The preparation and assay of Aqueous Iodine Solution (Lugol's Solution)

- It contains 5% w/v ***Iodine*** (limits 4.75- 5.25% w/v) and 10% w/v ***Pot. Iodide*** (limits 9.5-10.5% w/v).
- Used in pre-operative treatment of thyrotoxicosis.
- **Preparation**:

I_2 50gm

KI 100gm

purified water sufficient to 1000ml

*Dissolve KI in a little amount of water then add the I_2 and shake well until the I_2 is completely dissolved, then add sufficient water to 1000ml using volumetric flask.

- **Assay:** Dilute 25ml of the original sol. to 100ml with distilled water, then:`

a) **Assay of I_2,**

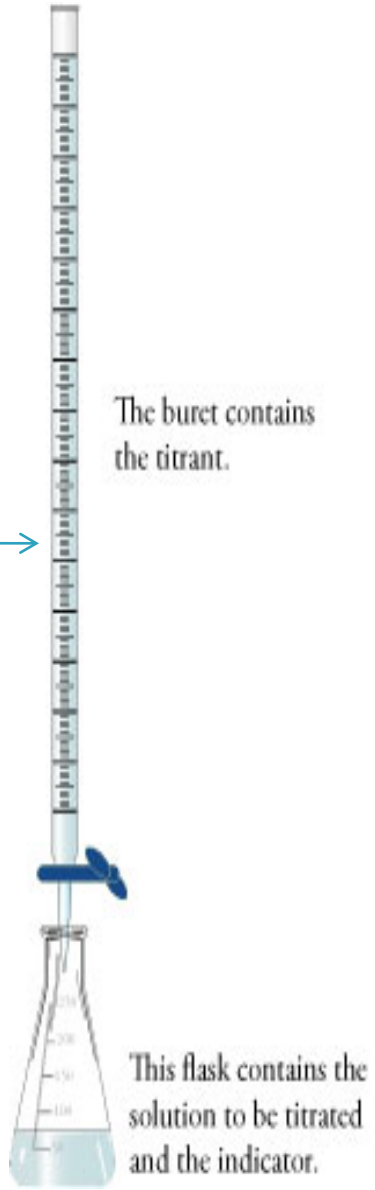
note: *we must use stoppered flask*

Each1ml of N/10 $Na_2S_2O_3$≡0.01269 gm I_2

≈ N/10 $Na_2S_2O_3$ →

dark brown, titrate → yellow then add 1ml starch the color change to dark blue complete tit. until the end point colorless

10ml of unknown
10ml D.W

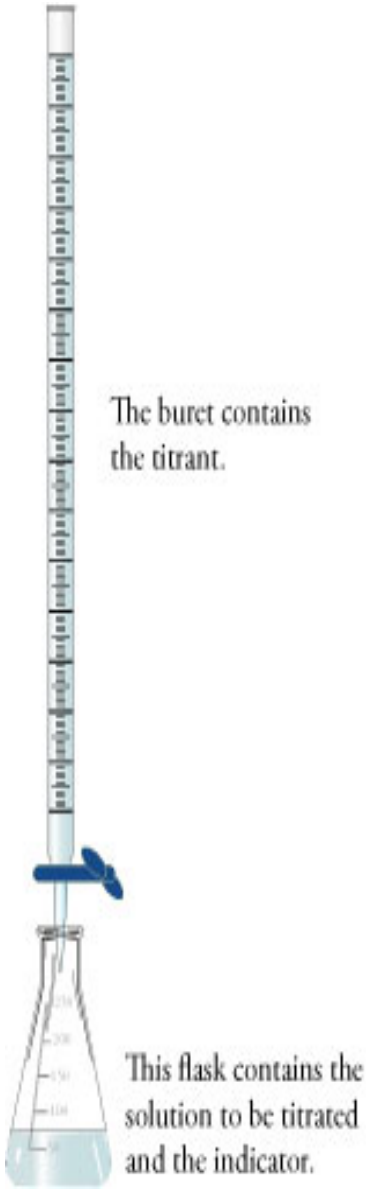


b) **Assay of KI,**

* *titrate with M/20 KIO_3 (Pot. Iodate) until dark brown sol. change to pale brown, add 1ml of amaranth sol.; the color of sol. Change to red and then continue tit. Until the color of sol. change to yellow –orange*

M/20 KIO_3 ⟶

5ml of unknown
10ml D.W
20ml conc. HCl



- From the no. of ml. of M/20 KIO_3 required subtract ¼ no. of ml of N/10 $Na_2S_2O_3$ required in the assay of I_2

  each 1ml of the remainder is≡ 0.0166gm of KI

- Chemical principle for I_2 assay:

  I_2 will oxidize chemically equivalent amount of sod. thiosulfate.

  $I_2 + 2Na_2S_2O_3 \longrightarrow 2NaI + Na_2S_4O_6$

- Chemical principle for KI assay:

  KIO_3 (pot. Iodate)is fairly strong oxidizing agent, it can quantitatively react with both iodide I^- and iodine I_2 .

*If the conc. of HCl not exceed 1N the reaction:

$KIO_3 + 5KI + 6HCl \longrightarrow 6KCl + 3I_2 + 3H_2O$

*In the presence of conc. HCl exceeding 4N, I2 produced by the previous reaction is further oxidized to iodine monochloride (ICl):

$KIO_3 + 2I_2 + 6HCl \longrightarrow KCl + 5ICl + 3H_2O$

* **<u>so</u>** the overall reaction between KIO_3 & KI in the presence of high conc. HCL >4N can be expressed by:

$KIO_3 + 2KI + 6HCl \longrightarrow 3KCl + 3ICl + 3H_2O$

The presence of high conc. HCl is required to decrease :

$HCl + ICl \longrightarrow ICl_2^- + H^+$

stable cpd

- In this experiment we use amaranth indicator, it is a dye, dyes which are destroyed or changed in the presence of oxidizing titrant can be use as indicator.
- We can not use starch as indicator because starch_ iodide complex can not be formed in high acid conc. used in the iodate titration.

- ***Chemical factor***: **<u>Homework</u>**

Each1ml of 0.1N $Na_2S_2O_3$≡0.01269gm of Iodine

Each1ml of M/20 KIO_3 ≡0.0166gm of KI

Each1ml of M/20 KIO_3 ≡0.02538gm of iodine

- **Calculation:**
- ***For I_2:***

original sol.	Vol.
25	100
X	10

X= 2.5ml of original sol.

V' x ch.fact. 0.01269x 100/2.5 = %w/v of iodine in orig. sol.
V' the corrected volume of sod. thiosulfate.

- ***For KI:***

original sol.	Vol.
25	100
X	5

X= 1.25ml of original sol.

$$V_{KIO_3\ M/20\ (\text{req. for KI})} = V_{KIO_3\ M/20\ (\text{used in the total assay})} - \frac{1}{4} V'_{Na_2S_2O_3\ o.1N}$$

Vol. of KIO_3 (req. for KI)x 0.0166 x 100/1.25= %w/v of KI

- It is preferred to use iodate (KIO_3) of known M rather than of known N, it depends on the nature of reaction.
- KIO_3 sol. used in the titration of sol. containing both iodide and iodine.
- The equivalent of KIO_3 in its reaction with KI differs from its equivalent when react with iodine.