Introduction:
Importance of Environmental Biotechnology

- Among the various subfields within biotechnology, the one dealing with environmental problems which is called environmental biotechnology.
- Environmental biotechnologies are competing with great success against traditional techniques and are providing solution to acute environmental problems, managing, preserving and restoring the environmental quality.
- Biotechnological methodologies can be suitably, transformation of pollutants into harmless substances, generate biodegradable materials from renewable resources and develop ecofriendly manufacturing and disposal processes.

All these aspects come under the importance of environmental biotechnology.

Environmental biotechnology in a broad term that: refers to techniques that use biological system, living organisms, or derivatives for remediation of contaminated environment (land, water, and air). Produce beneficial products of human need, benefits in health care, and in the treatment of municipal, agriculture and industrial wastes.

Environmental biotechnology very relevant field dealing with:

- Developing techniques which would consume fewer resources include recycling and reuse of component and reduce production of wastes.
- Treatment of organic and inorganic wastes. This aims to minimization of pollution load in the environment, restoration environmental quality, using different biological processes.
- Application updated information of bioremediation technologies for removal of recalcitrant compounds resulted from municipal, agriculture and industrial effluents.
- Application of different preventive approach to industries leading to cleaner manufacturing technology.
- Immobilization of living organisms, bacteria, fungi, and algae and their use for organic and inorganic material removal from waste.
- Technology include the cleanup of water and land areas polluted with petroleum product through (genetically upgraded bacterial species), rehabilitation of polluted aquatic reservoirs and land areas fouled by pollutants, including toxic metals from industrial effluents.

- Environmental biotechnology has provided better understanding the concept of biomethylation of toxic metals, their effect and biomagnifications.

Biomethylation: formation of organo-metalic complexes in the environment due to microbial action and metabolism, such conversion of:
Hg (inorganic) → CH3-Hg (organic Hg in the body of the organisms) could be more toxic than the inorganic form of mercury.

Biomagnifications: In this process the concentration of some toxicants gets magnified several folds in organisms through the food chain than their concentration in the environment e.g. DDT concentration in the dolphins is several (1000) times more than in the sea water.
Pollutants → Phytoplankton and plant → Fishes → higher animals.
(DDT,Cd,Hg)

Important terms in Environmental Biotechnology

Adhesions: Microbial surface antigens, often in the form of filamentous pili or proteins that bind one cell to another.

Alkane: Referring to saturated hydrocarbons with carbon atoms in a chain without double bonds

Alkene: Referring to unsaturated hydrocarbons with carbon atoms in a chain containing double bonds between the carbon atoms.

Anoxygenic: Referring to activity that contributes to the anaerobic environment.

Assimilation: The incorporation of compounds into cellular materials.

Augmentation: With respect to bioremediation, the addition of desired bacteria to a bioreactor or to a contaminated site.

Bacteriophages: Viruses that attack bacteria.

Biodiesel: An extract of algal cells containing oils; suitable for use in engines.

Biofarming: The addition of contaminated soil to agricultural soil with the purpose of soil microorganisms mineralizing the organic contaminant.

Biofilm: Film containing microbial cells of diverse genera that are localized on a surface by extracellular matrix material.

Biofuel: A biological product (ethanol, methane, H_2, etc.) that can be used as an engines fuel.
Biogeochemical cycle: The path that a nutrient or element takes as it moves through the biosphere, hydrosphere, lithosphere, and atmosphere.

Biomineralization: The process by which microorganisms form mineral phases.

Biomining: The use of microorganisms to aid in the extraction and recovery of metals from ores.

Bioremediation: The application of microorganisms (or biological material) to detoxify organic substances or inorganic compounds.

Biosorption: Metablism-independent binding of metal ions or radionuclide species to cellular components.

Cellulose: A biopolymer that consists of several dozen chains of microfibrils where each chain of glucose is held by -1, 4-glucosidic bonds.

Chemoautotrophy: The process in which carbon dioxide is used as the source of carbon.

Chemolithotrophs: Microorganisms that couple electron flow to oxidation or reduction of inorganic materials.

Chemolithotrophy: The process in which inorganic compounds are oxidized to generate energy for organisms.

Chemoorganotrophs: Organisms that utilize organic compounds as their energy sources.

Compost: A process using aerobic microbial decomposition of plant material for the production of a soil conditioner.

Conjugation: The genetic exchange resulting from cell-cell contact; occurs in both prokaryotic and eukaryotic microorganisms.

Dehydrogenase: An enzyme that oxidizes molecules by transferring electrons to an electron carrier of NAD or cytochromes.

Denitrification: The conversion of nitrate to atmospheric nitrogen.

Dinitrogen: Atmospheric nitrogen, N_2.
Dissimilation: Activity leading to the conversion of an electron acceptor to a metabolic end product; not associated with incorporation of chemicals into cell biomass.
Dissimilatory reduction: In microbiology, the transfer of a large number of electrons to an electron acceptor with the consequence of producing a high quantity of product from respiration.

Dissimilatory sulfate reduction: The use of sulfate as the final electron acceptor by chemolithotrophic organisms with the production of H_2S.

Disturbance: An event that causes the death, displacement, or harm of or to individuals within a given population, community, or ecosystem; leads to opportunities for new individuals to replace them.

Extracellular polymeric matrix (EPM): Polysaccharide material surrounding bacterial cells along with other polymeric material.

Extremophiles: Organisms that live in and have adapted to extreme conditions of pH, temperature, or salinity.

Fermentation: An anaerobic metabolic process of bacteria and yeast resulting in the production of desired end products including ethanol and lactic acid.
Indigenous bacteria: Bacteria normally present in the environment.
Methanotroph; A microorganism that grows with methane as the electron donor.
nitrogen fixation: Also called **diazotrophy**; the process of reducing atmospheric nitrogen to ammonia, carried out by various bacteria and archaea in order to supply nitrogen for building proteins and nucleic acids.
Nitrogenase: The enzyme that converts atmospheric nitrogen to ammonia.
Rhizosphere: The area of soil surrounding plant roots.
Siderophores: Small organic compounds produced by bacteria or fungi; these compounds facilitate cellular uptake of $Fe^{3}+$.
Sludge: Solid material containing a high concentration of microorganisms, inorganic precipitates, and undigested organic solids.
Sorption: A term used to include adsorption and absorption; a process where chemicals moves from a soluble phase to an insoluble phase.
Xenobiotic: A chemical produced in the laboratory and not produced by any living system.