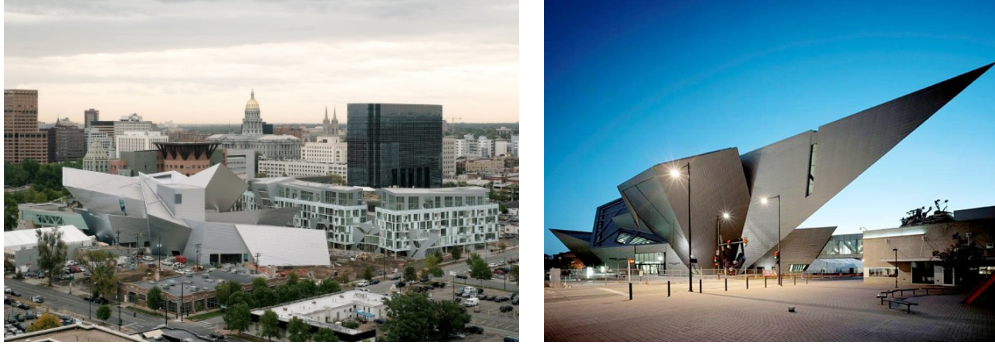


المصدر: <https://www.archdaily.com/84524/ad-classics-villa-savoye-le-corbusier>

يرى الباحثان ان فكر الحداثة أعتد الرجوع إلى أصل النظام في الوصول إلى المفاهيم الاساسية التي تحكم الشيء. وبالرغم من أن هدف الحداثة في تعمدتها لبساطة الاشكال هو في التخلص من الفوضوية الموجودة في تعقيدية الأشكال للمدينة الكلاسيكية، التي انتقدت وبشدة من قبل التفكيكيين في كونها أشكال لا تنبض بالحياة كما تم اتهام النظرية الوظيفية بكونها خالية من الحياة، وأصبحت هذه الاشكال ذات طراز عالمي موحد يتم استخدامها دونما اعتبار للسياق البيئي والاجتماعي وبالرغم من أن إبداعها المفاهيمي جاء بمثل عليا لا تهدف إلى هدم المفاهيم الاساسية وجلب المخالف لها كما هو الحال في التفكيكية.

فالتفكيكية اعتمدت في مفهومها للإبداع على الجانب الشكلي والانشائي في التملص من الماضي وتجسيد أشكال إنشائية لا تمت إلى الماضي بصلة تحمل في طياتها أبعاد سيكولوجية في رفضها للتراث وهذا هو الاساس الذي نشأت وفقه الحركة التفكيكية، التي تعرض ما هو غريب من خلال التشويه والتجزئة القائمة على الاختلاف مع السياق والمحيط، فهي تعلن إبداعها الشكلي من خلال المختلف والغريب فعلى العكس من الحداثة فالشكل لا يتبع الوظيفة وإنما الشكل يتبع الشكل وهذا يعود للأساس البنيوي اللغوي التي نشأت على أساسه فالتفكيك أصله ممارسة لغوية(ممتاز، 2010، ص3). وبالرغم من أن هنالك اختلاف في نسب حركة التفكيكية فمنهم من يعتبرها حادثة متأخرة ومنهم من يعتبرها أحد حركات ما بعد الحداثة. إلا أنها تختلف في توجهها عن الاثنتين فهي على العكس من الحداثة التي أكدت على أهمية الفراغ وضرورة استمرار الفراغ الداخلي وانسيابه مع الخارج جاءت التفكيكية لتعلن الانقطاع ما بين الداخل والخارج هدفها الاختلاف والتمايز الشكلي، وتعتبر أن البساطة التي جاءت بها الحداثة تؤدي إلى مباني خالية من الحياة وأن التعقيد الشكلي هو الذي يؤدي إلى فراغات نابضة بالحياة،(المصدر السابق، ص4) ففي مشروع دانيال لابسكند Daniel Libeskind متحف دنفر للفنون شكل (3) نرى فيه الابداع الشكلي من خلال تحدي كل ما هو ثابت وكل ما هو محفز في ذاكرة المتلقي .

### Denver Art Museum شكل (3) متحف دنفر للفنون



المصدر: <https://www.archdaily.com/80309/denver-art-museum-daniel-libeskind>

يرى الباحثان ان كل من الحداثة والتفكيكية اعتمدت على جانب معين من الإبداع النظري ليكون اما ابداع مفاهيمي **paradigm** أو أبداع شكلي تطبيقي **theme** . ففكرة الإبداع في التفكيكية اعتمدت على تطبيقات يقوم بهدمها فهو بذلك يضرب المفهوم، أما الحداثة فهي تطبيقية اعتمدت على هدم النموذج وتفكيك علاقاته وترابطاته الشكلية. وبالرغم من أن تبريرها لذلك هو في الوصول إلى حقيقة الشيء بغية إيجاد النموذج الاولي له إلا أنها في المحصلة اعتمدت على التطبيق في تفكيكها للنظام الظاهر واهتمامها بالقيمة التشكيلية، فالتفكيكية تصل بالمفهوم إلى تعدد بالأجزاء غير المتشابهة لأن فكرة الابداع لديها هو في تهشيم النظام، أما الحداثة فقد اهتمت ببناء مفاهيم هدفها الانسان. بذلك فأن إبداع المفاهيم كان باتجاهين: تطبيقي بتهديم الاشكال فله توجه نظري خاص به كما أسلفنا؛ أو مفاهيمي فأبداع في الوصول إلى المفاهيم حيث رجع إلى النظام الذي يحكم الشيء كما في الحداثة. فالحداثة اعتمدت على الجانب النظري بأعلى قيمة للمفهوم والآخر التفكيكية اعتمد على الجانب التطبيقي بأعلى قيمة للمفهوم. وكما في الجدول (4) الذي يوضح مقاييس الابداع وانواعه حسب الحركات المعمارية.

أما ما بعد الحداثة فقد جاءت كرد فعل على اختزالية العمارة الحديثة ولعل من أبرز منظريها "فنتوري" في كتابه "التعقيد والتناقض"، أكد فيها على أن القليل لا يعني الكثير والكثير لا يولد من القليل، ردا على مقولة المعماري الحداثي ميس فان دي روه وأكد على دور التعددية والتعقيد في الابداع المعماري، التي اعتمدت في إبداعها على الجانب الشكلي الخارجي فكانت مقولتها "الشكل هو الهدف"، ردا على رتابة وجمود أشكال الحداثة وأهمية المضمون والابعاد السيكولوجية الاخرى خلف الشكل المادي الظاهري. والحركة ركزت على أهمية الفراغ كما هو الحال في الحداثة و اكدت على اهمية ارتباطه بالسياق المحيط وترابطه معه وهذا ما اختلفت فيه عن الحداثة التي انفصلت فيه عن السياق والمحيط ، كما تماثلت مع التفكيكية في أهمية التناقض(فنتوري ، 1986، ص 105) ، ولكن تناقض بهدف الوحدة وليس بهدف الاختلاف فهي تجمع المتناقضات في كل واحد، كما اختلفت مع الحداثة والتفكيكية في أهمية الارتباط مع الماضي وليس الانفصال عنه بالرغم مما يؤخذ عليها في هذا الارتباط بكونه شكلي فاستعارة الاشكال المجردة التي تعبر عن الماضي وتجسدها بعلاقات شكلية مع الحديث ليكون الابداع شكليا تعبيريا في الحنين إلى الماضي، كذلك فأن الابداع على المستوى المفاهيمي كان حاضرا إلى أنه لم يكن بقوة الطرح الذي جاءت به عمارة الحداثة حيث جاءت بتصحيحات وتعديلات عن سابقتها (عمارة الحداثة) (المصدر السابق، ص 103) . شكل(4)



شكل (4) ستاتس جاليري في شتوتغارت، جيمس ستيرلنغ.  
James Stirling Staatsgalerie in Stuttgart, German



المصدر : <https://www.archdaily.com/124725/ad-classics-neue-staatsgalerie-james-stirling>

جدول (4) يوضح مقياس الابداع لأعلى قيمة لمفهوم الابداع

ابداع نظري		ابداع تطبيقي			مقياس الابداع اعلى قيمة للإبداع
ابداع فكري مفاهيمي	ضعيف متوسط عالي	ابداع شكلي	ضعيف متوسط عالي	ابداع انشائي	
✓		✓		✓	الحدثة
	✓	✓		✓	التفكيكية
✓		✓		✓	ما بعد الحدثة

يرى الباحثان: إن هنالك خطين متعاكسين ومتلازمين للإبداع في العملية التصميمية عبر تاريخ العمارة وهما: الابداع المفاهيمي بأعلى قيمة في عمارة الحدثة متمثلاً بالجانب النظري في الرجوع إلى أصل النظام وصولاً إلى المفاهيم الأساسية التي تحكم الشيء متجسداً بعمارة الحدثة؛ والابداع المادي بأعلى قيمة متمثلاً بالجانب التطبيقي عبر هدم النظام وتهشيمه متجسداً بالعمارة التفكيكية. وللوصول إلى الابداع المتكامل يتطلب تكامل الجوانب الابداعية المادية والعقلية في توازن منتظم واقترابها من الواقع. فالإبداع المتكامل هو الذي يربط ما بين النظرية بجانبها المفاهيمي والممارسة بجانبها العملي.

4- المحور الثالث: نموذج الابداع المتكامل -النموذج المركب في تحقيق تكامل النظرية ما بين الممارسة والتطبيق في العملية التصميمية:

أحد صفات نواتج العملية التصميمية (البحثية) هو الاحتمالية فلا يوجد يقين مطلق، فنتائج العملية الفكرية هو افتراض، ودور الباحث يكمن في إبراز أحد تلك الممكنات ضمن العملية الفكرية (التصميمية) بما يتلائم مع واقع المفكر أو الباحث، فإمكانه في اظهار جوهر الموضوع يأخذ مجالات متعددة ومختلفة باختلاف الموقف الفكري الذي يتبناه الباحث ويكمن دور الانسان (كمصمم أو مفكر) من خلال إعادة تنظيم الجزء الكامن من الحالة المتبلورة في إمكان الشكل بحدود النظام الذي يجمع حالات ظهورها. وإمكان الباحث في طريقة تفكيره يمكن ايعازه إلى نظرية هيرمان في التفكير. فالنمط الفكري وفقاً لهذه النظرية يتنوع ما بين (فكر تحليلي - فكر تنفيذي تنظيمي) مقابل - (فكر عاطفي) - مبينا أن الفكر الابداعي هو ما تتكامل فيه جوانب التفكير العقلانية والحسية جدول (5)

جدول (5) المماثلة ما بين النظريات وما يقابلها في العملية التصميمية للنموذج التعددي المركب

الجانب التفكيري	خواصه ومميزاته	ما يقابله في المنهج
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## التصميمي

العقل التحليلي	تحليلي	منطقي	كمي	حقيقي واقعي	التحليل analysis
العقل العاطفي	مشاعري	عاطفي	يهتم بالإنسان ومشاعره	حدسي خيالي	التركيب syntheses
العقل التنفيذي	ترتيبي	تنظيمي	تفصيلي	توجيهي تخطيطي	التقييم evaluation
التنظيمي	تسلسلي				
العقل الابداعي	كلي	حدسي	تكاملي	تأليف وتركيب	Analysis-syntheses- evaluation

المصدر : الباحث حسب تصنيف هيرمان لانماط التفكير الابداعي

فحسب مقياس هيرمان لأنماط التفكير فإن خطوات العملية التصميمية عملية إبداعية تختلف طبيعة الابداع فيها باختلاف المراحل في العملية التصميمية وللوصول الى الابداع الكلي الشامل يكون من خلال موازنته ما بين جوانب الابداع المختلفة (الهيلات، 2015 ص 79) ، فهي تتطوي على الابداع التحليلي المتمثل بمرحلة الدراسات الاولية وهي أولى مراحل العملية التصميمية. أما العقل المرتبط بالأحاسيس والمشاعر فيرتبط بالجانب التركيبي synthesis ويتحرر فيها المصمم من القيود من أجل توليد الافكار والتخمينات البديهية خلال خطوة تشكيل النماذج المعمارية، بينما ترتبط الخطوة الأخيرة بالعقل التنظيمي، الذي يرتبط بالواقع من خلال مرحلة التخمين Evaluation وتعني تقييم عدة بدائل للحلول التصميمية وفقا لمجموعة معايير وتقييم الحل الامثل على أرض الواقع.

وعند تغلب نمط فكري على آخر فإنها تعطي حلول جزئية غير شمولية، فمثلا لو افترضنا أن نمط التفكير يتغلب عليه الجانب التحليلي فهو بذلك يعطي نتائج إبداعية على الجانب الوظيفي أو الانشائي أو التكنولوجي كالمباني التي تعتمد على أنظمة مستدامة حيث تعتمد على تطبيقات تكنولوجية وإنشائية فهي إبداع مادي تماثلها في البحوث التطبيقية التي يكون الانتقال فيها من مرحلة الـ briefing إلى التقييم دون المرور بالاطار النظري فهي تطبيق لحالة معينة في سياق معين أو لتقييم واستكشاف وتقييم امكانية برنامج مسبق في سياق معين فهي استنباطية - تطبيقية . (Nesbit, 1996, p14)).

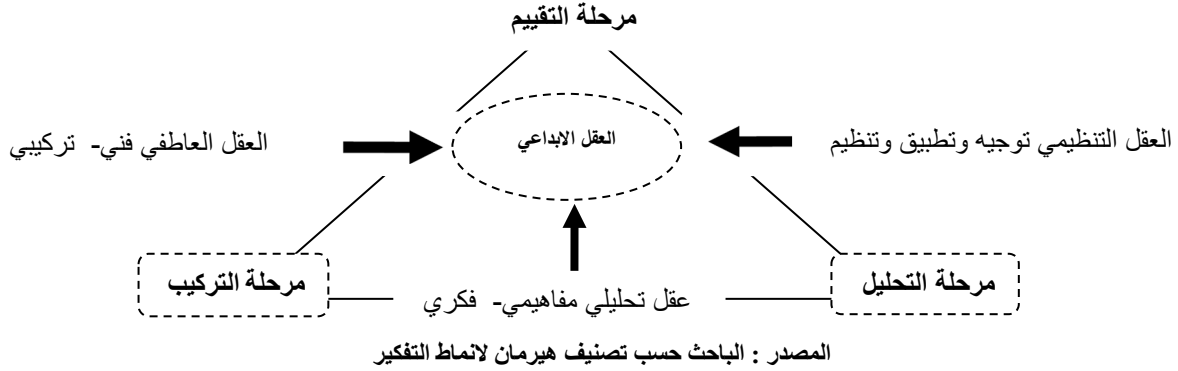
أما اذا تغلب الجانب العاطفي التركيبي فهو بذلك يعطي نتائج لأنماط تصميم تقليدية تعبر عن انتقاله خطية في توظيف البيانات المسبقة لعملية التصميم من خلال التوفيق بين الحاجات والمتطلبات الداخلية والخارجية دون المرور ، أو قلة الاهتمام، بعملية التحليل والتقييم وطرح البدائل التصميمية Decomposition of Form ، فهي عملية استعارة مباشرة كما يحدث عند استعارة المفردات التراثية كنماذج شكلية يتم استعارتها بهدف التزيين دون أن يكون لها دور وظيفي ودون تحليل وفهم الأصل الفكري الذي أدى إلى ظهور هذا النتاج المادي. فالشكل الحقيقي بعد تقليده يفقد صفة الابداع لافتقاده إلى روحية الزمان والمكان، فتُفقد صفة الابداع عند لصق شكل قديم في محتوى جديد فلا يوجد شكل ثابت لأن المجتمع متغير، كذلك فإن احتياجاته متغيرة، فالبحث عن قيمة الشيء هو المهم وليس الشيء نفسه (هيثم ، أحمد ، 1436هـ، ص 9)، كذلك فإن الخرائط الذهنية لمصممي التفكيرية تثبت تغلب الجانب الشعوري العاطفي على الجانب العقلي بل يكاد يكون الاخير مهمشا، فهي تُعنى بتفكيك النظام وتهمل الجانب التحليلي فتكون نتائجها مبدعة على الجانب الشكلي بما يثير الاحاسيس والمشاعر لدى المتلقي بعرضه للغريب واللامتوقع فهي نماذج متأقنة منفصلة عن السياق تتجاوز التحليل Analysis لتتفرد بالأشكال المعمارية.

يرى الباحثان أن هنالك خطين متعاكسين ومتلازمين في العملية التصميمية عبر تاريخ العمارة: الأول في التطبيق وما يعادله من استنباط بجانب مفاهيم ونظريات وما يعادلها من استقراء، فالخط الاستنباطي يعتمد على مفاهيم يقوم بتسقيطها كان واضحا في عمارة الحدائثة؛ والخط الثاني استقرائي يعتمد على مفاهيم معينة يهشمها ويكسرهما

من أجل الوصول إلى تطبيقات، وكان الخط واضحاً في عمارة ما بعد الحداثة والعمارة التفكيكية. وللوصول إلى عمارة معاشة تقترب من الانسان فلا تكون إلا من خلال تكامل أنماط التفكير التحليلية والشعورية في وحدة واحدة ترتبط بالواقع. ومن ذلك يستطيع الفكر الابداعي أن يحقق التوازن ما بين الجانب التحليلي والجانب الشعوري ويحقق الارتباط فيما بينهما، ويتحقق الارتباط من خلال مرحلة التقييم والبحث لاختبار نتائج الاحتمالات الناتجة ومعرفة مدى ملائمتها للواقع. ارتباط الجانبين العقلي والمادي من خلال البحث والتقييم فهي منهج استنتاجي من خلال عملية استقرائية استنباطية وبدورات متكررة من أجل التغذية الاسترجاعية وصولاً للهدف الذي ينشده المصمم ويلعب البحث دوراً في تكامل الجانب النظري مع الجانب التطبيقي في العملية التصميمية من جهة وارتباطه بالواقع من جهة اخرى.

فالنظرية المتكاملة للإبداع وكما يشير إليها " عيسى حسن"، هو تكامل أبعاد الابداع الثلاثة المادي والفكري والفني في وحدة واحدة تكمل أحدهما الاخرى وتتكامل جوانبها في الاعتماد على ثلاثية الجسم - العقل - النفس. فالإبداع المتكامل هو توازن الجانب العقلي مع الجانب الحسي نحو هدف غايته الانسان وذلك يتحقق من خلال التوازن ما بين الجانب العقلي والجانب المادي. في التفكير فالمنهج التوفيقي لا يقر بالمتناقضات وإنما يعتبرها الاساس في الحكم على القضايا فالجانب الروحي يمثل المضمون الجوهرى الثابت في الفكر الإسلامى، وهذا الجانب الروحي دائماً يكمل بجانب مادي يعكس صورة الروح لكون العلاقة بينهما تكاملية. أما العلاقة بين المادة والصورة فهي علاقة تلازمية فالمادة لا تتخلى عن الصورة لأنها لا تقوم إلا بها، والصورة تلازم المادة لأنها تحتاج لقوة لكي تظهر (ال يوسف، إبراهيم جواد، 2014، ص 140) كما في الشكل (5).

شكل (5) يوضح النظرية التكاملية للإبداع في العملية التصميمية وفقاً لمقياس هيرمان



ويتمثل العقل الابداعي من خلال النظرية النقدية فهي نموذج مركب يجمع ما بين النظرية بجانبها النظري في المفاهيم والنظرية بجانبها التطبيقي في الأفكار. ويؤسسها على الواقع فهي نموذج نقدي بحثي يدمج البحث النظري بالممارسة التصميمية ويربطها بالواقع ونظرية الحياة اليومية.

وتعتبر النظرية النقدية مفتاح الحل في المزوجة ما بين النظرية والتطبيق من خلال ربط الجانب النظري المفاهيمي بالجانب النظري العملي لتخرج بنظرية شاملة ومخصصة بنفس الوقت هدفها دمج الهياكل الاجتماعية في النظرية المعمارية، كما تمثل نظرية جدلية تخدم المجتمع وتنتقده من امراضه وأفاته، وتربط الممارسة المعمارية بالواقع لتدعم التطور التكنولوجي للثورة الرقمية ودخولها في العملية التصميمية. بالتالي هي نظرية تدعم الممارسة co-practice لكنها لا تقف بالصد من النظرية بل هي مزج ما بين الاثنتين ( Sykes & Hays,2010, p14 )

ويبرهن وورث مان worthman إلى امكانية تواصل وتكامل العلاقة ما بين الجانب النظري المفاهيمي والجانب التطبيقي من خلال البحث research بينما ان حقل العمارة من الحقول المستندة على البحث discipline based research - لأنه يساهم في حل واقع المجتمع وتطويره B.Dworthman. فال تصميم هو فعالية اندرج تحت نظرية Gardner للذكاء المتعدد multiple intelligences، حيث يرتبط بالتصميم ويكملة فاصبح التصميم والبحث ثنائيات متكاملة متبادلة اصطلح عليها الثنائيات المهجنة (Groat & Wang, 2013, p.12).

واشار كابلان أن الحقائق العلمية تكون في مكان ما خلف ما هو ظاهر للعين وهو بهذا يهدف إلى صياغة منطق استنباطي - استقرائي أسماه المنطق المعاد بناؤه فهو منطق استكشافي Reconstructed Logic يفترض اهمية الحدس في الفرضيات العلمية ومنطق الاكتشاف العلمي فهو عملية منهجية لصنع وتحقيق الاكتشافات عن طريق صياغة الاسئلة بغزارة. (Groat & Wang, 2013, p.10) فالمنطق المعاد بناؤه يبدأ من الواقع وي طرح الاسئلة ويضع الاحتمالات الممكنة في عملية تشاركية لتشخيص المشاكل ووضع الحلول. كما أنها عملية تحليلية فالبحث يرفد والتصميم بعدة طرق و عدة مرات في العملية التصميمية كما أن العملية التصميمية بالمقابل تنم عن اسئلة تتناسب مع العديد من أشكال الاستفسار والتحقق البحثي. فهي ضرورة لتستجيب للطبيعة المعقدة لمجتمع المشاريع المعمارية، ولا تستبدل الحدس بالمنطق وإنما هي توليفة من الاثنين. ووفقا لذلك فإن المنطق المعاد بناؤه يتألف من ثلاثة مراحل متكررة لتؤلف نموذج منهجي متكامل يربط ما بين النظرية والممارسة التصميمية وهي: التحليل Analysis ثم التركيب Synthesis والتخمين Evaluation. وتمائل عملية التركيب Syntheses الإطار النظري في البحث حيث تترك هذه المساحة لذاتية الباحث أو المصمم في تشكيل الاحتمالات والبدائل، وتمائل مرحلة التقييم Evaluation تقييم فرضيات المشكلة البحثية وفقا لمجموعة معايير (مكنية - زمانية) وفقا لمؤشرات الإطار النظري وتقييم الحل الامثل. فهي انتقالات خطية ودورانية من اجل التغذية العكسية Feed-Back تهدف إلى التغيير والتطور والتكامل مع اهداف وغايات المصمم. (Groat & Wang, 2013) ويمكن المماثلة ما بين المراحل الثلاثة للعملية التصميمية مع انواع النظرية في العمارة حسب تصنيف Nesbit في مقدمه كتابها Theorizing New Agenda النظرية في العمارة الى:

**اولا : نظرية وصفية:** تحدد نظرية تصميم قائمة على تقديم حلول حية للمشاكل، وتؤسس مبادئ جديدة للممارسة والتطبيق لتعطي مقاييس ايجابية من الممكن أن تكون انتقادية ( بصورة جذرية ) أو تكون مؤيدة ( للحفاظ ) للحالة الراهنة فهي نظرية بالجانب النظري التطبيقي Themes يتم تطبيقها في الجانب التحليلي من العملية التصميمية.

**ثانيا : نظرية تجريبية:** المقاييس تقرر ما يتجنبه التصميم هدفها ان تخلو العمارة من السلبيات يمكن ان تمثل نظرية حفاظية تشجع نوعية متماسكة من خلال تحديد المواد واختيار الطراز، فهي نظرية بجانبها التطبيقي Themes تنعكس من خلال الافكار التميمية وتمائل مع الجانب التركيبي Synthesis في العملية التصميمية.

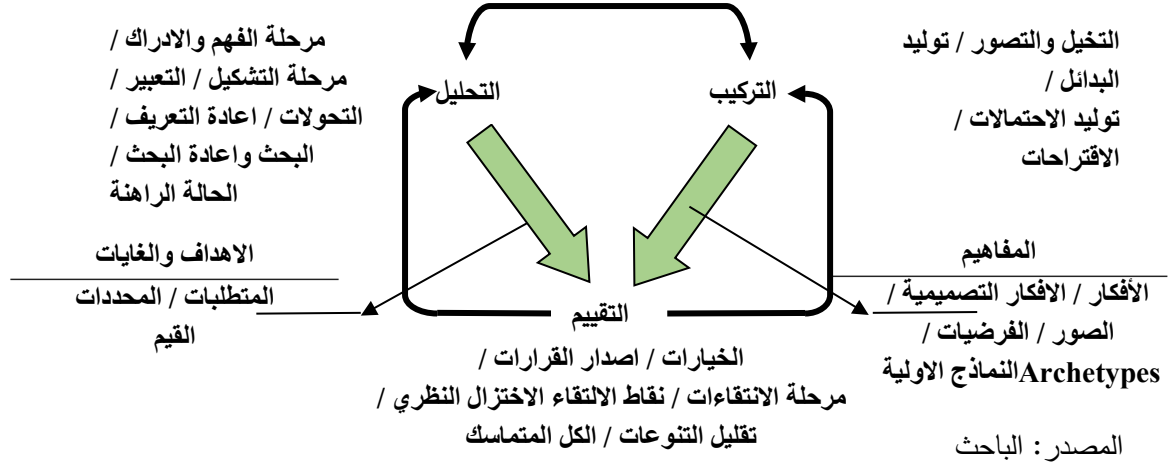
وتقود النظرية الوصفية والتجريبية إلى نتائج متوقعة تتضمن جميع المعارف التي يستخدمها المعماري في عمله بما في ذلك اختيار الموقع الافضل، واختيار مواد البناء الاكثر ملائمة.

**ثالثا : النظرية النقدية:** هي نظرية تأملية، متسائلة، وفي بعض الأحيان مثالية جدا تقيم من خلال علاقة العمارة بالمجتمع هدفها تحقيق تغيير في المجتمع كونها مثالية وتبرعن توجه سياسي واخلاقي تتدرج تحت التوجهات الفكرية الماركسية أو الانثوية. فهي بذلك تتدرج تحت النظرية بجانبها المفاهيمي Paradigms بالامكان تطبيقها

في الجزء التقييمي Evaluation من العملية التصميمية. فهي عملية بحثية تبدأ من الواقع لتقوم بتعديل نتائجها، فهي نظرية تشجع على الممارسة.

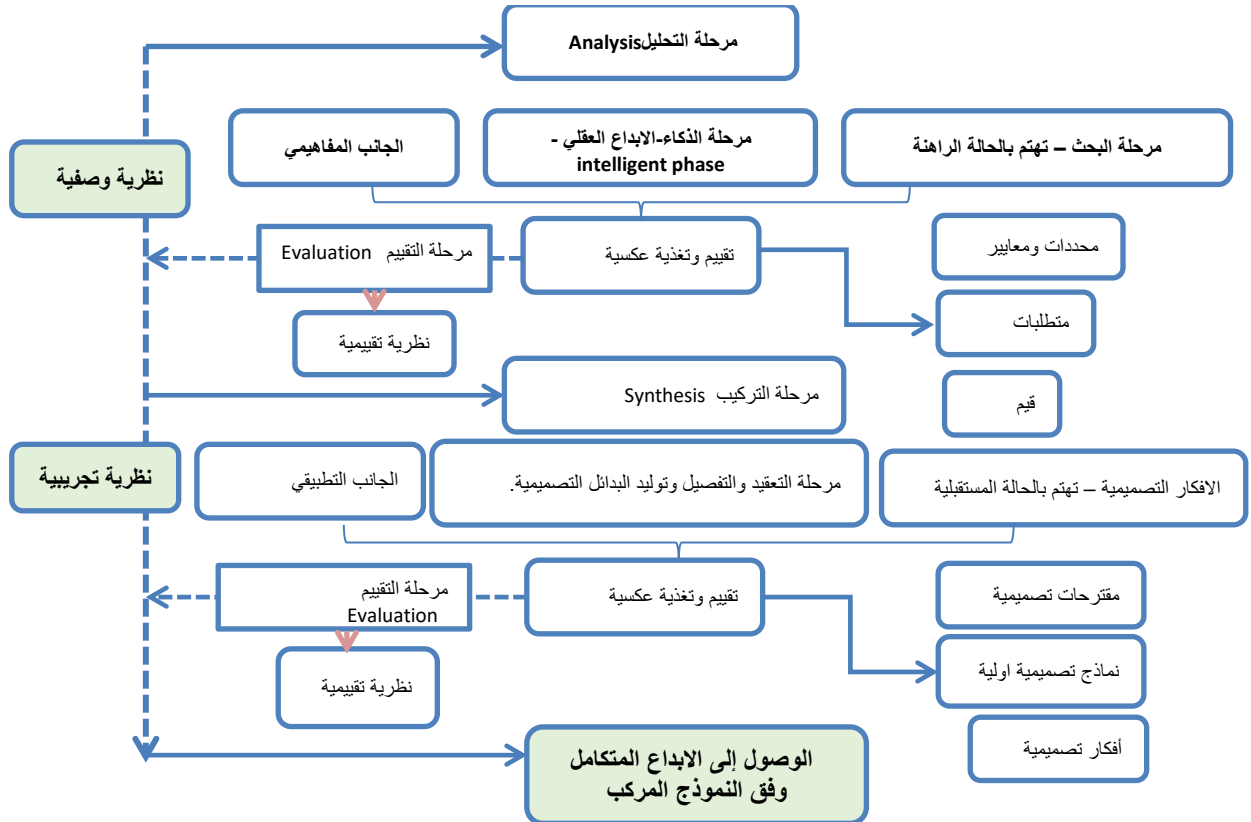
يبين فيها تراكب عملية Duerk شكل (6) تحليل العملية التصميمية وفقا لـ

البحث وتداخلها مع العملية التصميمية التي تعتمد على البرامج الحاسوبية



شكل (7) نموذج الابداع المركب في المنهج التصميمي الذي يربط ما بين النظرية والممارسة

في العملية التصميمية



المصدر: الباحث

5- النتائج والاستنتاجات:

- (1) هنالك خطين متعاكسين ومتلازمين في العملية التصميمية عبر تاريخ العمارة: الأول في التطبيق وما يعادله من استنباط والمفاهيم والنظريات وما يعادلها من استقراء فالخط الاستنباطي يعتمد على مفاهيم يقوم بتسقيطها، وكان واضحا في عمارة الحداثة، أما الخط الثاني الاستقرائي فيعتمد على مفاهيم معينة يهشمها ويكسرها من اجل الوصول إلى تطبيقات كان واضحا في عمارة ما بعد الحداثة والعمارة التفكيكية.
- (2) تعتبر حقل العمارة من العلوم الانسانية ذات طابع اجتماعي فهي بذلك تكون ديناميكية ومتغيرة الا انها في نفس الوقت تتضمن عمليات وممارسات علمية للتضمن بذلك قيم معيارية ومقياسية في نفس الوقت فالعمارة من الحقول المستندة على البحث Discipline –Based Research لأنه يساهم في حل واقع المجتمع وتطويره.
- (3) للوصول إلى عمارة معاشة تقرب من الانسان، لا تكون إلا من خلال تكامل أنماط التفكير التحليلية والشعورية في وحدة واحدة ترتبط بالواقع. والفكر الابداعي هو الذي يستطيع أن يحقق التوازن ما بين الجانب التحليلي والجانب الشعوري ويحقق الارتباط فيما بينهما ويتحقق الارتباط من خلال مرحلة التقييم والبحث لاختبار نتائج الاحتمالات الناتجة ومعرفة مدى ملائمتها للواقع.
- (4) ارتباط الجانبين العقلي والمادي من خلال البحث والتقييم وهما منهج استنتاجي من خلال عملية استقرائية استنباطية وبدورات متكررة من أجل التغذية الاسترجاعية وصولا للهدف الذي ينشده المصمم ويلعب البحث دورا في تكامل الجانب النظري مع الجانب التطبيقي في العملية التصميمية من جهة وارتباطه بالواقع من جهة أخرى.
- (5) تتجه العمارة اليوم إلى اهمية التطبيق والممارسة على أرض الواقع في صياغة وتشكيل الجانب المفاهيمي والنظري وأهمية السياق الاجتماعي كفاعل مهم في العملية التصميمية. وهذا يتطلب منهج جديد في العملية التصميمية عبر إمكان المنهج العلمي الجديد Abductive Reasoning الذي يتحقق بالعلاقة التبادلية ما بين الاستقراء والاستنباط وبدورات متكررة خلال العملية التصميمية.
- (6) يتمثل الابداع المفاهيمي بأعلى قيمة في عمارة الحداثة، بالجانب النظري في الرجوع إلى أصل النظام وصولا إلى المفاهيم الاساسية التي تحكم الشيء متجسدا بعمارة الحداثة والابداع المادي بأعلى قيمة متمثلا بالجانب التطبيقي عبر هدم النظام وتهشيمه متجسدا بالعمارة التفكيكية.
- (7) للوصول إلى الابداع المتكامل يتطلب تكامل الجوانب الابداعية المادية والعقلية في توازن منتظم واقتربها من الواقع. فالإبداع المتكامل هو الذي يربط ما بين النظرية بجانبها المفاهيمي والممارسة بجانبها العملي.
- (8) النظرية المتكاملة للإبداع هو تكامل ابعاد الابداع الثلاثة المادي والفكري والفني في وحدة واحدة تكمل أحدهما الاخرى وتتكامل جوانبها في الاعتماد على ثلاثية الجسم – العقل – النفس فهو توازن الجانب العقلي مع الجانب الحسي نحو هدف غايته الانسان يتحقق ذلك من خلال التوازن ما بين الجانب العقلي والجانب المادي.
- (9) النموذج المركب وهو ثنائيات متكاملة متبادلة يصطلح عليها الثنائيات المهجنة Well-Fabricated Hybrids تحقق امكانية تواصل وتكامل العلاقة ما بين الممارسة التصميمية والنظرية حيث يربط العملية البحثية بالجانب التصميمي ويربط النظرية بجانبها المفاهيمي والتطبيقي بارض الواقع.

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## **Evaluation of Intervention Policies for Urban Development Projects in traditional cities.**

(1) Assist. Prof. Dr. Saad Khudhair Aljumaily  
Al-Nahrain University  
[saadaljumaly41@gmail.com](mailto:saadaljumaly41@gmail.com)

(2) Baneen Abdul-kareem Alsaadawi  
University of Technology  
[archbaneen@yahoo.com](mailto:archbaneen@yahoo.com)

(3) Nawres Oday Alquraeshe  
Al-Nahrain University  
[nawrasalquraeshe@yahoo.com](mailto:nawrasalquraeshe@yahoo.com)

### **Abstract:**

The ancient city of Kadhimiya is one of the cities with a traditional organic texture and distinct residential buildings in its architectural, planning, environmental and social characteristics. It is considered one of the holy cities as it includes the tombs of the two imams, Musa al-Kadhim and Imam Muhammad Baqir al-Jawad.

The city suffers from multiple problems due to its inability to absorb the huge number of visitors and tourists that arrive throughout the year because they were not designed to meet the activities, events, rites and religious rituals accompanying them.

There have been many studies to find solutions to these problems, as well as attempts to upgrade and develop the city, ended with the latest development, which represents the removal of large parts of the city to provide dynamic and visual axis of the two shrines, as an attempt to accommodate the movement and the movement of visitors only without thinking about the development of the place and maintain the characteristics of it, The research problem was identified in: (Lack of planning and design intervention mechanisms of the traditional fabric of Kadhimiya city, to achieve integration, consistency and balance in the land uses, solve the problem of movement, movement of visitors, as an applied policy to meet the challenges and Contemporary Problems).

This problem was addressed by the following hypothesis: (the contemporary intervention policies failed to achieve balance in land use and place development, because they contributed to the destruction of planning, urban, environmental and social characteristics).

The aim of the research is to verify the effectiveness of contemporary intervention policies in achieving the integration and balance of land uses in order to achieve place development in addition to finding solutions that suffer from the city through analyzing and evaluating these policies.

The research found that all intervention policies contributed to the destruction of the city's planning, architectural, environmental and social characteristics, as well as the lack of cohesion, balance and spatial development.

**Keywords: Intervention Policies, Urban Development, Traditional Cities.**

### **1. Introduction:**

The city of Kadhimiya is an old town with an ancient and glorious past, part of old and modern Baghdad. It is a traditional city with historical roots and is considered one of the historical-traditional cities still inhabited by its original inhabitants who inherited their customs, traditions, social, ideological, economic and political values and activities. The city gained a special identity that expressed the depth of the city's belonging to the place through a complex system of relations that express its ideological, economic and social identity. And the design of the city and buildings, "as an Islamic city" as a symbolic response to the environment, faith and social norms that still prevail today and are part of the culture and identity of the place. Kadhimiya is a city that grew north of central Baghdad. It has a large mausoleum that surrounds the tombs of Musa al-Kadhim and Mohammed al-Jawad. The city is characterized by a continuous expansion towards the north of the city. The city suffers from planning and design problems. The study seeks to "study the environmental, urban, social, economic, cultural and urban problems resulting from the city's successive planning and development processes and to clarify the most important applied mechanisms affecting



the traditional fabric and their compatibility with the principles and policies of Bar Urban, which aims to develop the place and the formation of memory Assembly ", and this requires the following:

-Building a knowledge base for the concept of planning and design intervention mechanisms in traditional environments, as an applied urban policy adopted within contemporary urban development projects.

-A statement of the planning and design goals to preserve the heritage and historical areas, and explore the values of the place (visual and invisible) that are popular to people in those areas and reveal their importance in achieving the continuity of the city and preserving its historical sequence.

- To verify the efficiency of development proposals for the city of Kadhimiya on the basis of the mechanisms extracted and to show their impact on the traditional fabric, and then draw conclusions, conclusions and recommendations.

## **2. The first axis: Planning and design intervention mechanisms in traditional environments:**

Traditional environments usually include a set of natural or cultural values that are an extension of the local and historical elements, as spatial facts that express the identity of the society and its culture when it deals directly with its environment, as well as the expression of inherited occupations that meet the needs of the society humanely and spontaneously (Such as buildings, areas, squares, terraces, historical and heritage sites, etc.) or non-physical (such as folklore, stories, customs, traditions, events, activities, religious rites ...), and for the purpose of Show those values to be N local mechanisms to address the dimensions of world-class intervention in traditional settings as follows:

- "Fitch, 1990" identified a series of levels of intervention (patterns of change) of historic buildings in environments:

- Preservation: Craft maintenance in its assessment of the current physical condition state.
- Restoration: The real return of the building or the urban environment to its physical state, which was at an earlier stage of its life.
- Refurbishment (conservation and consolidation): Physical interference in the fabric of the building to ensure continuity of its performance.
- Reconstruction: The construction of the building piece by piece either on site or in a new location.
- Conversion adaptive reuse: Adapt the building to accommodate the new use.
- Reconstruction: Reconstruction of abandoned buildings in their original locations.
- Replication: Build a replica of an existing building.
- Facadism: Preservation of the facade of the historic building with a new building behind it
- Demolition and redevelopment: Demolition and disposal, with new development of the site. (Carmona & Heath, 2003,p 201)

- "Cohen, 2001" refers to planning mechanisms for the protection of vocabulary and architectural buildings of symbolic, cultural, historical or visual value and their maintenance and reuse in order to eliminate the distortion that occurs in them, in light of the factors and conditions that affect the architectural configuration of the facades, These aim at:

- Preserving the constructed physical environment (physical nature) and the social, cultural and economic environment (moral character) to achieve the identity, the distinctive character of the place and the sense of belonging to it.

- Control and control of the changes associated with the development processes that are subject to areas of distinctive architectural character. (Cohen, 2001, pp 85-86)
  - Preserving the spatial characteristics which in turn contribute to the economic development of the place, the activation of its environmental and social values absent, as well as the richness of environmental, cultural and natural diversity. (Hough , 1990,p149)
  - Transferring and preserving the meanings and characterization of the familiar system as a local culture that contributes to and participates in the knowledge of how to use these symbols through perception and reproducibility. (Schulz, 1974,p428)
  - Protect heritage and deal with it separately from macro-development, in light of its linkage to tourism development and the revival of the local economy and local governments, as well as promoting the growth of society based on values and cultural elements in the urban landscape. (Srinivas, 1999,pp1-2)
- Orbasli, 2000, states that preservation is the promotion of the environment and the preservation of its continuity as a desirable place to live, in the midst of insecurity in place and time and its connection with culture. Conservation is not merely an architectural debate but also an economic and social one The preservation of structures means preserving the desirability or continuity of a culture - we are, in fact, preserving cultures rather than buildings, in order to move from the "continuity of living in the environment" to more aesthetic and external qualities that aim to attract visitors from the outside world Activation of legacy location data Bioterrorism) is a procedure to deal with actual or potential limitation, ensuring that the cultural heritage is maintained over a long period of time. (Orbasli, 2000, pp1-18)
- The Heritage Branch said that conservation is an intervention mechanism, which is concerned with the protection of the heritage site in light of its use for various purposes such as tourism or education, in a way that does not lead to the deterioration of its heritage value, but to preserve it well and make it places that contribute to the cultural, economic and social well-being of individuals Community.(Heritage Branch, 2013, pp1-2)
- "Havik " (rs) classifies intervention projects in urban environments into three types: projects that change the form or appearance of urban areas, and projects that change or add urban routes), Such as Hidden City tour, and interventions that change the function of urban places. These interventions have provided new opportunities for interaction with abandoned or neglected areas, encouraging people to observe and enjoy the hidden beauty of spaces Urban (hidden beauty in urban spaces), and achieved extensive cultural activity in the light of the reuse of dramatic spatial characteristics. (Havik, 2006, pp167-175)
- "Costa, 2006" pointed out the mechanisms of intervention in urban centers of historical and cultural importance, as spaces that preserve the memory, identity and values of society, as cultural assets with high potential to give influence and assistance to local development. Several mechanisms of intervention appeared within the context of these centers, including: reconstruction, rehabilitation, rehabilitation, regeneration, restoration and other "restoration mechanisms", with the aim of "enabling the social, economic and cultural resurrection of these spaces", guided by coordinated action between public authorities, private institutions and civil society. Urban intervention mechanisms within city centers therefore address several issues such as value of exchange and value of use , the diversity of uses, the consumption of built

heritage and its use as a unified and attractive landscape, the building of urban areas and the promotion of community participation among all members of the population. (Costa, 2006, pp75-77)

- "Reekie, 1972" describes the policy of preserving historical heritage buildings as cultural or economic values to be useful and attractive to tourists because of the historical or emotional attachment of those buildings, and stated that preservation shall be on "buildings with proper construction, Urban buildings, buildings with distinct architectural styles and good structural condition that can be reused after internal modifications, buildings in the above paragraph, possessing dominant and unique properties as well as having collective value with other buildings. "(Reekie, 1972, pp 121-124)

- Ahmed, 2003, "Trends in intervention policies in traditional areas [the conservative trend of not allowing any change or renewal except with great accuracy and care, while ensuring the preservation of the original uses of traditional areas and buildings and the non-introduction of other uses, With the city and its support as attractive targets for the activities and vital centers of the city, and based on several factors (the physical-physical condition of the place or region as a whole, the non-overlapping of new uses, the relative scarcity of extraneous uses on the traditional region), the romantic trend The continuity of the past by maintaining the external appearance of the facades without taking into account the nature of the composition of the old city]. (Ahmad, 2003, pp55-63)

- The mechanism of intervention in the preservation of historic buildings takes into consideration the preservation of the building as a museum, and allow rehabilitation in the same way, and since the concept of integrating history into the lives of everyday people is widespread, so can change historical buildings according to contemporary needs, and to varying degrees are determined according to the importance of the building, Are essential to maintaining the psychological connection between the past, present and future, and the methods of intervention to maintain it is a way to customize the environment and to create a unique place. (Yin, 1992, p2-9)

- Parfect & Power, 1997, classified historic buildings as important to buildings with exceptional characteristics: their importance at the regional level is architectural and historical, and buildings of special importance: their importance is local, Special attention: stands out in its homogeneity with its surroundings.(Ibid, P2)

In response to contemporary urban challenges such as social, economic, environmental, cultural, natural, technological, functional (change of use), etc., planning intervention mechanisms have become involved in managing change for places that reflect importance in their contexts in ways that support their traditional and traditional values, And provide opportunities to interpret and promote these values in the present and future generations, the intervention mechanism is achieved in light of the emphasis that such places retain their authenticity through those attributes and elements that reflect them.(English Heritage, 2008, p22).

- In the 21st century, urban design interventions are recognized as incentives for urban revitalization. Design intervention mechanisms can be defined according to the following criteria: (interrelations and interdependence among professionals in the fields of architecture, design, urban planning and art, Shaping marginalized spaces, addressing social issues with urban design solutions, addressing the problems of urban centers from anarchy, isolation and decentralization, engaging local citizens, and seeking the diversity of use that contributes to shaping a platform for economic growth and attraction. As well as creating effective spatial centers in the light of a flexible environment that promotes social cohesion, quality of the community and its vitality identified through increased levels of civic participation, cultural expression, economic

sustainability and social justice - within the urban neighborhood or city). (Walter, 2013, p8-41)

Therefore, intervention policies within traditional areas are a set of targeted contextual measures or tools of positive change in urban morphology to preserve buildings of heritage value as one of the urban assets possessed by the original places and cities. They must be understood and invested in ways that develop and develop societies sustainably, Heritage, and the visual and intangible values and values they contain in order to achieve continuity and urban integration with contemporary culture. These policies have a central role in providing an urban environment with diverse cultural heritage values that contribute The rehabilitation of the marginalized areas (their industry) and revitalization by adding new economic and social activities that enhance the heritage of civilization and achieve the well-being of current and future generations as a sustainable tourism and in accordance with a number of mechanisms or patterns such as restoration, preservation, rehabilitation, protection, renewal (protection and promotion) (Ie, conservative, psychological, and realistic). These policies act as growth drivers (changing the shape or appearance of urban areas, or adding roads to urbanization). Or changing the function of urban settings) or development-oriented returns the lost values and the identity and character of the traditional place.

### **3. The second Axis: Planning and design objectives for conservation in Traditional environments (heritage and historical):**

The historical areas are one of the elements of the heritage of its cultural, civilization and archeological value, which is transmitted over time, which in turn binds the present society to its historical roots. These areas represent tourist and cultural attractions that give cities their value and originality. Due to the structural transformations represented by the growth dynamics in the urban centers, To the fragmentation of these buildings and the deterioration of urban fabric, which led the organizations and stakeholders to integrate heritage conservation processes within the planning and development tools and strategies of all dimensions, in a way that promotes cultural values and manages the In order to change in a sense of heritage, and here will be addressed to some of the design and planning objectives to preserve the heritage areas can be read as a matrix of symbols and events and formulations and aesthetic representation of the presence of the city and the clarity of spatial values attractive to users.

- Al-Haidari et al., 2002, pointed out the reasons for preserving traditional environments with a set of objectives, including protecting the national heritage embodied in the urban fabric for reasons of (spiritual, historical, social, national, functional and aesthetic dimensions) To restore life to places of decay and change in use, as well as to meet the functional needs of the community in the light of the revitalization of heritage areas, and to achieve the economic feasibility of the mechanisms of intervention]. (Al-Haidari, 2002, p. 87)

- The conservation of heritage areas achieves a set of economic objectives embodied in [values used in light of] promoting bio tourism as an important economic resource, attracting commercial investment to the heritage site or city, source of income for project implementation, directing public funding for conservation, conservation and reuse programs, Economic status, job creation for the population), and other unused uses include the value of existence in the light of (estimating individuals of the existence of the heritage element although they may not directly consume its services), value of choice (people desire to preserve the option they may consume they or others For asset services at some time in the future) and the value of inheritance through (the desire to inherit assets for future generations)]. Social and social interaction among different groups, support for community participation in decision-making processes, sense of identity, development of public places, urban facilities and infrastructure, in addition to reflecting some historical buildings reflected Of a particular social thought

or tradition or belief), historical and educational value and emotional value through (contact with the past as a point of restoration of separate periods in the place of construction, creation of personal identity based on past experiences, The symbolic buildings represent signs or signs of the progress of humanity (symbolism is embodied in the fact that the buildings are conveyor depots of meaning, and the preservation of monuments and monumental monuments represents the development of the sense of temporal continuity of the place in particular and of the city in general, To an important event, story or person), and aesthetic (by achieving contextual harmony by adding and repeating complementary buildings, providing a repository of patterns adopted to form the city memory, physical and functional adaptability), and spiritual goals including understanding, enlightenment, Insight or acumen insight). (Rojas, 2007, pp41-46)

- "Elnokaly & Elseragy, 2013" is a comprehensive term covering a wide range of issues that can be categorized under three categories: social, physical, socio-cultural and environmental. The intervention mechanism is described as an evolutionary process that involves preserving, restoring and adapting old structures. Introducing new structures, preserving the sustainability of the typical urban fabric, the basic characteristics of the historic areas and the lives of the communities living there, and respecting the continuity of history, traditions and the needs and cultural aspirations of the population, as well as its contribution to the quality of the environment. A key driver of change according to two key drivers is the value of resources and responsibility to others, respectively. The former represents an important value for maintaining the current stock since then, preserving historic stocks that save more resources, rather than building new resources, (And this is a sustainable approach). (Elnokaly & Elseragy, 2013, pp31-33)

It is clear from the above that the mechanisms of intervention to preserve the heritage areas have a number of objectives at the planning and design level. The planning of the intervention mechanisms is as follows: protecting the national heritage embodied in the urban fabric in all its dimensions, adapting the fabric to suit the contemporary requirements and analyzing the internal performance to evaluate how to maintain an urban site To analyze the comparative performance of urban fabric, to create sustainable spaces with their historical, social and historical values, to preserve and restore old structures, to maintain the sustainability of the typical urban fabric, to sustain the basic characteristics of traditional areas, The need to achieve continuity of the lives of communities residing within the city, respect for local and historical values in the design to maintain what is good and rehabilitate them, and to promote culture as a catalyst for creativity in the framework of a strategy of growth and balanced functions). The design goals are divided into several dimensions (social, Functional, historical, aesthetic, symbolic, and spiritual). Therefore, the mechanisms of intervention increase the understanding of the architectural / archaeological importance and scientific values of the heritage site. Today, the heritage is the social capital of societies, by contributing to and promoting tourism activities as spatial facts that need to be studied and understood in order to be assimilated by the designer.

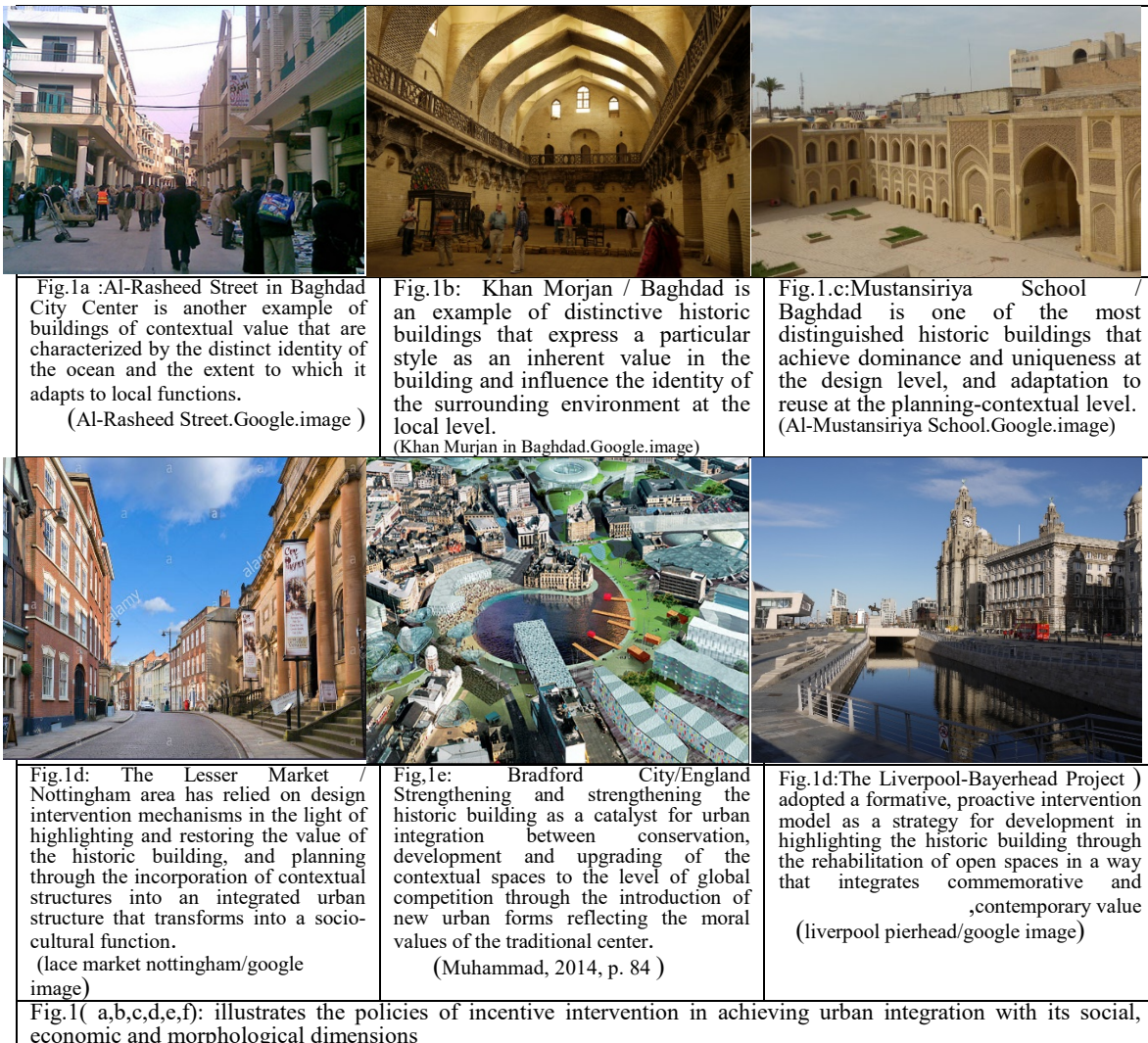
In order to build a comprehensive conceptual framework on the role of intervention policies in the integration and coherence between the proposed urban development and the traditional cohesive fabric, a number of specialized studies will be reviewed:

### **3.1 "Mohammed, 2014", entitled "Historical Stimulus in Urban Integration":**

The study examined the patterns of intervention in historical buildings as a testament to the memory of the city and its distinctive cultural heritage in the formation of its identity. The importance of this study was highlighted by activating the role of the historical building in urban development projects and how to deal with it according to its classification (high historical buildings, distinct buildings ), Within an integrated approach that ensures its transformation into a catalyst that achieves urban integration and its different levels of design (functional intervention, formal intervention) and

planning embodied in (highlighting the value of the historic building, creating a link between historical buildings) In the light of the revival of the local economy and the provision of global competition, and the socialization of cultural awareness and social cohesion, and finally the morphological level through restructuring of the uses, restructuring of the urban space system and restructuring of the urban landscape. The value of the historic building within the fabric is more important in the integration of planning characteristics. The more the value of the building becomes contextual, the more important it is in the integration of design characteristics. Therefore, the role of the historic building is different in relation to the nature of the context. To compete with the global and local as a tool for positive change, and other represents the supporting element of tourism investment in developing countries because it is aimed at the continuity of cultural identity. As in figure (1) below:

It is clear from the above that the focus of the study is on the urban stimulus of all types (physical as an element or building or any particular project, non-material policy or development program or approach) as a pattern of strategic intervention contextual oriented within traditional areas or involved in making positive changes in urban morphology reflected in reactions within The researcher dealt with the historical building by different classification as a material element that stimulates urban integration at all levels, which in turn contribute to creating a dynamic environment characterized by interdependence, flow, diversity and porosity, as well as achieving adaptation and compatibility with the context, and invites Development and economic growth, ensuring quality and social cohesion.



### **3.2. Study of "Lynch, 1972" (what time is this place):**

This study deals with the policies of intervention within the traditional areas in light of the adoption of the balancing mechanism between preservation of the heritage of the past and its continuity, the development of the present and its migration to the future, and the emphasis on the need to have places and cities express an explicit time in its existing urban fabric through the integration of historical buildings and modern elements for The realization of temporal legibility, linking the individual within a specific historical-temporal period, ensures a deliberate balance between continuity and change. One way to achieve this balance is to accommodate the preservation in harmony and harmony with the requirements of the times, According to a number of open-ended strategies, the call to deal with the urban fabric in a systematic and integrative manner, with flexible rules and regulations that reflect the sense of the chronological history of any place within the city, help manage historic buildings and places, and emphasize the flexibility and simplicity of the urban preservation system. The broader scope, he pointed out, is the integration of historic buildings and traditional richly symbolic places, which in turn convey the environment of the past and are directly linked to old human behavior, within contemporary urban development projects as a selective strategy that promotes pluralism And the importance of the urban landscape, and the interaction with the contemporary context by exciting and contradictory ways that allow a sense of permanent development within the fabric, so that the urban output is rich in a sense of both time and space.

Lynch's focus on intervention policies within traditional areas is reflected in the balance between conservation and development, enhancing the continuity and timeliness of dealing with historic buildings as integral parts and homogeneous with the contemporary urban context.

### **3.3. Study of "Nepravishhta, 2015" (Conservation and Rehabilitation of Urban Heritage and Tourism: Shkoder Case Study):**

The study focuses on three axes: The first is related to the importance of preserving and rehabilitating the urban heritage, and the development of cultural tourism as policies for intervention within the traditional areas. The second axis refers to the description of the main contextual related factors, the historical context of urban development and the national strategy for tourism development. The third axis deals with the urban development of the ancient town of Shkodar, and the attempt to identify the distinctive architectural identity in terms of (interpretation of historical and archaeological features and monuments, And the preservation of historical and cultural landmarks (such as religious buildings, castles, fortresses, traditional houses, etc.), and the preservation of historical and cultural values and traditions. As well as stimulating cultural and heritage tourism based on the attractions within that city, achieving sustainable urban tourism development that meets the needs of citizens, and regards heritage as an integral part of the life and history of society and according to a number of mechanisms (reference to the importance of heritage tourism , In the light of studying the characteristics of history, culture, religion and urban heritage carefully, and analyzing the visitor's influence on social culture and the environment, and activities and planning for protection and preservation: the cultural essence of ancient protection and archeological protection is divided into planning, integration, innovation, adaptive reuse, The integration of areas close to the heritage sites within the tourist area, maps and signs for tourists (furnishing the place): such as exit and entry, and important warning signs in addition to include tour guide manuals the story and characteristics of the city, Activities by cartoon characters or other means of tourists, monitoring in the light of monitoring and reviewing reactions, complaints and satisfaction of others, arts and crafts activities: by displaying local motifs, sculptures and architectural styles that represent more attention to urban heritage, special cultural events, change management

to ensure the sustainability of urban heritage In the long run), and in accordance with two objectives: to protect the cultural assets of future generations as a fundamental wealth, and to preserve the "spirit of place" and the sense that gives historical areas their individuality.(Nepravishhta, 2015, Pp.26-35)

The changes that are related to historical buildings must include adaptive reuse and reconstruction in order to prevent structural and functional limitations in accordance with a strategy for reducing negative impacts and maximizing gains from tourism, in the light of the management of heritage resources, the quality of new development, and the balanced uses and activities that build a sustainable environment, thus complementing these two factors P social and cultural needs of the local community, helping to raise the efficiency of urban competition between cities, and understand the importance of weaving, links and meanings-based manner enveloping the historical, scientific, aesthetic and spiritual values of the place of the past, and in the present and the future.

### **3.4. Study on "Investing in Heritage - A Guide to Successful Urban Regeneration": "European Association of Historic Towns and Regions, 2007".**

The organization adopted intervention policies aimed at exploiting historic buildings with distinctive cultural heritage and transforming them into a catalyst for the restoration of integrated urban life in order to enhance the interests of historical and heritage cities and to revive buildings on the economic, physiological and morphological levels. The exchange of experiences and good practices in sustainable urban conservation, As well as the management of such places and facilitate international cooperation between cities, towns and other relevant organizations, and increase the city's ability to regenerate material Economic and social development in view of realizing the potential for investment in heritage oriented for development or for a successful urban renewal that contributes to: Improving a higher quality environment that leads to regional attractiveness and is an attractive location for investment and intensive activities that greatly increase employment opportunities The quality of life, the stimulation of investment in renewable energy and the reuse of buildings, and strengthening the strength of the identity of the region and its community, making them more attractive to visitors. The study also pointed to a number of patterns of intervention directed to development within traditional areas, embodied by With the contemporary needs as a way to achieve sustainability in all its aspects, and the revival of one building or a group of buildings and their inter-public spaces to allow for physical improvement at the level of urban space, change in the economic structure by attracting high value investments, And the historical center for achieving integrated urban development. The patterns of intervention aimed at preservation (conservation intervention) within historic buildings is a transitional axis which constitutes a successful and sustainable coherent framework for future urban projects in the light of ensuring continuity. Harmonic organic growth with the traditional context, and social and cultural renewal through the veneration of local cultures and the search for a strong sense of confidence and pride in places. (Pp1-16, 130-132)

It is clear from the above that the policy of intervention for integrated urban regeneration can be assessed in the traditional areas according to the following: (1) intervention aimed at the development of historic buildings by investing the value of the heritage building or permitting change to form vibrant and diverse urban centers incorporating conservation and contemporary processes, (2) A "conservation intervention" that supports the compatibility and harmony of the context and emphasizes the traditional identity within the places in a way that achieves social and cultural development at the local planning and planning level, thus improving the quality of living and Community requirements, and raise the level of aesthetic design standards, and create community partnerships focused on the strong management of city operations.



Based on the above, it is clear that planning and planning intervention policies for urban development projects within traditional areas can be assessed and defined according to (intervention mechanisms, intervention methods, intervention patterns, intervention types).

#### **4. The Third Axis: Practical study of the analysis of the city of Kadhimiya in Baghdad:**

The studies affecting the planning and rehabilitation of the city of Kadhimiya will be analyzed for the period from 1970 until the preparation of this study, some of which caused a clear planning and design crackdown in the traditional urban fabric of the city, while others presented studies that did not see the light in time. The traditional fabric of these studies. The study of Polish PolService in 1970 and the study of John Woren & Roy Worscate in the early 1980s are different from the Bureau of the 2014 Bureau as a result of changing political data and the emergence of new needs that were not present in the seventies and eighties, namely the problem of visitors' movement as well as the conflict between the religious and political authorities Urban planning and design These principles were not influential and had no presence because of the dominance of these two authorities on the principles of planning and design. As a result of this problem, any study that did not contribute to meeting the economic, social, cultural, religious and urban needs, in addition to its lack of crystallization of the idea of religious tourism, which requires transforming the region into a local, regional and global attraction, is a pressing factor in the traditional fabric. Resistance and resistance to those interventions that contributed to the deterioration of planning and design.

These ideas and studies have resulted in a conflict between preserving the traditional closed system and the idea of openness and pluralism. Consequently, the first failed to survive and withstand the challenges that it faced. It seems that it failed to show any traditional environment to the global level as places intended by others. The competition is paralyzed because it is unable to meet the needs of the renewable, and this failure is not inherent in the contrary, since then it has the energies that enable it to emerge as we will see in the study, "John Warren" in 1980.

Thus emerged the problems of planning and design tried to study (Diwan) dealing with them seems to have also failed and can be seen in the analysis of this study later.

##### **4.1 Study of Polish PolService 1970:**

This company is one of the first companies that made recommendations for the redevelopment of the city of Kadhimiya within the master plan for the development of the city of Baghdad in 1970, designed to remove the slums surrounding the mosque, with space for (used as parks and public squares, and provide sites for some public buildings, And the buildings were nominated for demolition). These neighborhoods lacked the most basic requirements of modern life in terms of physical condition, poor construction, and lack of suitability for modern technology. In 1980, a large area of these neighborhoods, places, baths, The designers stopped work and rethink the subject. Designers Roy Worskett & John Warren were commissioned to give a design proposal that would preserve the historic area and its traditional fabric, with its maintenance and stop its demolition in 1980.



Fig. 2a, 2b, 2c: An aerial photograph with a lateral view showing the removal of the area surrounding Khadimiya in accordance with the recommendations of Paul Service in 1980.  
Source: (researchers)

#### 4.2: Study of (John woren & Roy Worscate 1980)

Roy, 1980, pointed to the incentives to intervene in preserving historical sectors, especially urban development, which in turn is the main dilemma to be mentioned. He also inquired about how to preserve such cities if the majority of the inhabitants are poor and if they are rich How to work without legislation to reduce the excesses that occur on the fabric of traditional cities. This is achieved in the light of the creation of new jobs that penetrate these environments under the names of maintenance, and the importance of linking planning strategies, social and economic policy of preservation and rehabilitation of traditional environments of value, as well as indivisible Working in such environments.

This study aims to improve the social structure of the area surrounding the Kadhimiya landscape after the Mahalla and its environs lost its distinguished cultural heritage and its richness of folklore, in addition to activating the importance of community participation in the preparation of policies and implementation of preservation plans and the need to survey and analyze the traditional structure of economic and social life in the city, The study also pointed to the importance of social change as it will contribute to the establishment and construction of new ties and relations that raise the low levels of social life, and to re-establish the cohesive and complex structure of the religious city. Each locality represents a real entity is connected and linked to forms, patterns and feelings of affection and loyalty and cooperation, which embodies the intrinsic characteristic.(Al-Jumaily, 2015, Pp128-129)

As a conclusion to this study, it is possible to refer to the most important planning and design indicators affecting the traditional fabric:

- 1- Preserve the urban fabric and repair and compensate the lost parts of it to enhance the confidence and pride of the city's society.
2. Encourage people to invest their money while maintaining popular social characteristics, by linking development with economic development and tourism activity.
3. Maintaining the organic and narrow street pattern as part of maintaining the urban fabric morphology of the old city.
4. Maintain the spirit of the place. Through the construction of similar residential roles in their characteristics of the role of heritage with an internal courtyard, and using of local materials.
5. Studying the possibility of mixed use of commercial and residential activities.
6. Make exterior walls that touch the shrine, the modern commercial façade of the city by surrounding the market to give freedom of movement to visitors.
7. By re-employing the spaces achieved by removing the old role. (Warren, P9,1980)

#### 4-3: Study of Diwan: Development of area surrounding the hadra Khadimiya:

In this study, three scenarios will be analyzed and critique of the third scenario adopted by the Diwan study as the best suggested scenario which depends on the followers of a

balanced approach that combines the conservation of historical areas within the old urban fabric and the renewal of some of its parts. According to the vision of this study, and consists of three Scenarios are:



Fig. 3a,3b,3c.: Illustrates the strategic location aimed at preserving the architectural urban fabric of the buildings and houses of old Baghdadi houses with a distinctive personal character, and the relation of that site to the natural and urban surroundings. (Diwan, 2011, Pp. 3-17)



Fig.4a,4b,4c,4d.: Shows the percentage of preservation of heritage buildings to the location of the area surrounding the scene Kadhimi. (Diwan, 2011, pp. 5-12)

#### 4.3.1: First scenarios:

The historical area (A) consists of the rest of the historical urban fabric, parts of which were sacrificed to provide open spaces around the holy shrine. The reconstruction of the empty or destroyed areas between the existing heritage buildings will be in a style consistent with the heritage buildings and form a model for "the old traditional neighborhoods of Kadhimiya." (Diwan, 2011, p. 26) as in Fig.5

#### 4.3.2: Second scenarios:

The residential area (B) and the middle residential area (C) occupy an area further away from the historic center of Kadhimiya and feature limited architectural homogeneity, with a number of simple craft and industrial activities interspersed with vehicular traffic and parking. According to the development plan adopted in this study, the area will be developed and updated for residential purposes and multi-use buildings, as shown in figure 8. (Diwan, 2011, p. 27)



Fig. 5: Illustrates the overall development strategy of the second ring.

Fig. 6: Illustrates the comprehensive development strategy first ring.

### 4.3.3: Third scenarios:

Area (D) consists of a group of residential buildings and modern hotel buildings along the main roads around the historic center of Kazimiyah to form a "ring around." There are three main axes that penetrate the three hoops surrounding the religious center of Kadhimiya and connect the surrounding areas with the rest of the city of Baghdad. These main axes are Al Zahra Street, Al Qibla Street, the new axis from the west, With a fourth hub in the north connecting the center of Kadhimiya and the Tigris River. The four axes are designed as a wide pedestrian road where shops, restaurants and hotels are opened to serve visitors and residents of the area. (Diwan, 2011, p. 28), and as in Fig.6

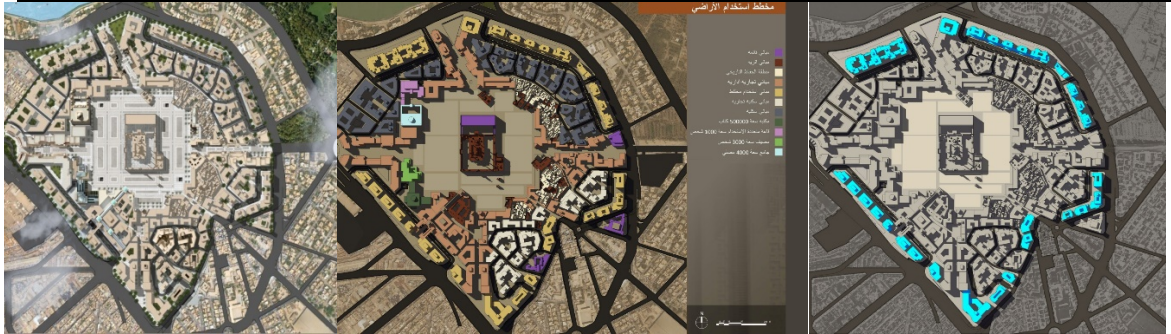


Fig.6a,6b,6c.: The comprehensive development strategy illustrates the third chapter on the level of land use and traffic axes, in addition to addressing the ends of the urban fabric with architectural designs that are developed in selected places and specific angles overlooking the main arena, thus giving them privacy within the space (Diwan,2011, Pp28-35)

### 4.4: Analysis of the traditional fabric of the Kadhimiya (criticism of previous studies):

The traditional fabric of the city of Kadhimiya can be divided into two ranges. The first area represents the old area surrounding the Kadhimiya landscape from the north-northwest. Which starts from the Bab al-Qibla (south) to include the al-nbarian area - the hill of the hill - Habana - the market of the Istrabadi - the area of the Smailat, the ocean, and this range was penetrated through the development of two axes to accommodate the movement of visitors by removing all the buildings that pass through.

As for the second area, it represents the old area surrounding the scene Kadhmi, which extends from Bab Al-Qibla Street to the eastern side of the scene to include (Orouba Square, Zahra, Bab Al-Darwaza and Bab Al-Mourad Street from the east side.

These two domains will be analyzed according to the vocabulary derived from the theoretical framework, in order to achieve the morphological integration of the intervention policies between conservation and development processes within the traditional areas, the restructuring of the urban land uses, the types of intervention and its mechanisms:

#### 4.4.1: Scope I: Scope and surroundings of the Anbarian Area:

The most important characteristic of this range is that it is a residential area with activities and economic and service activities is weak and is surrounded by the Tigris River and the Ocean Road, which is a natural determinants to the people in the evenings usually to enjoy the features of this river, which includes the axis of transit and transit to the other side of the river The most important characteristic of this scope or axis is the implementation of what recommended by the study of the Office "Diwan" and opened two main streets in the Anbaris and Smilat area towards Hadra Kadhimiya to accommodate the movement of visitors, and this latest work cracking urban fabric as well as planning problems, design, Consciousness, cultural and psychological. As well as the change in the uses of the land at the level of urban fabric, this was previously lacks:

- The existence of attractive economic activities
- Balanced population density

- Craft activities.
- Hotel accommodation
- Special attractions
- A narrow and winding strip of organic tissue
- Activating activities on the Tigris River throughout the day.
- The existence of governmental institutions (administrative, judicial, service, health, etc).
- Visible access and transition hubs.



Fig.7.a,7b,7c,7d.: Illustrates the scope of the Anbarian region and the effect of removing parts of the traditional fabric on its cohesion and bonding.

#### 4.4.2: Scope 2: The Bab Al-Dirwaza and its surrounding areas:

It is considered as an important attraction in the Kadhimiya region, in addition to its have many hotels, commercial facilities and heritage markets. As it is connected to the network of roads and transport to the city of Baghdad and thus it is an extension. What distinguishes this area is its preservation of its old architectural and planning characteristics and its distinctive activities and events throughout its history. It has not been influenced by any development or intervention, but all the interventions, studies and actual development in the area surrounding of the Kadhimiya civilization from the other side. As a conclusion to the above, all these attempts failed to happen:

- Balance in land uses
- Balance in population densities and population
- Balance in economic, social, cultural, religious, service and entertainment activities.
- Balance in making all the places surrounding the Kadhimiya civilization function day and night with vitality and effectiveness.
- Balance the access and movement methods and solve the traffic problem of visitors.

#### 5. CONCLUSIONS:

Through the analysis of policies and mechanisms of intervention to develop the traditional environment of the city of Kadhimiya and the results achieved in comparison with the expected objectives or the image that may be the city of religious and economic destination, it failed to achieve the following:

- Balance in land uses.
- Balance in population densities and population.
- Balance in economic, social, cultural, religious, service and entertainment - activities, and failed to activate the surroundings surrounding the Kadhimiya civilization and make them work day and night.
- Balance in access and movement methods and solve the problem of movement and movement of visitors.
- Graduation in the movement and movement of visitors and provide a safe and comfortable environment.
- Restoring the old urban fabric, on the contrary, it has caused a strong morphology in the fabric.
- Preserve the identity of the city through forced displacement of the community.

- Preserving the environmental balance of the city from exposing and exposing it to large areas of the traditional fabric of the sun.

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# Determinants production of surrounding spaces and common between urban environments

## Baghdad city center is a model

Assist.Prof.Dr.Saad khudhair Aljumaily<sup>(9)</sup>

Al-Nahrain University

Baneen Abdul- kareem

Alsaadawi<sup>(10)</sup>

University of Technology

### Abstract:

The common urban areas are the active element in shaping the city's basic structure and its distinct cultural identity, as it contains material and moral values that test the authenticity of the peoples and the depth of their human belonging as facts in time and space. The latter stage witnessed increasing developments and concerns that led to the deterioration of unity, The places surrounding the historical and traditional environments and the common areas, as well as the loss of the manifestations of interdependence and the transition between them and the integration of activities and events and sequence, the result of the absence of policies governing those, The problem of research was determined by the absence of mechanisms to regulate the relationship in the surrounding and common places between historical and traditional environments, which leads to the absence of visual unity, lack of integration and harmony among them.

The study adopted the descriptive analysis method in building a comprehensive knowledge framework for the policies and mechanisms dealing with these environments, as they constitute a cultural and vital separation indicating change and temporal and spatial transition. The center of Baghdad will be treated as a local study experiment for analysis and evaluation based on the indicators derived from the theoretical framework. A number of recommendations for the production and production of surrounding and common places that elevate the urban environment to the level of efficiency, excellence and competition, and explore the values, symbols and concepts that contribute to the reconstruction of the place elements in the context of the unconnected, and in a way that achieves the idea of integration and harmony with those environments in the light of inspiration and simulation and borrowing to ensure the rehabilitation of these cities and try to revive them and transform them from mere effects and museums to cultural and social environments and economic development In all its dimensions, and to do so requires the following methodology :

- Create a theoretical framework on the concept and importance of these environments, as well as the introduction of the most important policies, legislation and principles of urban design that regulate the work in traditional and historical environments in addition to the surrounding and common environments.
- Exploring the potential challenges and opportunities facing the industry of places and their formation in these environments, in order to interact with the traditional and historical place data on the one hand and build new ideas on the other.
- The applied study of the surrounding and common areas between the historical and traditional environments. The environment surrounding the traditional environment will be focused only in the center of Baghdad as a model for study and application of the research problem, and then draw conclusions and recommendations.

**Keyword:** Urban determinants, Historical environment, Traditional environment, Temporary environment.

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<sup>9</sup> ) (PhD in Architecture / University of Baghdad / Specialization in Urban Design, currently teaching at the Department of Architecture /Al- Nahrain University / Iraq, has many participations in training courses, workshops and conferences inside and outside Iraq. He has several books including: Book aesthetics of the place between deterioration and competition, Cognitive psychology and the development of creative design skills, has contributed to many research related to the development, industry and aesthetics of the place.

<sup>10</sup> ) (M.Sc. In Architecture / University of Technology is an urban design specialist, PhD student currently, has many research inside and outside Iraq, her participation in many local and regional conferences, relevant in the place industry, contemporary trends in urban design.



## **1. Introduction:**

Local architecture is an extension of nature and historical architecture, and as a natural, aesthetic, symbolic and intellectual reference to those environments. When remembering innate architecture, it means returning to local materials related to nature, the surrounding environment and the local techniques used in construction. It moves from generation to generation. When historical architecture is mentioned, it means dealing with the references related to events, facts, occupations, victories and historical defeats that historian, on the one hand, and the philosophical, contemplative and critical history that fall outside the authority of the historian as Hegel sees. These historical values contribute to the description of physical values (Archeological sites) that are differentiated in various historical sites without which it is difficult to explain their value and the reasons for their origin.

There are other invisible values that have disappeared with the disappearance of the societies that lived in these historical sites (palaces, temples, dwellings, tents, etc.). These invisible values are called anthropological values. Anthropology is the science that examines the culture of historical societies, (Symbols, legends, myths, stories, stories, novels, arts, customs, traditions, customs, lifestyles, and beliefs of those communities).

Anthropology also contributes to the description of these archaeological-archeological sites and completes its appearance and image. Thus, it is one of the important references to local architecture, which can be used to refer to the cultural depth of any society or nation. There are ethnological values that also act as intellectual references. Ethnology is the science that examines the culture of local and contemporary societies. These include (folk tales, folk tales, symbols, signs, local folklore, beliefs, customs and traditions that reflect the culture of the community, some of which are apparent, So ethnology (visual and invisible) is one of the references that contribute to the description, imagination, retrieval and source of inspiration and creativity to preserve the identity and culture of urban environments, including Iraq.

There are other values that are no less important than ethnological values, which are the sociological values that represent the local social capital. They include closed customs; traditions and traditions as they are passed down from generation to generation, contribute to the differentiation of societies among themselves and increase the cohesion, interaction and social solidarity of traditional urban environments.

The ethnological and sociological values are accompanied by other values as outputs, namely, public buildings including palaces, temples and other administrative facilities such as cafes, bars, baths, public spaces, and schools. Some of them have physical spiritual dimensions such as waltz, mosques, tombs and mausoleums of prophets and righteous parents, These buildings are naturally influenced by prevailing building styles, expertise, techniques, arts and local materials, and constitute an intellectual reference to local (traditional) architecture.

As for the natural references of local architecture, it is natural to say that nature and its role in the education of man since its inception and its presence on the ground, it stimulated the person to imitate and mimic and borrowed from them and preserved, and embodied in the inspiration of inscriptions and decorations and drawing, whether natural phenomena or plant or animal purposes Functional, aesthetic and security (defensive) .

The city center of Baghdad suffers from a lack of integration between the values (anthropological, archeological, ethnological, sociological and natural) and the mechanisms of design planning for the projects of modern urban development in the surrounding areas and common historical and traditional environments, and highlighted many of the challenges and problems facing those places, The objective of the research is to identify the mechanisms of integrated urban design with spatial values as historical references to the past and the conditions of the present and expected in the future and to regulate the relationship in the surrounding and common places between historical and traditional environments as a means of achieving visual unity of the place, Towards contemporary environments). This problem will be addressed in light of the analysis of a number of global policies related to the urban area industry to develop reliable policies and mechanisms to enhance urban environments and their surroundings to contribute to the development of the places.

### **1.1 The first axis: the urban determinants of the production of surrounding spaces between environments:**

The characteristics of the production of urban areas vary according to their classification. There are traditional, historical and contemporary environments, and there are environments or places around them that are common to each other. Each of these urban environments has their own policies, legislation or determinants whether separate from their fabric or in their urban fabric. Restricted by international laws such as traditional and historical environments, others restricted by local laws or laws such as contemporary environments, It should be noted that the traditional thinking of working in urban environments and the absence of clear policies for what will be those environments, especially traditional and historical, and the surrounding places, away from the global competition based on the idea of the unity of these environments and configured in accordance with urban marketing strategies within the concept of urban tourism. Accordingly, these determinants, policies and mechanisms will be addressed in the light of three axes:

#### 1.1.1 Urban determinants in relation to the general framework of urban design:

Previous knowledge and literature indicate that the policies and determinants of urban environments emerged from the principles and strategies of urban design that were addressed by the ideas of Kevin Lynch, Jane Jacobs, etc., which crystallized in the early 1960s as an intellectual and moral reference For most policies, mechanisms and contemporary determinants of manufacturing or producing places.

- "Sanders, 2006" shows the basic concept of urban design for the art of making places for people, making them places of attraction of meaning, value, and a unique, beautiful and clear character that people are constantly seeking, achieving community safety, dynamic, And have the ability to adapt to change, It promotes the use, the viability of living, and strengthens the communicative link between people, places, movement, urban form, nature and built-in fabric. Cultural, social, urban and economic progress, rational use of natural resources). (Sanders, p137 , UD-5 , 2006)

- Since urban design is the art of making places for people, it is a comprehensive concept that opens wide horizons for creativity, innovation, addition, modification and development. It is a free and unrestricted concept, and therefore there is a general framework for combining them within the general framework and outputs of urban design. (Transport & Regional Affairs, 2000, p6-8)

- Motloch, 2000, pointed Five factors are essential for the manufacture of places and their production, spatial positioning and spatial identity. They are to change the sensory characteristics of the settings to make them more distinct and clear, to employ culturally and aesthetically appropriate elements and signals, and to control the groups of signals, symbols, elements and configurations, And the connection of elements and references to a certain event or story to know the concepts, myths, ideas and identities within the design, as well as to promote certain behaviors in the preparation and preparation, and the integration of cognitive qualities sensory environment, cultural traditions and social relations, with humanitarian activities and length of stay within the place). (L.Motloch, 2000, p252)

- Carmona et al., 2003) defines the determinants of the production of places in environments according to the objectives and principles of urban design, including personality in terms of location, identity, continuity and containment, where public and private spaces can be clearly distinguished, the quality of the public space, The movement of any place is easy to access and move from, and any clarity that the place has a clear image can be understood or understood, the ability to adapt is concerned with the possibility of changing place easily, and diversity anywhere with diversity and choice. (Carmona Matthew & Heath, Tim,2003, p 9)

- Grabow, 2015" refers to the determinants and principles of production of places surrounding traditional environments, namely, maintenance and operation concerned with the need for the community to maintain the quality of the place and its distinctive character, and economic generators: that the community has a strong economic base to support the quality of places, The clear distinction of places, and the interest of historical city centers as the "heart and soul" of the community and is essential to the economic health and heritage of the city and its civil pride, redevelopment and dictation of the heritage center surrounding the historic and traditional places, and the integration of housing and employment centers and shopping areas for the manufacture of livable places and work and shopping and bring comfort and enjoyment to users,

Vibrant and distinctive and close to the historical urban center, and increase population densities and housing and avoid low-density residential development on the outskirts of cities.

The diversity of housing that meets the needs of a variety of households with different income levels, the promotion of pedestrian and bicycle friendly environments (promotion of walking), the promotion of high quality public transport coordinated with land use and centralized development along transport corridors, conservation of environmental resources and parks To consciously integrate them into the fabric of society.

To preserve open spaces and to reconstruct them as an area surrounding heritage sites, to conserve and integrate historical and cultural resources consciously, integrate them with contemporary requirements, And to strengthen the local identity of the city and society, which in turn leads to a sense of place and belonging to it, and dealing with historic buildings in an integrated manner with its surroundings as the constants of urban form the structure of the city over time and reflect the memory of the Assembly as patterns of past present and characterized by universality and permanence, accessibility and interdependence in the axes of movement, highlighting the figures, facades of buildings that provide evidence that it is a real place not just superficial, the reflection of local values such as appropriate architectural styles, materials ,techniques used, create places for cultural exchange and social interaction]. (Grabow, 2015, p4-34.)

-Jacobs and Appleyard, (1987) suggests a number of determinants for the production of urban spaces surrounding environments (including livability): the city must be a place where everyone can live, relative comfort, identity and control: people must feel that a part of the environment belongs to them individually Or both, and access to opportunities: the imagination and joy that people find the city a place where they can break the traditional mold and communicate with the past in the present, thus expanding their experience and enjoyment, originality and meaning: People should be able to understand their city - its basic planning - its functions and public institutions - and the opportunities it offers, society and public life should encourage places to share their citizens in society and public life, and urban self - reliance as cities become more self - sufficient in energy use and The scarcity of resources, and the provision of an environment for all concerned with the need to make good environments accessible to all as every citizen has the right to environmental minimum, identity, control and opportunity. "(Jacobs and Appleyard, 1986, p.115-116)

Urban Design Compendium also notes that the quality of the places in which we live has an impact on all aspects and aspects of life. It is essential that the places we develop, improve or produce reflect the principles of good urban design, and the latter is necessary to provide sustainable spaces in all respects. : Places of social, environmental and economic value, while ensuring community participation in the formation and preservation of the built environment. (Transport & Regional Affairs, 2000, p1-6) The abstract also outlines urban design strategies and principles that can be determinants of spatial production, including urban fabric and determinants of urban structure, ensuring historical continuity of cultural and heritage values, encouraging mixed use, learning from the past, enhancing densities, designing outer spaces, As well as attention to the details of the place and the streets and their development, places of preference and love for people and a sense of safety and services ... etc. (Evans, 2013, p2 7-181).

- Historical heritage in its multilayered nature, and provides different contexts in the production of surrounding areas, and with the passage of time can be called for the continuous re-examination and interpretation of history (historical continuity), can be understood and understood the structure of the place heritage through its interaction with the surrounding and continuity over time, Varies according to different stages of time due to physical, contextual, religious, political, or theoretical factors, Which in turn acts as urban determinants that place the place around the historical and traditional environment within a certain framework and impose rules that limit the possibilities of its development. This framework not only makes the decoration out of it, it also changes the natural organic progress and prevents it from adapting to it. Brought by this process of adaptation will add only to the layers of history in the story of the heritage structure.

Reviewing the current approach and protection policies and preserving the surrounding heritage sites may seem just a first step, complemented by a policy of rethinking our expectations and understanding of the heritage structure. The appreciation of the interrelationship between the

past, the present and the future will motivate the recipient to the precise narrative that is being constructed. This will allow the creation of places that preserve the original position in the traditional and historical environment and occupy new or rehabilitated functions, creating a state of integration and continuity through gradation. In moving and moving between those environments and exploring their physical and intangible values as static spatial facts that cannot be reconfigured or avoided. It also achieves homogeneity, adaptation or adaptation to contemporary changes, forming an equation with the surrounding context that in turn evolves organically into what is around it. This in turn allows for an interesting new sense of the nature of the interaction between tangible and intangible aspects, as shown in figure 1 below. (Malladi et al., 2015, p265-279)



Figure (1) shows Louvre Museum & King's Cross station and its potential to produce and manufacture the surroundings of traditional and historical environments through the contemporary urban addition that accommodates the old with the new and respects the heritage value, enhancing the functional use of space and giving symbolic, aesthetic and tourist significance to tourists. (Malladi et al, 2015, p271) &(Louvre Museum, King's Cross station/ google image)

- "Fitch, 1990" refers to intervention mechanisms for the production of surrounding and common places between historical and traditional environments (protection: embodied in manual maintenance in its assessment of the current physical state, restoration concerned with the real return to the physical state it was at earlier in life, (Conservation and reinforcement), which allows physical interference in the urban fabric to ensure continuity of its performance, and reconstruction concerned with the collection of the building piece by piece both in the same location or in a new location, The adaptation of the building to accommodate the new use, the reconstruction of the reconstructed buildings in their original locations, the repetition of the construction of a replica of an existing building, and the facade (false appearance), which is concerned with preserving the facade of the historic building with a new building. And demolition and redevelopment in the area of demolition and disposal, with new development of the place). (Fitch, 1990, p46-47)

Urban determinants in terms of their relation to the general framework of urban design are embodied in how to produce sustainable, meaningful, valuable, and personalized spaces that are constantly accessible, livable, work and learning that respect the historical and historical value of the surrounding urban context and ensure ecological balance and cultural, social and economic progress. And works to strengthen the communicative link between (people and places, movement, urban form, nature and structured fabric).

### **1-2 / Urban determinants in light of their relationship with the contemporary challenges of urban design.**

Most countries face world-class challenges brought about by globalization that seeks political, economic, social, cultural, environmental, security, aesthetic, cognitive and urban domination, resulting in societies that seek to strengthen their presence locally and globally by providing the best services to their communities and self-defending societies seeking to minimize their crises. (Economic, social, cultural, educational, residential, recreational, health, environmental, green spaces, roads and infrastructure as well as preserving, restoring and rehabilitating its cultural heritage, etc.). Refer to global competition, and will address the determinants in light of this:

- Madanipour, 2006, notes that the contemporary challenges of urban design are manifested in a number of ways (the rapid structural changes in the urban context which in turn lead to the aging of the surrounding space, the aesthetic, environmental, political, economic, social and cultural challenges of urban development and design, the lack of identity, (One use) associated with new technologies, the emergence of a large gap between design and urban planning, and the lack of application of urban design principles that cause the revival of the place and make it beautiful. The lack of integration of design inputs with its outputs, poor infrastructure services that make the place more attractive to life and work, poor interconnections between places and

forests, neglect of historical buildings and spaces, and urban design as a marginal area of activity that contributes to the appearance of places Without its function, the decline of the public domain and the lack of integration among producers, regulators and users). (Madanipour, 2006, p2-23)

- Al-Saadawi, 2016, pointed to a number of contemporary challenges facing the process of producing places and manufacturing them (negligence, disruption and fragmentation of streets and public places and open, making them isolated places cut off from the ocean and the lack of places and paths to attract elements that reshape the place and highlight its identity, On the design criteria and the neglect of aesthetic urban form, as well as the emergence of places that are not friendly to the population and encouraging the use of private transport, and not rely on the policy of development and preservation of values and motives that established the place and make it an important contextual value). (Saadawi, 2016, p. 24b)

- The NACTO Urban Street Design, 2013, outlines the determinants and principles of cities to meet the challenges of the 21st century in the design of their streets and is based on the basic idea that streets are places for people as well as traffic arteries as one of the most vital public spaces, Play a much larger role in the public life of cities and communities, and must be designed to include public places in addition to channels of traffic The streets of cities have to have economic aspects as much as a functional component, and the streets can be designed well to generate revenues and benefits for companies and homeowners, Dealing with m The street as a place for people helps guide urban development and development within the city. (NACTO Urban Street Design, 2013, p4-24) In this regard, Al-Jumaily, 2013, pointed out that what makes the places distinguish between them is the symbols, values, signs and events related to the community and the place, expressing its privacy, faith, identity, experience, heritage and memory throughout its history. The largest of the review of these signals and values and make them live and sustainable in the community as well as to achieve functional and aesthetic considerations, and also addressed the determinants of production of surrounding urban environments in light of (Efficiency and ability to meet the needs of the tourist, and the reverse of the level of organization of the urban construction of various sectors and streets and buildings and urban spaces, and the extent of harmony and cohesion and achieve the containment of space, in addition to the clarity of its motor and visual and the level of paving floors and furnishing and colors, as well as attractive and strong Its vital centers include a broad range of possible opportunities for life, exchange of ideas and experiences among the members of the community, and it aims continuously by offering all the amenities, recreation, living opportunities, work, learning, services, accessibility, and mobility between its sectors and centers ). (Al-jumaily, 2013, p. 16, 127)

Based on the above, the determinants of the production of surrounding and inter-urban environments are focused on how to achieve the complementary relationship between man, place and structure, and thus integrate the temporal dimension in the process of spatial change and promote harmonious urban development with its social, economic, environmental, aesthetic, cultural and urban dimensions. And promote dynamic and dynamic surroundings, achieve community safety and adapt to change, and promote pedestrian-friendly mixed environments that are globally competitive and ensure for pleasure and imagination. To summarize, the determinants of the production of ambient and inter-urban environments will be summarized in light of (Urban Design Principles, Contemporary Challenges) and as Table (1)

Table (1) shows the urban determinants of production of ambient environments between urban environments (researchers)	
Functional determinants	<ul style="list-style-type: none"> <li>- Encourage mixed use</li> <li>- Diversity in urban activities and events</li> <li>- Balance in the distribution of land uses on both sides of the place</li> <li>- Attention to population density and population</li> <li>- Reviving the place locally in light of respect for the past, connection with the present, restoration of valuable jobs and promotion of places of cultural importance.</li> </ul>

Social determinants	<ul style="list-style-type: none"> <li>- Sense of spatial belonging</li> <li>- Promoting cultural and intellectual exchange</li> <li>- Development of community customs and traditions</li> <li>- Promoting integration and social interaction</li> <li>- Community capital development.</li> </ul>
Economic determinants	<ul style="list-style-type: none"> <li>- Attract local and international investments level</li> <li>-Development of the local economy.</li> <li>-Hierarchy in the sequence of functions and events</li> <li>-Promoting in situ tourism.</li> </ul>
Aesthetic determinants	<ul style="list-style-type: none"> <li>-Preserving the identity of the place surrounding the traditional environments.</li> <li>-Reverse local values in design.</li> <li>-Making the place as an intervention to achieve cultural and cultural diversity.</li> <li>-Revival of values and physical and moral symbols associated with the place.</li> <li>-Enriching the place architecturally with people and prominent buildings.</li> </ul>
Historical determinants	<ul style="list-style-type: none"> <li>- Describe the physical values (anthropological), which is located in historical places.</li> <li>- Description of the archaeological values of events, facts, defeats and historical victories.</li> <li>- Exploring visible and invisible ethnological values.</li> <li>- Description of sociological values.</li> </ul>
Natural determinants	<ul style="list-style-type: none"> <li>- rational use of natural resources</li> <li>-Taking into consideration social, cultural and urban progress</li> <li>-Change the sensory characteristics of the places.</li> <li>-Inspiration and drawing of decorations and inscriptions, whether they are plant, animal or natural phenomena for aesthetic, functional and defense purposes.</li> <li>-Promote ecological balance and biodiversity.</li> </ul>

**1-3 Determinants of the production of surrounding and common urban environments in the light of the concept of urban tourism.**

The developed countries seek to compete among themselves and dominate the world first in conjunction with meeting the needs of the local community and tourists through the sustainable urban development of cities and make them livable cities, work, learning and entertainment work day and night attracting investments, where cultural diversity, economic and social, it seeks to work within the urban trends to prepare it For urban tourism, which can be called new or contemporary perspectives or opportunities.

The study finds that the lack of fragmentation of urban areas and working within the concept of urban tourism as a labor market is a qualitative leap in dealing with cities. This view needs advanced awareness by the architectural and urban designer, investors, decision makers and academic institutions. The tourist will change his destination to efficient and effective urban environments. It has the best services and facilities that enable it to roam and move freely and enjoy throughout the day in the urban environment.

- Heritage tourism protects historic, cultural and natural resources in towns and cities by involving people in their community. When it comes to their personal, local, regional or national heritage, people are often eager to protect their historical resources. Heritage tourism enriches residents and visitors around local and regional history and common traditions. By sharing and exposure to local historical sites, people become more familiar with their history Traditions, and understanding the importance of one's heritage provides a continuity and context for the people of society, promotes the values of citizenship, confidence and pride of society and improves the quality of life. Tourism also has economic benefits through:

- Create new jobs in the travel industry in cultural and historical attractions and in travel-related institutions.
- Increase revenues and taxes.
- Attract new investments
- Building community pride and sense of place
- Educate individuals about their heritage
- Filter important contextual features of the National Register of Historic Places
- Economic diversification in the service industry (restaurants, hotels, motels, bed and breakfasts and tour guide services), manufacturing (arts and crafts, souvenirs, publications), agriculture (specialized gardens or farmers' markets).

- Encouraging entrepreneurship and local ownership of small businesses.
- Investing in historic real estate and thus increasing property values.
- Increase the economic return of heritage and cultural tourism. (Green, 2010, p3-9)

-Urban tourism includes the activities of tourists as well as the local population in urban areas, in the context of built landscapes, recreational facilities and infrastructure services. Urban areas such as towns and cities are a source of incentives for visitors and act as tourist destinations and gates to other places. The majority of the world's population is civilized. The dynamics and characteristics of urban tourism are important to understand as forces of the global tourism economy within the space and in a way that integrates with social, spatial, economic and technological issues as well as urban issues and local response to globalization, change, Li for the places surrounding the traditional and historical environments, urban tourism consists of:

- Key elements that help attract tourists and visitors.
- Secondary elements such as transportation used by tourists to travel to the destination or as services after arrival (Cave & Jolliffe, 2012, p268-269)

Urban tourism is the means to reduce the increasing pressures on the natural, cultural, social and economic environment and to balance the uses of the urban land, as well as the clarity of axes of movement and their good association with other branches and public spaces, and re-examination of historical places and attention to urban landmarks and attractions, Sustainable places reduce tensions resulting from complex interactions between tourism, tourists, the environment and host communities, meet the needs of present and future generations, and maintain the capacity and quality of natural and human resources to Long term. (Pavlic, et al., 2013, p8)

- The report of the World Tourism Organization (WTO) refers to the most important policies related to the development of urban environments, making them world-class and competitive to support the economies of countries and the development of spatial development, which protect the economy, society and services. They bring domestic and foreign investments and bring benefits to societies before governments. . Tourism is a very important element in all urban development policies. It is not just a strategy to provide a competitive product to meet the expectations of visitors, it is a way to develop the city itself, provide more infrastructure and provide the best conditions for residents. (UNWTO Editorial Team, 2012, p7)

- Ashworth described the emergence of urban tourism through operations after tourism was perceived as a danger to the city in 1970. It was suggested that tourism be a means of managing change, transition and transformation of city functions, and that it has an important urban function as a catalyst to promote urban economies. He pointed out the importance of integrating the urban and tourism concepts together, indicating the complexity of the relationship between urban features and tourism functions in the establishment of urban tourism are:

1. The basic characteristics of stable cities are a tool for shaping tourism or recreational activities.

2 - The role of tourism or entertainment play a role in shaping the important aspects of cities. (Eldaidamony, 2010, p15).

- The Center for Active Design has developed the following tools for measuring urban development: mixed use of land use, transportation, parking, parks, open spaces, leisure facilities, play areas, public squares, grocery stores, access to fresh produce, Interconnected streets, congestion relief, sidewalks and walkway design, urban landscape, bicycle network and connectivity, checklist urban design. (checklist urban design)

The emergence of urban tourism is one of the major challenges for decision-makers, developers and communities rich in cultural heritage that have to choose from the old view of traditional tourism and urban tourism. The urban environment must function in all its natural, cultural, economic, social and recreational structures and its administrative, service and information institutions.

Restructuring and urbanization will be one of the most important problems or challenges of planning and design policies at the urban level, and requires understanding of the interplay between several types of urban environments.

- Al-jumaily pointed to the existence of several urban environments with different characteristics and formations that sometimes appear together or overlapping or diverging between them, each of which has characteristics distinguishing it from the other according to the history of its origins and its relations with each other (traditional-historical-contemporary) The common and surrounding environments of those recognized environments, and the

identification of possible intervention mechanisms to promote them for tourism purposes, as they represent the threshold separating them from each other, and are separated cultural and civilized among them. These environments are classified as follows:

1. The historical environment
2. The traditional environment
3. The contemporary environment
4. The environment surrounding the historical environment
5. The environment surrounding the traditional environment
6. The common environments between these environments. (Al-Jumaily, 2008, p. 124)

Studies suggest that interconnected and coherent environments play a role in spatial development and the promotion of urban tourism. In contrast, in disintegrated environments, which are not combined with urban design and structure, they lack the elements of urban tourism. Based on this, the determinants of the production of ambient environments can be drawn in the light of urban tourism: As in Table (2)

Table (2) illustrates the summary of the determinants of place production in light of the concept of urban tourism (prepared by the researchers)	
kinds Urban environments	Determinants of production of urban environments
1. Historical environment	Universal Laws (Conservation, Rehabilitation and Maintenance)
2. Traditional environment	Universal laws (conservation, rehabilitation, maintenance, water, development)
3. Environment common to historical and traditional environments	Combining traditional, historical and contemporary urban features
4. Environment common to historical and traditional environments	Is a reflection of the determinants of preserving the traditional and modern urban environment?
5. The environment surrounding the historical environment	Is a reflection of the determinants of preserving the historical and contemporary urban environment?
6. Contemporary environment	Be defined by the principles of the general framework of urban design

For the purpose of building a comprehensive theoretical framework on the determinants of production of surrounding and inter-urban environments, a series of pilot studies will be reviewed:

**First, "Australian Heritage Commission, 2000" (Protecting Local Heritage Places: A National Guide for Local Government and the Community):**

The study deals with the concept of heritage in Australia, which is made up of nature and history, as a heritage that passes from one generation to the next. It includes many things - the way the community lives, the traditions it cherishes, the history and values of the community and its values. Helps the recipient to understand the past and influence the current urban scene, and understanding the heritage place surrounding traditional and historical environments embodies recognition of all elements and respect for all values (natural, cultural, spiritual, social, fungal, historical and attractive to interest).

The study also pointed out that the determinants of the production of heritage sites surrounding urban environments may be aesthetic, economic, historical, ethical, environmental, legal, or even personal related to the past, a reminder of special moments in life, history or culture. The definition of the place and the relevant associations to secure the place and make it safe, collect and record information about the place to understand the importance of documentary, oral and physical significance, then come to evaluate the importance and prepare its statement. (Such as user needs, external factors and physical conditions), developing a general policy for the protection of places, managing space in accordance with the previous policy, then monitoring and rapid review). The policies used in the production of surrounding areas and in a manner that maintains and integrates with historical environments include the following:

- Protection: includes maintenance management measures that are either direct or indirect in order to prevent or minimize the effects that may result in degradation of the natural importance of the place and facilitate renewal.



- Maintenance: Maintenance techniques and procedures must be consistent with approved maintenance of the premises and should not detract from their natural importance.
- Regeneration: Renewal depends primarily on natural processes that facilitate recovery from turbulence or deterioration. It does not include physical intervention, but should be accompanied by monitoring and protection measures that do not deteriorate.
  - Restoration: Restoration is appropriate only if there is sufficient evidence of a prior situation to guide the process of integrated conservation with the spatial production process, and whether the biological diversity, geographical location or location of the site is consistent with the natural importance of that place.
  - Reinstatement: Restores the place to an earlier position and is appropriate only when there is evidence that elements, habitats or geological characteristics that must be reintroduced are normally present earlier, and the return to the place contributes to maintaining its natural importance, Threatening its presence in that place.
- Enhancement: improvement is limited to natural systems based on a small part of the biodiversity or geographic diversity of the place, and must not alter ecosystem processes and do not constitute the majority of habitats or features of the geographical diversity of the place.
- Preservation: It is appropriate when the natural importance of the place is fully reflected in its existing phase, and the natural importance depends on retaining the existing conditions that may be lost by progress in natural processes.
- Modification: Modification of a place to accommodate other non-preservative uses is acceptable when preserving the natural sense, and does not adversely affect the natural importance of other places.
- Presentation: Explain to visitors and others the natural importance of the place, encourage appreciation and respect, and promote awareness, understanding and support for heritage values and the goals of preserving it in a conservation program or activity.
- Monitoring: allows review of the effectiveness of conservation programs and reconsideration of the appropriateness of decisions, is essential for improving conservation practice and requires the maintenance of adequate records.
- Interpretation: Acts that help people change their behavior.
- Adaptation: to adjust a place that suits the proposed compatible uses. (P1-58), as shown in figure (2).

The study pointed to a number of cultural, natural, aesthetic, spiritual, physical, historical, ethical, environmental and legal determinants of their different values that influence the production of surrounding and interconnected environments, ensuring integration and balance between conservation and heritage development. Emphasizes the need to invest historical buildings of contextual value as aesthetic and essential elements that stimulate the economic and social development of cities on the one hand, and the industry of the places on the other and in the light of a range of policies (protection, renewal, restoration, Maintaining, adjusting, showing, observing, and adjusting).

## **II. Study "Mc, Laughlin, 2006" entitled (Contemporary preservation):**

The study focused on how to deal with the places surrounding the historical and common buildings between the traditional and contemporary environments, and focused on identifying the most efficient and efficient ways of dealing with the production of places by studying the values of historic buildings that were associated with the context surrounding the building and its purpose, (Its urban context), and these values are the main determinant in the production of places surrounding these buildings and environments, including the following:

- A commemorative value that embodies and documents an event or person permanently important.
- Historical value that reflects both the material and the model of a certain historical period and associated with educational and emotional value to assess and understand the aesthetic of the historical place.
- the age value reflected in the light of the natural process of change and development across the different stages of time and this value requires more than physical presence because of its association with a period and a certain time.
- The value of nostalgia derived from the historical places as a reminder of a famous past at the local level, contributing to the creation of personal identity and the realization of cultural affinity and diversity based on past experiences, as well as to prevent the possibility of change and expansion horizontally and globally by embracing the cultural history of the place.

- The coming value of the cultural and social reaction of traditional places as concrete memorials of the cultures or civilizations that have ended.
- The economic value of historical places that are still in use or that can be converted into sources of tourism investment, and the value of continuity inherent in the social interest of both present and past and the future of the culture that it expresses. As in Figure (2)

The study focused on the determinants of the production of environments surrounding the environment through the variation of the latent values in terms of existence (tangible values such as economic value, intangible value, social, emotional, commemorative value, historical and age value), the successful investigation and evaluation of all values constitute the correct intellectual orientation in the production of surrounding spaces between traditional and historical environments

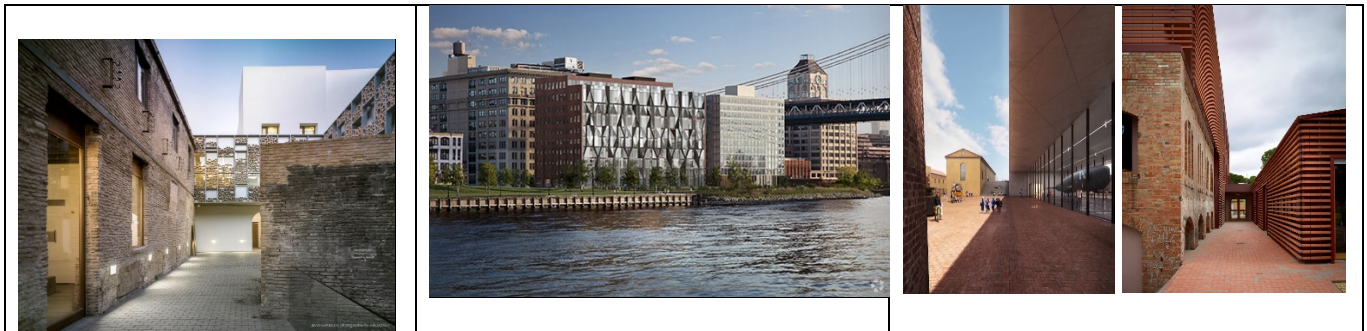


Figure (2) shows the determinants of the production of the surroundings of traditional environments based on the values of existence (tangible and intangible), the scale (global and local) and its role in the formation of spatial identity and changes in the social structure and functional and cultural place in order to accommodate the new requirements of tourism and adapt them to the spirit of the times.

**Third: Edward D Mills study entitled "Design for Holidays and Tourism" 1983.**

The study emphasized the importance of tourism at present and its role in the economic, social and cultural development and production of places. It is related to intellectual comfort, creativity and pleasure, the ability to access opportunities and attracting investments.

It also dealt with the necessary reciprocal and integration relationship between tourism and preservation of the environment and cultural heritage the surrounding and inter-urban environments in an integrated manner with the surrounding context by showing spatial and temporal values, and enhancing the sense of harmony and harmony within that place.

It is clear from this study that it stressed the necessity of activating urban tourism in all its dimensions and its role in producing areas surrounding the urban environments in light of the re-examination of urban land uses, strengthening the axes of traffic, flexibility and clarity, adapting and adapting in the urban structure of the urban scene, as well as enhancing places with elements and attractions for tourists.

Based on the above, the procedural definition of urban determinants in the production of surrounding and inter-urban environments as elements, legislation, mechanisms, policies, physical or moral values in place determines its production and composition in a manner that achieves continuity and urban integration with the context of traditional and heritage environments.

The surrounding areas become either a development tool or a growth-oriented motive that combines contemporary traditional, historical and urban features.

The most important vocabulary of the theoretical framework of urban determinants can be summarized in Table (3).

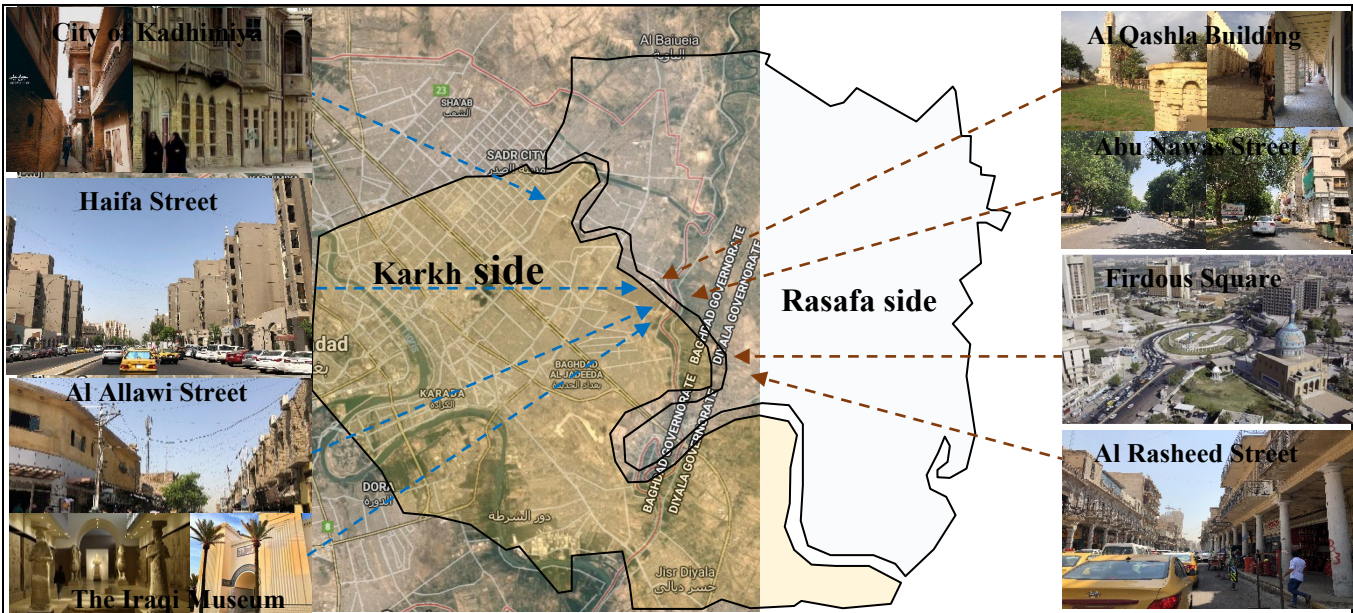
Key vocabulary	Possible values
Urban land uses	<ul style="list-style-type: none"> <li>- Encourage mixed use.</li> <li>-Diversity in activities and events.</li> <li>-Balance in the distribution of activities and functional events on both sides of the place.</li> <li>-Attention to population density and population.</li> <li>-To create functional accommodation to meet the needs of current and future individuals</li> <li>-Reviving the place locally through: (respect the past and link with the present, and the restoration of valuable jobs, and upgrading places of cultural importance).</li> <li>-Encourage local activities in employment</li> <li>-Compatibility of new uses with the menu.</li> <li>-Promoting in-place and biotourism.</li> </ul>

	<ul style="list-style-type: none"> <li>-Remove occupations that harm the urban context.</li> <li>-Attract local and international investments level.</li> <li>-Development of the local economy</li> </ul>
Characteristics of Urban Structure	<ul style="list-style-type: none"> <li>-Attention to space containment</li> <li>-Re-examination of population and population density</li> <li>-The visibility of urban entrances</li> <li>-Interconnectivity and harmony of functions</li> <li>-The visual unit of the urban scene</li> <li>-Strengthening local identity</li> <li>- Attention to legislation and laws of traditional and historical areas.</li> </ul>
Axes of movement and access	<ul style="list-style-type: none"> <li>-Enhance the optical coherence of the place.</li> <li>-Enhancing permeability.</li> <li>-Encourage coherence and local and global access.</li> <li>-Development of the movement axes of the Association.</li> <li>-Enhanced safety and privacy.</li> <li>-Promote the use of natural elements.</li> </ul>
Urban attractions and attractions	<ul style="list-style-type: none"> <li>-Enhancing social cohesion</li> <li>-Cultural and intellectual exchange within public places</li> <li>-Development of social capital</li> <li>-Attention to anthropological, archeological and psychological values (sense of spatial belonging, revival of collective memory, interdependence and social interaction, development of community customs and traditions, and highlighting the stories, stories and historical novels).</li> <li>-Revival of values and physical and moral symbols associated with the place</li> <li>-Reversing local values in design by taking into account the appropriate styles and architectural styles.</li> <li>-Enriching the place architecturally with people and buildings with a monumental and symbolic influence that contribute to the realization of the place and make it beautiful .</li> <li>-Reviving the underlying aesthetic values associated with the place</li> <li>-Maintain symbolic values in place</li> <li>-Encouraging and reviving communicative values</li> <li>-Preserve and rehabilitate historical values</li> <li>-Furnishing the place with attractive elements.</li> <li>- Inspiration and drawing of decorations and inscriptions, whether they are plant, animal or natural phenomena for aesthetic, functional and defense purposes.</li> </ul>
Policies for production of surrounding and inter-urban environments	<ul style="list-style-type: none"> <li>Protection ◊maintenance ◊Regeneration ◊Restoration ◊Reinstatement ◊ Enhancement ◊Preservation ◊Modification ◊Presentation ◊Monitoring ◊ Interpretation ◊Adaptation.</li> </ul>

## **2- The second axis / practical study:**

The city of old Baghdad (traditional) and the surrounding contemporary urban environments, the cities that have a distinct from other cities, is characterized by the presence of the Tigris River, which divides into two (Karkh and Rusafa) and the old residential neighborhoods distributed. These neighborhoods are surrounded by contemporary residential neighborhoods.

The current research aims to study the common areas between the traditional environment of the traditional city of Baghdad (Karkh side), which usually forms the boundaries of the old areas, which represents the first meeting point of the tourist and visitor to the cultural places. Urban Extension.



The map of the city of Baghdad with its sides Karkh and Rusafa with some places surrounding the traditional areas on both sides illustrates some of the uses of the urban land, the urban body, the landmarks and the distinctive attractions, as well as the axes of movement within the streets are clear and distinctive.

**1-2/ Region No. (1): Analysis of Sheikh Maarouf Street:**

<p>A large aerial view of Sheikh Maarouf Street showing his direction and location</p>		<p>Low population densities and loss of containment</p>
<p>Land uses do not correspond to the specificity of the contextual value of a place with harmful occupations</p>		<p>The lack of clarity of the entrances to the alley and the places surrounding traditional areas</p>
<p>The image of the water tank is described as one of the city's attractions and attractions and is a specific place of production</p>	<p>It illustrates the boundaries of the study area of the places surrounding the traditional Karkh area. What are the determinants of the production of places in terms of clarity, motor cohesion, diversity and mixed use of jobs.</p>	<p>The diversity of activities and events and their interdependence within the context, with modern additions not studied.</p>

**Area (2): Analysis of Al-Talaiy Street**



The lack of clarity of the entrances leading to the surrounding areas and their poor association with well-used forests



The imbalance in the uses of urban land and the lack of consistency of the formal structure due to low densities



Leaving unused spaces does not enhance security and safety.



Occupations that are not consistent (harmful) in context with the traditional urban fabric



Lack of diversity in urban land uses



Shows the boundaries of the area of the vanguards surrounding the context of the traditional Karkh, with the most important weaknesses that contribute to the weakening of the surroundings and deterioration and loss of identity distinct civilization.

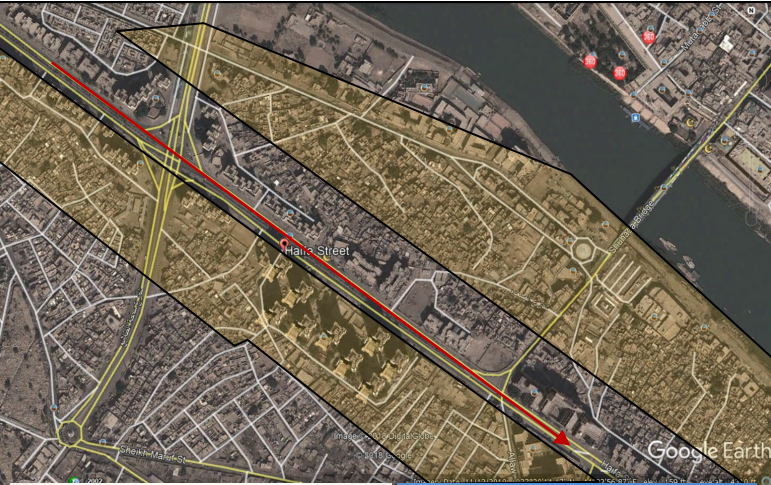


Urban features that are not homogeneous with the traditional context of the heritage area

**Area (3): Analysis of Haifa Street:**



Mixed densities are integrated with surrounding development and public transport



Clear harmony in building heights and avoid gaps between them



Its size and shape are sufficient to meet the intended use of the site, while ensuring equal opportunities for all



The visual continuity of the hallways gives the proportion, proportionality and sense of spatial containment



The distinctive height of the buildings promotes cohesion, develops social capital and encourages communication	The Haifa Street area is a desirable place to live, work and learn through various uses, high densities, flexible movement axes, a sense of belonging and a sense of local identity with a comparative influence that contributes to the recognition of the place and its beauty	Densely populated and densely populated areas that allow a mix of diverse activities and events
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### **Axis III / Conclusions :**

The absence of a clear vision of what urban environments will have together makes them different in the preparation of legislation and determinants, except for traditional and historical environments that have world-class determinants, laws and policies aimed at preserving the cultural, social and economic characteristics of these environments as a testimony to human achievements throughout history.

The visual and urban chaos indicates that there are no local determinants or legislations that regulate and govern the relationship between traditional and historical environments and their surroundings, as well as the common environments among them. This led to a weakening of the work between local and contemporary legislations and the ability of the designer to express his awareness of the implicit values For those environments making those environments outside the framework of global competition (urban tourism in particular). The conclusions will be as follows:

#### **First: the land uses of the surrounding area of Karkh heritage:**

- 1- The uses of the land in the places surrounding the traditional environment, refers to the existence of service occupations (car maintenance workshops and shops for the sale of spare parts and local restaurants for the general public, but to serve these workshops) in addition to the existence of warehouses for the sale of construction materials and other industrial.
- 2- The land uses also indicate that the use of these places for limited hours of daylight hours and that the movement falls to the lowest levels in the late hours of the day.
- 3- These places are limited to green spaces, parking lots, play areas and recreation areas.

#### **Second: The Urban Structure of the Karkh Heritage Area:**

- 1- The urban situation indicates that the rise of buildings, most of which do not exceed the two floors and the lack of mixed use, which is one of the characteristics of contemporary urban streets.
- 2- There is a weakness in the densities of population and housing in the places surrounding the traditional environment.
- 3- There is a weakness in the definition of traditional entrances to the environment.
- 4- The relative relationship between the width of the street and the height of the buildings (non-realization of space containment) is not achieved in the vicinity of these environments.

#### **Third: Urban Monuments and Attractions:**

- 1- The Tigris River, which overlooks the traditional environment is one of the important attractions, which is characterized by the abundance of restaurants and entertainment spaces open on the river.
- 2- The traditional Alberto café overlooking the Tigris is an important attraction.
- 3- The use of river boats and platforms through which it can transit and connect with the other bank, which is characterized by the presence of Mutanabbi Street and the building of Qashla and Rashid Street and river and Shorja Street.
- 4- The existence of Haifa Street, which penetrates the old heritage area, which is characterized by the vitality and high density of the population of high-rise buildings, despite the problems caused by the construction of this street and shredded urban fabric.
- 5- There is a variety of activities and activities that serve the residents of the Haifa suburbs as well as the existence of official buildings, but not to urban tourism.
- 6- This street does not mean by the other areas of Baghdad because it lacks urban attractions. But it penetrates the heritage area.
- 7- The street leading to the square and the bridge of the martyrs and the commercial and cultural bank of the Rusafa side, limited peak hours during

daylight hours shrink and fade the hours of the day, but it is effective on Friday of every week.

- 8- Street Pioneers, which runs through the heritage area leading to the other side of the river (Bab al-Mu'amam), to improve the physical condition and to address the surrounding buildings, as well as it lacks the containment of space and environmental treatments and points of attraction and activities and events, Walking.

#### **4- Fourth axis / Recommendations**

##### **4-1 Recommendations for land uses:**

1. Strengthen the architectural characteristics of the entrances of the traditional environment and increase its visibility to attract attention and encourage people to attend.
2. Review the height of the buildings surrounding the traditional environment to ensure increased population density and population.
3. Promote the idea of mixed use to increase the economic, social and cultural activities and activities of the traditional environment, as well as to provide employment opportunities for the local community.
4. Use of local materials and distinctive architectural details to distinguish and define the edges of the traditional environment.
5. Disposal of workshops, wholesale and retail shops and service professions prevailing in the traditional environment (Sheikh Al-Sheikh Street in Al-Karkh and Sheikh Omar Street, for example), and inside them (Al-Rasheed and Al-Mutanabbi Street in the Rusafa side, for example) and encouraging people to reuse and rehabilitate them. To serve local residents and visitors.
6. Maintenance and restoration of old buildings and encouraging the local community to reuse them for tourist attractions.
7. Disposal of the buildings on the traditional urban fabric and encourage their reconstruction according to the original design schemes.
8. Re-employment of urban spaces and spaces to strengthen the characteristics and economic and social activities ... etc
9. Strengthening environmental characteristics through the use of the concept of space containment and the human scale of the surrounding streets.
10. To ensure the continuity of activities and economic events and non-fragmentation to encourage people to walk and use continuously, and make them work throughout the day.
11. Preparing legislation and building laws that regulate environments surrounding the traditional environment and not leave them vulnerable to transgression.

##### **4-2 Urban monuments and scenes:**

1. Maintenance and restoration of monuments and urban and cultural scenes (visible and hidden).
2. Organizing the motor and visual axis leading to distinctive urban landmarks.
3. Organizing spaces surrounding distinctive urban landmarks and scenes.
4. Tents and lighting, providing seating areas, chairs, guide boards and services in the vicinity of monuments and urban scenes.
5. Easy access and transition to and from urban scenes and ensure their coherence and continuity.
6. Maintenance and restoration of monuments and urban and cultural scenes (visible and hidden).
7. Organizing the motor and visual axis leading to distinctive urban landmarks.
8. Organizing spaces surrounding distinctive urban landmarks and scenes.
9. Tents and lighting, providing seating areas, chairs, guide boards and services in the vicinity of monuments and urban scenes.
10. Easy access and transition to and from urban scenes and ensure their coherence and continuity.

11. Pay attention to the river bank and remove the excesses and ensure continuity of movement and assembly and enjoy the Tigris River, and turn it into a magnet for people and tourists.
12. Maintenance, restoration and organization of river transport platforms as one of the important points of interest (such as Abu Seifin, Kiryimat and Al-Shuhada Square), as well as ensuring the transfer and communication with other events and landmarks of the river bank.

#### **4-3 Transport and Mobility:**

1. Provide safe paths for the movement of people through the creation of sidewalks furnished and seats to sit and wait on both sides of the environment of traditional environments.
2. Ensuring the interconnection of internal traffic paths with the environment environment.
3. Provide public transportation and metro for the movement of people to and from the traditional environment.
4. Providing public and private parking spaces.
5. Provide spaces to bring people together on both sides of the traditional environment.

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# Self-Assessment of Construction Companies by Using Organizational Project Management Maturity Model (OPM3)

Dr. Sabah Noori Hammoodi Al Ani (Ph.D. in Civil Engineering- Project Construction Management)  
Founder and lecturer at civil Engineering Department- Ashur University College / Baghdad- Iraq.  
*alani.sabah@yahoo.com*

## Abstract

Maturity Models are become more popular because of its diversity and its ability to have more control on the cost-effective and project duration. It has adopted more and more by other project management organizations as a key strategy to stay competitive in the construction industry environment day by day. This type of model allows the organization of construction company determine what steps to take, what actions must be achievement and also the succession to achieve meaningful and measurable results. By the help of the maturity model, organizations can determine the construction ability to provide high performance and implementation of the project on time.

The model have 3 inter-related components which are Knowledge, Assessment Improvement. Main useful of using the maturity models are to increase the capabilities of any contracting company towered maturity levels by finding factors which has the most direct impact to successfully implementation of the model in the organization by finding size, complexity and initial maturity of it; when applying the assessment; organization's strategic objectives nature ; and the available resources .

**Key word: PMMM, OPM3, Construction Management**

## 1-INTRODUCTION

The industry of construction has important effect and take major part in the economy of any countries in the world. Due to fact that, in many countries, this industry with its major activities involved about Eighty

percent from capital assets in total, Ten percent of Gross domestic product, and in fixed assets Fifty percent or more from the total invested. Moreover, this construction industry is providing more opportunity for the career all over the world with different capacities, which lead it to be the industry which come back after agriculture [ (Ofori, 2006,15), (Jekale, 2004,10)]. In spite of its important contribution for the developing countries economy and the crucial role they play in it " development, the performance of the industry still remains generally low ". Furthermore, the progress in this industry in developing countries manly too late far after from other industries. Finally and as a conclusion this industry almost failure to confront aspirations of governments, customers and community as a whole.[ (Ofori, 2006,16) & (Jekale, 2004,11)] .

## 2-MATURITY MODELS

In order to reach a successful competition in the today global business for any organizations, a production of high standard of performance should be adopted. In a similar way, at the area of project management, it is necessary for the managers of any project should learn better practices to reach the privilege in project management [Kerzner,2011,21]. There in only a one way for it through the implementation of the strategic planning by successful steps [Kerzner,2011,22]. Strategically plans for the management of any project in this condition means the expansion of a specified standard of any methodology for the management of the project which is appropriate for each environment of any organizational [Kerzner,2011,26].

As a group subsidiary of the strategical planning for management of any project, PMMM provide the ways to identify important steps should be manage, the activities which is important to complete, lastly the concatenation of tasks necessary to recognize significates and commensurable outcomes. Essentially, the aim of the MM is to provide an assessment to improve the business result for any organization's by evaluation the organization's project management weaknesses and strengths, making compare with other organizations which is similar in work, finally make the necessary correlation measurement between an OPM level and actual project performance [Combe, & Ibbs,2008,18 ].

Maturity model was derived from the field of TQM (Cook,2002,12). They push a strategic continuously improving linked which this requires comprehensive comprehension of the up to date situation of the organization, which it aims reaching at the Future. Compliance with these change is necessary to have the participation of management with senior levels (Hayes, 2007,32). Determine the maturity of the change at field of model indicates that a lot of the developed ideas should addressed a wider change businesses viable in the environment and project management.

### **3-MODELS OF MATURITY IN PROJECT MANAGEMENT**

Levin (2002) explain that an organization which has a progressive approach to promote improvements in project management through the establishment of programs metrics, conducting assessments in project management, and using a model maturity in project management in the projects have a means to success and growth of the organization.

Baca and others (2007) show that in today's competitive world organizations seek methods to continuously improve their skills to implement due to their strategies. Kerzner (2000) states that a lot of contracting companies use the processes of the maturity in the application of development that lead to excellence. Klantjakosn (2001) adds that the concept of PMM is directly associated with the ongoing developing to the specific skills of project management.

Bolles and Hubbard (2007) also claim that the more evenly and consistently business processes are applied in project management and the maturing of different processes lead to maximal in the benefits and the good outcomes achieved by organizations. In addition, the return on investment in project management of an organization will increase as the business processes in project management become mature. Pitargosky (2005) also mentions that organizations persistently seek to improve the performance of the business through the launch of new products launched more quickly and cheaper, higher profits, increased customer satisfaction, risk smaller and increased market share, which are precisely the goals of application of project management maturity, ie, performance excellence organizational.

Kerzner (2003), explain that all organizations wishing to achieve privilege stage in projects management, but not all of them noticing that this need may be performed more rapidly through strategic planning in management projects. Using of PM despite of long periods duration, don't necessarily result privilege. On the contrary, the outcomes in the execution repetitive errors, and provide the worst case scenario, learning from their mistakes to Instead the mistakes of others.

Thus, for implementing best practices in project management and consequent evolution of maturity, should be conducted detailed planning for your embodiment. Morris and Pinto (2007) present the goals that lead organizations to use a maturity in project management model are:

- Understand which practical and useful processes need to be performed by organization that seeks the achievement of organizational project management.
- To promote the improvement of the business.
- Access the ability for implementing plans with strategic business at the tactical levels.
- Integrating the practices and processes of any organization in the areas of management portfolio, programs and projects.

Morris and Pinto (2007) also pointed out that the maturity model should contain best bureaucratiz are not malleable practices for activities related to the projects. Like this, similar projects may use different or additional best practices in due to their current need.

Fincher and others (2004) point out the needs of organizations for enhancing project management:

- Need to know which specific best practices - knowledge, technical tools - consistently proven their usefulness in their organizations;

- Need a method to assess the current state of maturity; and

- Need to know how to improve specific skills identified required for improvement.

Thus, even for Fahrenkrog et al (2004), in an attempt to search for these needs, individuals and organizations have developed various models and methodologies to assisting pursuits of maturity in PM. Cooke-Davies & Arzymanow (2003) emphasize that the present levels of maturity in project management can help organizations prioritize the improvement of efforts and convince the executives on the need for your application. For Bolles (2002), to determine the level of maturity in project management is a subject that created a huge interest in business lately.

A lot of maturity models of project management was presented in various publications since the mid-1990s, which created an increase in level of interest for the development of a model. Cooke-Davies and Arzymanow (2003) mentioning that the maturity models developed from 1990 were influenced by profession of project management. For Iqbal (2005) should now be roughly about 40 maturity models in circulation and that each is directed to a specific aspect of organizations. Table (1) below shows the main maturity models cited by Iqbal (2005),38.

**Table 1 Models of maturity in project management**

Model Abbreviated	Modelo Deascription
CMMI	Capability Maturity Model Integration
SW-CMM	Capability Maturity for Software

P-CMM	People Capability Maturity Model
SA-CMM	Software Acquisition Capability Maturity Model
SE-CMM	Software Engineering Capability Maturity Model
IPD-CMM)	Integrated Product Development Capability Maturity Model
IT Service CMM	IT Service Capability Maturity Model
OPM3	Organizational Project Management Maturity Model
PMMM	Project Management Maturity Model by Harold Kerzner
PMMM	Project Management Maturity Model by Jim K. Crawford
PM2	PM2 Maturity Model
PM2M	Project Management Process Maturity Model
pMMM	Programme Management Maturity Model
RMM	Project Risk Maturity Model
EVM3	Earned Value Management Maturity Model
BMM	Broccoli Maturity Model
SMM	Services Maturity Model
SAMM	Self-Assessment Maturity Model
TMM	Testing Maturity Model
WSMM	Web Services Maturity Model
SMM	Security Maturity Model
OMM	Operations Maturity Model
ELMM	E-Learning Maturity Model
EGMM	E Government Maturity Model
OMMM	Outsourcing Management Maturity Model
CPMM	Change Proficiency Maturity Model
PEMM	Performance Engineering Maturity Model
ITAMM	IT Architecture Maturity Model
IPMM	Information Process Maturity Model

LM3	Learning Management Maturity Model
ASTMM	Automated Software Testing Maturity Model
WMM	Website Maturity Model
IMM	Internet Maturity Model
UMM	Usability Maturity Model
SREMM	Software Reliability Engineering Maturity Model
S2ECMM	System Security Engineering Capability Maturity Model
CM3	Configuration Management Maturity Model
CPMEM	Cultural Project Management Effectiveness Model

**Source:** Adapted from Iqbal, 2005, 38

#### **4-OPM3 Purpose and Scope**

Bolles (2002,15) shows that in 1997 the Standards Committee of PMI, PMI Standards Committee, developed the Organization Project Management Maturity Model Project (OPM3) and his goal was developing model for maturity assessing to the project management to an organization. Morris and Pinto (2007,25) also claim that the PMI declared the intention of the company to start Organization Project Management Maturity Model in the initial release prior to its completion in 2003 this model differs from other models previously mentioned, by introducing a framework which is very near to the framework of Capability Maturity Model, relating to the Guide of Project Management Body of Knowledge; which covering 3 PM's areas which links the strategic management projects of any organization.

Bolles and Hubbard (2007,44) argue that the OPM3 developed for companies as a way to examine pursue strategic objectives through the application of best practices in management of organizational design. The OPM3 is committed to three elements General: knowledge, presented in the body of this model; reviewed, which provides a method for comparisons with the model, and improvements, which defines the scope for possible changes organizational. The OPM3 provides a basis for an organization to develop training in project management so you can achieve the levels of competence identified skills in project management model.

Zaguir and Martins (2006,2) also explain that OPM3 has been tested in several studies, used techniques of quality management, such as "Quality Function Deployment" and "House of Quality "to collect and test requirements of users, had strong participation of recognized experts

in the field of project management, in addition to executive sponsorship PMI. Schlichter, Friedrich, and Haeckel (2003,17) show that the evolution of OPM3 was as follows form:

- The 1998: Year of project creation to develop a model for international manufacturing and ministries among use of strict of volunteer efforts without pay.
- The 1999: Conducting research to verify the model innovations to be created and to establish teams for the segmentation of the skills evaluated.
- The 2000: Breakdown of best practices by teams responsible for each category previously identified.
- The 2001: Definition of the format and structure of the model by the project teams and early tests with business valuations.
- The 2002: Establishing best practices separated by levels of maturity, standardization, measurement, control and continuous improvement,

for each type of effort, projects, programs and portfolios.

- The 2003: Launch of the maturity model PMI, OPM3 in September 2003.

### **5-OPM3 CONCEPTS**

According to PMI (2003) the OPM3, Is a systematic and orderly managing of PM, PM & PM for purpose to alignment with the strategizing objectives of research in it, ie doing the right job to meet the objectives. The main concept of OPM3 to any company is instituted at a connexion between organizational capabilities in project, programs and portfolios management and the effectiveness in the implementation of organizational strategies. Schlichter (2001) as defined OPM3 set of practices and processes necessary for the execution of firm strategies through corporate projects. Klantjakosn (2001,24) states that contributes to the OPM3 is more than managing a single project or multiple project environment. Concerns with the pursuit of corporative objectives through effective transition plans strategic in specific jobs. PMI (2003) concludes that the OPM3 refer to the knowledge's, tools, techniques and skills application. The OPM3 also helps the planning of improvements of organizations wishing to develop in organizational project management.

Matassa (2006,23) defines as an OPM3 methodology for implementation and development the organizational project management. The PMI (2003,18) defines best practice as the best means currently recognized for achieve a goal or objective. According to Levin (2005,33), the evaluation of maturity, both in project management as in business development, is of fundamental importance for organizations, because it provides a benchmark of the current position in terms of best practices and serves as a foundation for continuous improvement, as helps identifying organizational weaknesses & strengths and the effectiveness amount for the organization unfastened improve their skills.

The PMI (2003) provides the following benefits of using OPM3 in organizations:

- Provides a method for searching organizational achievements by implementation the rules and application of project management.
- Provides extensive guide to knowledge
- Presents exactly what the organization best practices can applies & what doesn't apply.
- Provides a guide to prioritizing and planning.

Matassa (2006,24) to present as complete benefits of using the OPM3 companies become able to:

- Leverage investments in infrastructure project management organizational goals to the pursuit of strategies.
- Strengthen the ability to assess the maturity in project management organization through the application of best practices.
- Report which best practices and capabilities are applied by the organization.
- Provide a map for prioritizing and planning future improvements in organizational project management.

In general, the OPM3 has three basic elements, knowledge, evaluation and improvement. The PMI (2003) shows how these three elements:

1. Knowledge – which is the 1<sup>st</sup> step of a guide of OPM3 to be familiar with its principles as the PMBOK provide the basis for assessment of organizational maturity.
2. Self-Assessment - Use of a tool for the organization to determine strengths and weaknesses in the relationships to the guide containing besting practice. This process of evaluation lead helping organizations deciding in which the best practice will be



investigated in more detail, to confirm competence in a particular area or capabilities for identifying a constituent or several best practices that need attention.

3. Improvement - Evaluation results shall including capabilities' list of still not completely available in the company. Organization Project Management Maturity Model provide a guide for deployment of these capabilities in importance's order, in which plans form the consequential improvement plans.

### **6-Project, PROGRAM & PORTFOLIO Management Processes**

PMBOK Guide - Fifth Edition identifies five necessary for any project management process groups. These five groups have a clear process dependencies are executed within equal steps for every projects. Often the processes is repeated its operations before the completion of the project process called progressive mode. Progressive put simply means that, as more information becomes available, and repeated some of the processes and process groups to integrate new factors. Operations can also constituent interactions within the Operations Group and the process groups, overlay to admit that the draft of the internal and external factors affected by the current.

The above mentioned 5 Groups of processes are shown below:

- IP:** define the phases of any project.
- PP:** Refine & define goals, with steps which is necessary done to achieve the goals and scope of project which should be reached.
- EP:** combine all required human and non-human resources required to complete the projects.
- MCP:** Daily & weekly or monthly measuring with monitoring the project progressing to find the gaps between project plan and ongoing progress at site and identify the corrections plans to correct the work at site.
- CP:** Refer to all steps and action which required to close any project.

### **7-Maturity Models Elements**

A detailed explanation of the three steps of elements is necessary for the application of the model and it will be provided in the subsequent chapters, where each chapter will address the three steps of the model in which they will be explained in detail and from all aspects. In spite of that, the companies whom used this model are aware of the full and familiar with those steps completely because it will record in the process of reviewing each step. Fig.(1) show the elements of the model.

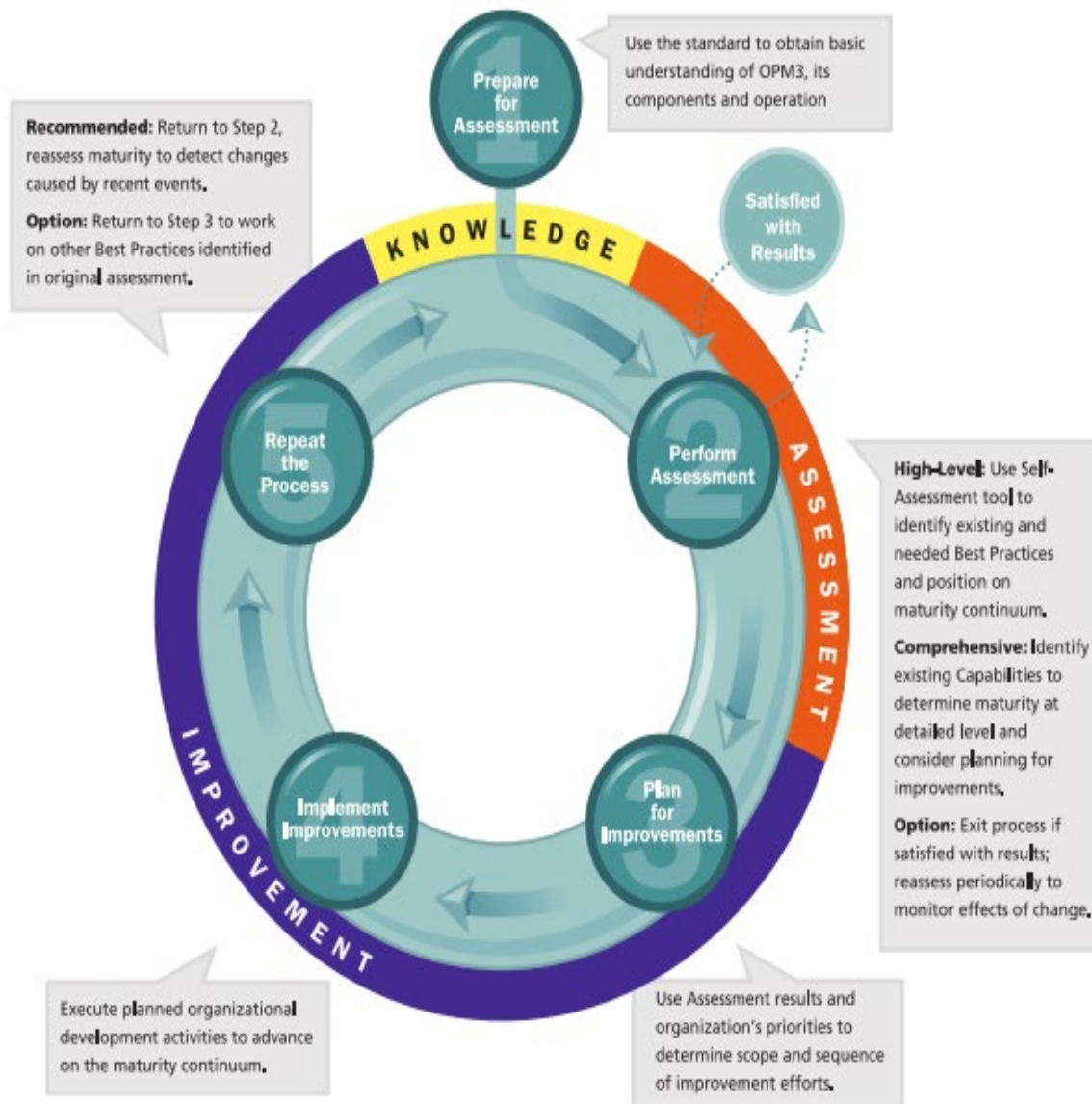


Figure 1. OPM3 Model stages

**Knowledge Stage**

includes the comprehension of the Model to the fullest possible. It becomes harmonious with OM of the project and within running of the model.

**8-Knowledge**

This is the 1<sup>st</sup> step to any company for arranging the preparation of the processes for the assessment of any maturity's company compared with the Model. That

**9-Assessment Stage**

The next step for the organization is to assess the degree of maturity in organizational projects, known as assessment performance. For

implementing this stage, the company should compare the current state of the Organization characteristics within elements which were detailed in the model. The 2<sup>nd</sup> phase is Assessment, which enables any company to proceed by gathering more details for the maturity levels in order to indicate the specific maturities associated with PB.

### **10-Improvement**

Organizations choose to follow the organizational improvements leading to increased maturity. The results from this improvement plan lead to reaching the maturity levels for any organization by using the documents, including capabilities for the organization with the dependency between all. This allows the arrangement of the results as per their priorities to the organization needed. This step is divided into the following:

### **11-Improvements Implementation**

Within this stage, the organization shows where organizational' changes happen. At the moment in which the improvement

### **The Field of Investigation for application of OPM3 in Iraqi Contracting Companies**

In the previous sections, the researcher covered the literature review for the subject of this Paper. Now for the application of the objectives, approaches, and methodologies, already described in the review of literature, in the field of construction management, this question may appear " How can we evaluate the

plans establishment, the organization has to implement the plan with the passage of time, any implementation of the necessary to obtain the necessary capacity and progress on the road to increase organizational maturity of project management and organizational development activities.

### **12-Return to Assessment and Improvement**

This process is repeated. After the completion of improving tasks, the company will have two choices which are this process is repeated. Continuity for the application of the model in which has the recommendation to do -or return back to the third stage by addressing the capabilities which were defined in a previous evaluation practices. Return back to evaluation stage for re-evaluating the current statues on the continuity for the OPM3 model in which has the recombination to do -or return back to the third stage by addressing the capabilities which were defined in a previous evaluation practices.

current statues of the knowledge of OPM3 which represents the first step of applying those models to reach the maturity level in the organization of contracting companies working in the Iraqi market?" To answer this, a survey was prepared to involve the people who are working with this filed of specialization to find the ways that they are thinking and doing regarding the application of Maturity Models in

Construction Management by asking some information through the design of the questioner.

The objective of this section is to investigate and evaluate the current statuses for the knowledge of OPM3 for the Iraqi contracting companies and some foreign contracting companies that they are working in Iraq construction market, taking into consideration the following:

- At Knowledge phase, company becomes skilled within the model.
- Suitable BP.
- Concept of OPM3 with the organizational.
- The participant in this questioner would be able to indicate the position of the company and organization form the concept of OPM3.

Appendix one shows the questioners and the result of it.

### **13-Conclusions**

From reviewing the result of the knowledge areas for the PMMM processes of maturity, we can find that almost more than fifty percentage of the contracting companies seen that they are not having all the necessary or appropriate parts of the maturity's process for the project management knowledge areas, as the

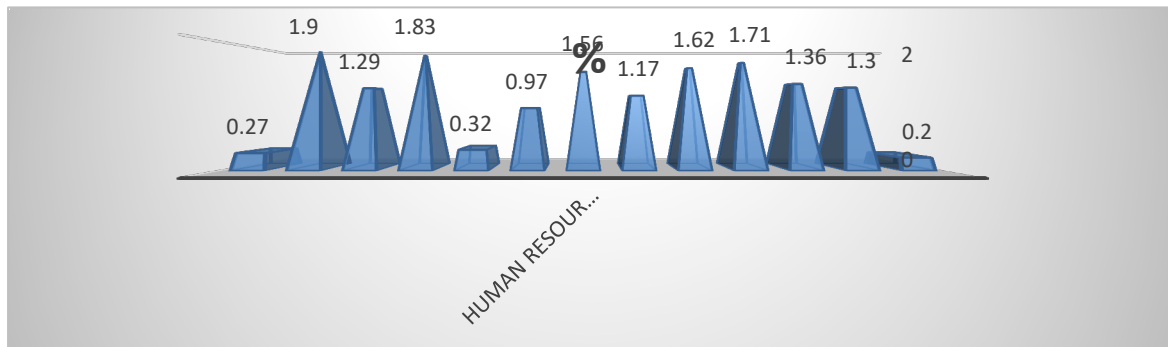
mentioned percentage for the contracting companies doesn't adopt or implement all the processes which have the necessity for managing the on-going projects in proper way. Mainly the mentioned contracting companies don't implement one of four of the maturity processes and/or practicing which foreseeable to be adopted for achieving knowledge's process targets. On the other hand, one third of the companies implement unofficially the processes for the majorities of project management knowledge areas, also twenty five percent implement it officially.

Also it is calculated that none of the companies reached the managing levels for maturity's processes which supporting assumptions of the author for using levels of maturities just of up to a specified level. Furthermore, the outcome indicates levels with low positions to the development of project management within the industry of construction in Iraq, other result was found that maturity comprehensive for the dimension of processes of the projects construction management is in its official levels of maturities. Fig. (2) Shows that the knowledge for MM, PM, CM, TM, FM &HRM relatively has high maturity's level compared with the others knowledge areas of project management.

Those areas are implemented officially from the contracting companies; other areas which are SM, QM & CM are relative with low maturity's level which can be unofficially implemented by the contracting companies, while the rest of knowledge areas which are GM, RM& SCM are at the bottom of knowledge areas mature.

Assessing outcomes show that fourth percentage from the contracting companies have deficient status to applying the maturity of project practicing, which mean that they are in lower base for this factors. Other results appointed that none of the samples adopted any methodology to

reach even a middle stage of project management maturity to its organization. The author also found that the SFM and RM are completely ignored at the management of the construction of projects in managing projects at Iraq. Further for the mentioned knowledge areas, the COM found to be at low level of PM. For the EM & MM which are also found to be at a low stage of PM relatively, this is as per the author analysis due to the behavior of the contracting companies to managing them by its local departments instead of being one of the project management functions and because of the purchasing and collecting .



**Figure 2**

**OPM3 Model Results**

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*Zuo ZhiLiang*; Study on the Project Management Maturity Assessment for Construction Enterprise; School: Huazhong University of Science and Technology; Master's thesis; Year: 2011

## Appendix 1

### Part 1- General Information

1. Name of person(optional): \_\_\_\_\_

2. Name of your company (Optional): \_\_\_\_\_

3. Company address and e-mail :

4. Your company is :

**A: Local privet company**

**B: Local Government Company**

**C: Foreign Company**

**D: Joint Venture of local and foreign**

**E: Other (please specify)**

5. Position /role in the company : \_\_\_\_\_

6. Qualification: **A. Bachelor** **B. Higher Diploma** **C. Master** **D. Ph.D**

7. Have you received any project management related training? **A.Yes** **B.No**

If YES please specify:

8. Have you worked as Project Manager and for how long? **A. No** **B. Yes**

9. What is the category of your company?

**A: General Contractor**

**B: Building Contractor**

**C: Road Contractor**

**D: Specialized Contractor**

**E: Other (please specify)**

10. What is the grade of your company?

**A. Excellent**

**B: first Grade**

**B. Second Grade**

**D: Other (please specify)**

11. How long your company been in the construction business? \_\_\_\_\_ years

12. Does your organization has ISO certificate?

## Part 2- OPM3 practice Knowledge questions

Answer all the questions that follow based on your Knowledge with the principle and concept of OPM3 in the project you are participating in your company, please choose:

**Yes:** if the description approximates the condition in your company

**No:** if the description does not come close to the condition in your company

**Sometimes (ST):** if the description applies some times to some project in your company.

#	FACTOR	YES	NO	S.T
1	Are the sponsor and other stakeholders involved in setting a direction for the project that is in the best interests of all stakeholders			
2	Does your organization consider risk during project selection			
3	Are your organization's goals and objectives communicated to and understood by the project teams			
4	Do the projects in your organization have clear and measurable objectives in addition to time, cost, and quality			
5	Does your organization continuously improve the quality on projects to achieve customer satisfaction			
6	Does your organization have policies that describe the standardization, measurement, control, and continuous improvement of project management			



	nt processes			
7	Has your organization fully integrated the PMBOK® Guide knowledge areas into its project management methodology			
8	Does your organization use project management processes and techniques in a manner that is relevant and effective for each project			
9	Does your organization use data internal to the project, data internal to the organization, and industry data to develop models for planning and re-planning			
10	Does your organization establish the project manager role for all projects			
11	Does your organization establish standard cross-functional project team structures			
12	Does your organization create a work environment that fosters team work, builds trust, and encourages project teams to take calculated risks when appropriate			
13	Does your organization have the necessary processes, tools, guidelines or other formal means to assess the performance, knowledge, and experience levels of project resources and assign them to project roles			
14	Does your organization create a work environment that supports personal and professional achievement			
15	Do the project managers in your organization communicate and collaborate effectively and responsibly with project managers of related projects			
16	Can your organization demonstrate a return on investment from undertaking projects			
17	Do the projects in your organization define and review goals and success criteria at the beginning of the project and then review them as the project progresses			
18	Does your organization have a standard approach for the definition, collection, and analysis of project metrics to ensure project data is consistent and accurate			
19	Does your organization use both internal and external standards to measure and improve project performance			
20	Does your organization have defined gateway milestones, where project deliverables are assessed to determine whether the project should continue or terminate			
21	Does your organization use risk management techniques to take measurements and assess the impact of risk during project execution			
22	Does your organization capture, analyze, and apply lessons learned from past projects			
23	Does your organization have an organizational structure in place that supports effective communication and collaboration among projects in a program leading to improved results of those projects			
24	Do project managers understand how their project and other projects in the organization fit into the organization's overall goals and strategies?			
25	Does your organization use a common set of processes to consistently manage and integrate multiple projects			
26	Does your organization effectively consider workload, profit requirements, and delivery time frames in deciding how much project work it can undertake?			
27	Does your organization align and prioritize projects to its business strategy			

28	Is your organization "projectized" in that it has project management policies and values, a common project language, and use of project management processes across all operations			
30	Does your organization use and maintain a common project management framework, methodology, and process set for its projects?			
31	Are your organization's executives directly involved in the organization's project management direction, and do they demonstrate knowledge and support of that direction			
32	Does the structure of your organization support its project management direction			
33	Does your organization support open communication across all levels			
34	Do people in different roles and functions throughout your organization collaborate to define and agree on common goals			
35	Does your organization set a strategy to retain knowledge of internal and external resources			
36	Does your organization encourage membership in external project management communities (e.g. professional associations or initiatives)			
37	Does your organization provide for the ongoing training and development of project management resources			
38	Does your organization have progressive career paths for project-related roles			
39	Is your organization's quality management system reviewed by an independent body			
40	Does your organization gather quality assurance metrics on its projects			
41	Does your organization use project metrics to determine project, program, portfolio, and organizational effectiveness			
42	Does your organization use formal performance assessment processes and systems to evaluate individuals and project teams			
43	Does your organization evaluate and consider the investment of human and financial resources when selecting projects			
44	Does your organization have project management tools that are integrated with other corporate systems			
45	Does your organization have a program to achieve project management maturity			
46	Does your organization recognize the need for OPM3 as part of a project management maturity program			
47	Does your organization incorporate lessons learned from past projects, programs, and portfolios into its project management methodology			

### Part 3- OPM3 Management Organization questions

Answer all the questions that follow based on your Knowledge with the principle and concept of OPM3 in the project you are participating in your company, please choose:

Yes: if the description approximates the condition in your company

No: if the description does not come close to the condition in your company.

Sometimes (ST): if the description is apply some times to some project in your company.

Is your company apply any of the following management organization in its structure?

#	OPM3 Management Organization	YES	NO	S.T
1	general management			
2	scope management			
3	time management			
4	cost management			
5	quality management			
6	human resource management			
7	communications management			
8	risk management			
9	procurement management			
10	financial management			
11	equipment's management			
12	material management			
13	safety management			

**Apendix 2**

**List of Abbreviations**

PJM	Projects Management
PGM	Programs Management
PTM	Portfolios Management
PPP	Projects, Programs, Portfolios
PMMM	Project Management Maturity Model
PMI	Project Management Institute
PMBOK	Guide to the Project Management Body of Knowledge
BP	Best Practices
KPI	Key Performance Indicators
SMCI	Standardize, Measure, Control, and continuously Improve
IP	Initiating Process
PP	Planning Process
EP	Executing Process
MCP	Monitoring and Controlling Process

CP	Closing Process
OM	Organizational Management
GM	General Management
SCM	Scope Management
TM	Time Management
CM	Cost Management
QM	Quality Management
HRM	Human Resource Management
COM	Communications Management
RM	Risk Management
PRCM	Procurement Management
FM	Financial Management
EM	Equipment's Management
MTM	Material Management
SFM	Safety Management

# PWM rectifier fuzzy logic control using DPC technology

S. Dahmani

A. Semmah

P. Wira

Department of electrical engineering

Department of electrical engineering

Université Haute Alsace de

University of Dillali Liabes

University of Dillali Liabes

Mulhouse France

## ***Abstract:***

This paper examines a control strategy for a pulse width modulation (PWM) rectifier in order to eliminate harmonic currents and thereby reduce the total harmonic distortion of the line and improve the power factor. The principle of direct control of active and reactive instantaneous powers is used. In this study, a comparative study on DC voltage control will be presented. In this case, a PI controller and a fuzzy controller are used to have a stable active power exchange. A numerical simulation was performed under Matlab Simulink, and the results are presented below.

***Keywords— PWM rectifier, DPC , voltage estimation, instantaneous active and reactive powers, fuzzy logic control, conventional PI controller.***

## I. INTRODUCTION

The growth of power electronics and the increase in energy consumption have encouraged electro-technicians to undertake important associations of static power converters with electrical machines [1]. Generally, these devices represent non-linear loads that behave like harmonic generators. As a result, the waveform of the current loses its sinusoidal shape and a power factor degradation is also obtained. Consequently, electricity distributors are obliged to impose standards and provide protection against such disturbances [2].

The first application developed for direct control was the control of stator flux and electromagnetic torque of an electric machine without a modulation block. Such a structure was called Direct Torque Control, DTC [3]. Then, Direct Power Control (DPC) was inspired by DTC. In this case, the active and reactive instantaneous powers represent the controlled variables [4].

DPC are based on the active and reactive power of the instant control [5]. In the DPC strategy, optimal control is obtained from a switching table that uses active and reactive power regulation errors and the position of network voltages. [6]

Therefore, it is important that the active power exchange is stable, ensuring a DC voltage equal to its reference, for the PWM rectifier to work with a good output [7]. This can be achieved by using a control system capable of regulating the DC voltage.

In this article, two

In this article, two DC voltage control systems are considered: in the first type, we will use a PI regulator whose proportional and integral actions offer the system a minimum overrun and a good response time; in the second type of control, we will introduce human knowledge to improve the performance of the system behavior.

## II. MODELLING OF THREE-PHASE PWM AC/DC CONVERTER

Figure 1 shows the structure of the three-phase AC/DC PWM converter used. It consists of six overrunning diodes mounted in anti-parallel with six IGBT transistors in order to make them bidirectional.

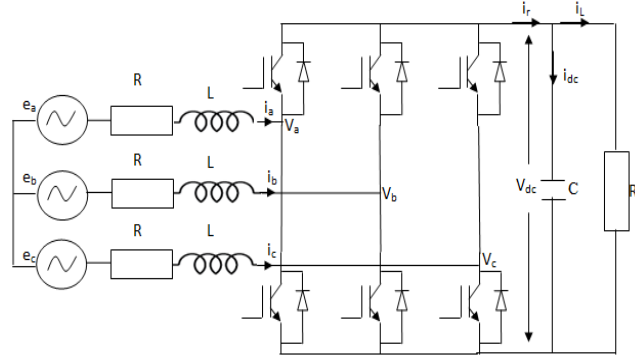


Fig 1. Main circuit representation of three-phase PWM AC/DC converter

The ( $e_a, e_b, e_c$ ) represent the grid voltages,  $R$  is the line resistor,  $L$  is the line inductance,  $C$  and  $R_L$  are the filtering capacitor and the resistive load respectively.

### II. DPC STRATEGY

In this paper, the proposed F-DPC is a control technique that uses direct instantaneous power as controlled variables [8]. This control strategy is very important. The voltage-vector sequence of the three-phase PWM converter was selected using a new switching table structure based on fuzzy logic rules [9]. Furthermore, it does not require a hysteresis controller. The fuzzy switching system inputs are the area where the position of the mains voltage vector  $e_{\alpha\beta}$  and the instantaneous active and reactive power errors ( $e_p, e_q$ ) are located as fuzzy variables.

However, the F-DPC diagram uses the position of the grid voltage vector  $e_{\alpha\beta}$  to determine the sector number, for this the vectors plan  $\alpha, \beta$  is divided into twelve equal sectors, as shown in Figure 2. These sectors can be determined as:

$$(n - 2) \frac{\pi}{6} < \gamma_n < (n - 1) \frac{\pi}{6} \quad (1)$$

Where  $n=1, \dots, 12$

$n$  indicate the sector number. It is instantaneously given by the voltage vector position and is computed as follows:

$$\hat{\theta} = \arctan \left( \frac{\hat{e}_\beta}{\hat{e}_\alpha} \right) \quad (2)$$

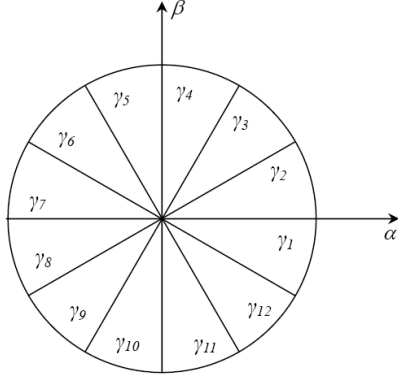


Fig.2.  $\alpha$ - $\beta$  plant divided into 12 sectors

The outputs hysteresis regulators given by the boolean variables  $S_p$  and  $S_q$ , indicate higher or lower goings beyond of powers errors according to the below logic:

$$\begin{cases} p_{ref} - \hat{p} > h_p & \Rightarrow & S_p = 1 \\ p_{ref} - \hat{p} < -h_p & \Rightarrow & S_p = 0 \\ q_{ref} - \hat{q} > h_q & \Rightarrow & S_q = 1 \\ q_{ref} - \hat{q} < -h_q & \Rightarrow & S_q = 0 \end{cases} \quad (3)$$

Where  $h_p$ ,  $h_q$  are the variations of the hysteresis regulators.

By neglecting line voltage variations [10], dynamics of active and reactive power can be given as follows:

$$\frac{dp}{dt} = \frac{1}{L} (e_\alpha^2 + e_\beta^2) - \frac{1}{L} (e_\alpha \cdot u_{c\alpha} + e_\beta \cdot u_{c\beta}) \quad (4)$$

$$\frac{dq}{dt} = \frac{1}{L} (e_\alpha \cdot u_{c\beta} - e_\beta \cdot u_{c\alpha}) \quad (5)$$

### III. DC VOLTAGE REGULATION

In order to regulate the DC side voltage and to generate the amplitude of the reference line current which will be multiplied by the DC voltage to obtain the reference of the instantaneous active power, the corrector in the external control loop of the PWM rectifier is used [11]. Therefore, to have a unit power factor condition, the reference reactive power is zero [12].

As the following figure shows, the regulation function is performed by a PI corrector:

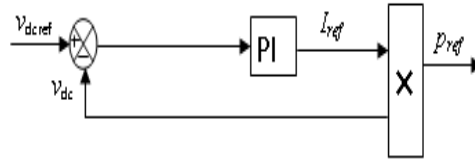


Fig.3. DC voltage regulation

Where  $K_p$  and  $K_i$  are the proportional and integral controller gains respectively

#### IV. FUZZY SWITCHING SYSTEM DESIGN

Fuzzy logic control is an artificial intelligence technique. Compared to traditional controllers, it allows to determine a very effective control law in different industrial fields. Thus, the fuzzy control is an effective tool for monitoring the complex non-linear system. Indeed, this fuzzy controller does not need an exact mathematical model of the studied system. Moreover, the Mamdani fuzzy controller contains four important steps: fuzzyfication, knowledge bases, inference engine and defuzzyfication [13].

In this work, the fuzzy switching system block has three inputs and three outputs

##### A. Fuzzyfication

In order to perform the input fuzzyfication, we applied the triangular belonging functions for the network voltage position and the trapezoidal belonging functions for active and reactive power errors. The fuzzy sets selected to perform power error fuzzyfication are N (negative), Z (zero) and P (positive). As for the position of the grid tension, the discourse universe is divided into twelve fuzzy sets.

##### B. Knowledge bases and inference engine

The knowledge base consists of a database and a rules database. The database provides the necessary information to perform fuzzyfication and defuzzyfication operations. The rule base is the most important step; it provides the information for the rule-based inference engine. Table I shows the language rules we used to improve the situation.

##### C. Defuzzyfication

The defuzzyfication block is used to transform linguistic variables into real variables. In order to accomplish this task, many methods have been proposed in the literature [5]. However, in our case, the center of gravity defuzzyfication technique was used.



TABLE II. INFERENCE RULES

$K_p/K_i$	$\varepsilon = V_{dcref} - V_{dc}$						
	NB	NM	NS	ZE	PS	PM	PB
NB	PB	PB	PB	PM	PM	PS	ZE
NM	PB	PM	PM	PM	PS	ZE	NS
NS	PB	PM	PS	PS	ZE	NS	NM
$\Delta\varepsilon$ ZE	PM	PM	PS	ZE	NS	NM	NM
PS	PM	PS	ZE	NS	NS	NM	NB
PM	PS	ZE	NS	NM	NM	NM	NB
PB	ZE	NS	NM	NM	NB	NB	NB

NB: Negative Big; NM: Negative Medium; NS: Negative Small; ZE: Zero; PB: Positive Big; PM: Positive Medium; PS: Positive Small;

### V. SIMULATION AND DISCUSSION

In order to verify the effectiveness of the control strategy studied in this article, a numerical simulation was performed under MATLAB/SIMULINK environment.

We tested the DC voltage control system and the DPC method following a DC voltage variation at  $t=0.5s$  from 380V to 480V.

The effectiveness of fuzzy DC voltage regulation is illustrated in Figure 4. We can observe that the system has become more stable and robust than when the PI controller was used. In this figure, the overshoot disappears completely and the response time is reduced.

Figure 5 shows that when the DC voltage reaches the new reference value, the active power and therefore the line current increase. For the fuzzy controller, the power increase is limited, which avoids harmful excess currents for the system. In Figure 6, during DC step variation, the reactive power is significantly reduced when a fuzzy controller has been used. The line voltage and current are almost in phase (fig.7), and therefore the power factor is almost equal to 1. In the case of the fuzzy regulator, the waveform of the line current close to the sinusoid.

The system parameters studied in this article are given in Table.II:

TABLE.II SYSTEM PARAMETERS

$R$	88m $\Omega$
$L$	3.127mH
$C$	1mF
$R_{load}$	100 $\Omega$
Peak amplitude of line voltage	200V
Source voltage frequency	50Hz

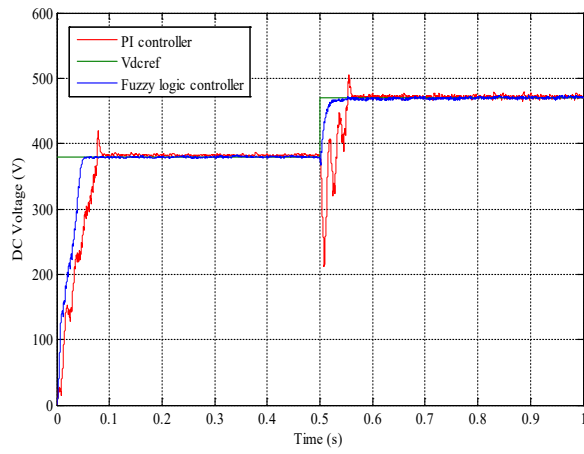


Fig.4. Control system step response

( $V_{dref}=380$  to  $480$  V)

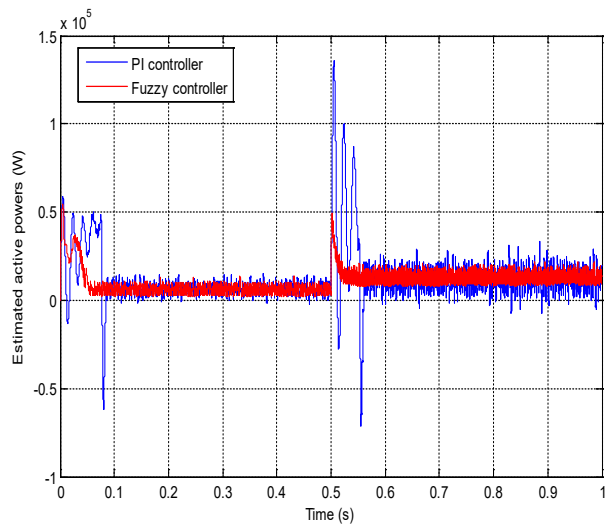


Fig.5. Estimated instantaneous active

power

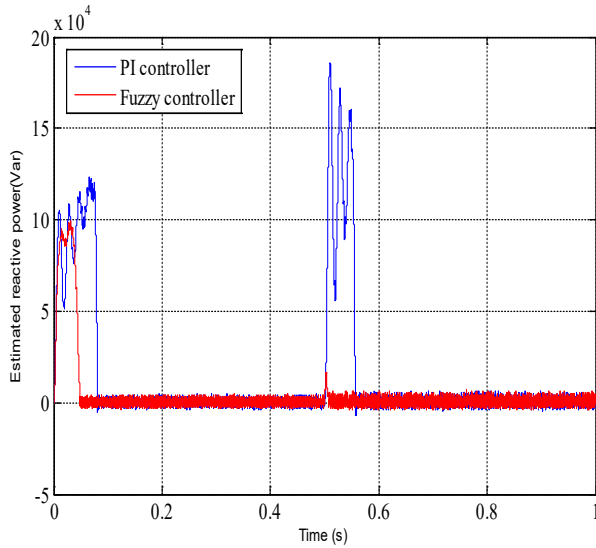


Fig.6. Estimated instantaneous reactive power

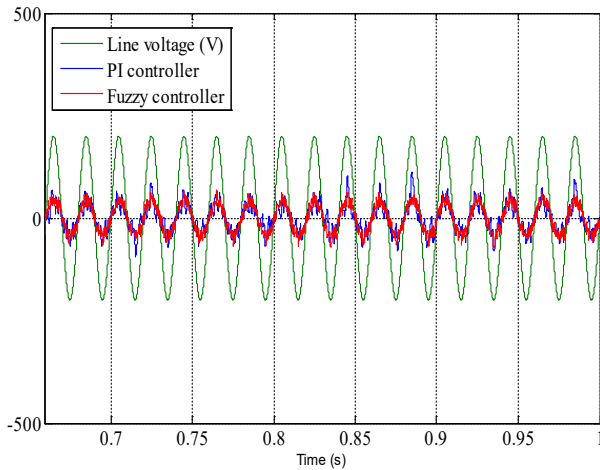


Fig.7. Line current in phase with line voltage after DC voltage step variation

## VI. CONCLUSION

In this article, we presented a new control strategy for a PWM rectifier. This involves using the principle of direct power control, reducing the number of sensors used, and providing a rapid power response following a disturbance. Two DC voltage control techniques were adopted in this study. All simulation results obtained showed that the fuzzy controller improves system performance compared to the PI controller. These improvements concern the system response performance on the DC side (overshoot and response time), as well as the power factor and THD of the line current.

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# SR CONGRESS



كتاب أبحاث المؤتمر العلمي الدولي الأول للعلوم والهندسة

1. ULUSLARARASI FEN VE MÜHENDİSLİK KONGRESİ KİTABI

1. INTERNATIONAL SCIENCE AND ENGINEERING CONGRESS BOOK



العلوم الهندسية

العلوم الصرفة

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