Week6:

REDOX TITRATIONS WITH IODINE

**Introduction:**

**Titrations** that create or consume I2 are widely used in **quantitative analysis**.

Iodine is a moderately weak oxidizing agent; it is reduced to form the iodide anion, as follows:

I2(aq) + 2*e*. 2I- (aq)

The above redox reaction is completely reversible, and so the iodide anion is a moderately weak reducing agent that will react with oxidizing analytes to produce iodine.

**In *iodimetric titrations*,(**direct titration)

the analyte (a reducing agent) reacts with iodine to produce iodide:

*iodimetry* Aox + I2 Ared + 2I-

where Aox and Ared are the oxidized and reduced forms, respectively, of the analyte.

**conditions:**

neutral or mildly alkaline (pH = 8) to weakly acid solutions

**.If the pH is too alkaline** , I2 convert to Hypo iodate and Iodide

**If the solution is too acid** the starch used for the end point detection tend to hydrolyze or decompose in this medium

***iodometric (indirect titration)***

When an analyte that is an oxidizing agent is added to excess iodide to produce iodine, and the iodine produced is determined by titration with sodium thiosulfate, the method is called "iodometry".

Example:

***2 Cu 2+*** *+ 4****I****-* ***→ 2CuI + I2***

Then the iodine (I2) is usually titrated with standard **thiosulfate**

as follows:

2S2O3-2. + I2 S4O6-2. + 2I-

The iodine produced in this reaction is stoichiometrically related to the amount of analyte originally present in the sample.

The end point is detect with starch.

The disappearance of the blue starch-I2 complex color indicates the end of the titration.

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The reason for such timing:

Starch is added just before the end point( the color become pale yellow)

**because:**

**1**. iodine-starch complex is slowly dissociated.

**2**. starch has a tendency to hydrolyze in acid solution.

**Titration of Sodium thiosulfate (Na2S2O3) by Iodine( I2)**

2S2O32- + I2 → S4O62- + 2I-

**Procedure** :

1-Pipette 10 ml of Na2S2O3 to the conical flask.

2-Add 1ml of Starch indicator.

3-Titrate the solution By I2 solution and shaking till reach the blue color of the I2 –starch complex.

4-Calculate the concentration of the I2 solution

**Iodometric titration of copper.**

 Iodometric determination of copper is based on the oxidation of iodides to iodine by copper (II) ions, which get reduced to Cu+

For the best results reaction should take place in the slightly acidic solution (pH around 4-5),

To detect titration end point we will use a standard indicator for iodine titrations - starch. We start with a solution containing relatively high concentration of iodine, so indicator has to be added close to the end point.

**2 Cu 2+** + 4**I**- **→ 2CuI + I2**

**I2 + 2S2O32- → 2I- + S4O62-**

**Procedure:**

1-Pipette aliquot containing copper (II)(10ml) of CuSO4.5H2O into 250 ml conical flask with a glass stopper.

2-Add 20 ml of potassium Iodide10%.

3-Add 20ml of (2M) H2SO4 and dilute the solution by 20 ml distilled water.

4- Titrate the solution till reach the pale yellow color

5 -add 1ml of starch indicator.

6-Continue the titration until blue color disappears.

7 Calculate the Concentration of the CuSO4 .5H2O