Determination of Iodide/ chloride sample

1- Principle Fajan's Method

Adsorption indicator

Adsorption indicators are acidic or basic dyes which change their color upon adsorption on the ppt. at the equivalence point

Has color when non adsorbed ⟵ **Organic dye** ⟶ Has Another color when adsorbed on ppt

Types

Weak acid e.g. Eosin & Fluorscein

For example titration of halide sample by Ag^+ titrant

Weak base e.g. Rhodamine-6-G

For example titration of Ag^+ sample by halide as titrant

N.B

Fluorescein is used for all halides at pH 7- 9

Eosin (Tetra bromo Fluorescein) being stronger acid than fluorescein used at pH 2 for determination of iodide and bromide

For Successful use of adsorption indicator

PPt. must be ..

1) Colloidal → surface area increase → Adsorption increase
2) ppt strongly adsorb its own ion

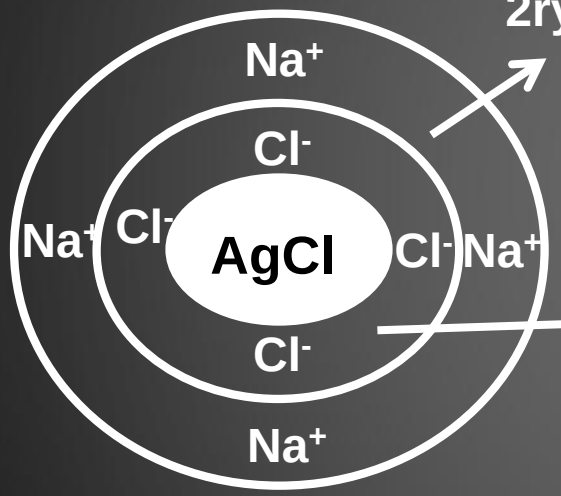
Indicator must be ..

1) Opposite in charge to titrant
2) Adsorption power not higher than the ion to be determined
   Adsorbed after complete pptn
3) Suitable concn of indicator to ppt after complete pptn of ions (not exceeding the ksp of its silver salt during the titration)

Medium must be ..

Suitable for ionization of indicator
- Acid indicator acts in alkaline media
- Basic indicator acts in acid media

For example:
Titration of NaCl sample with Std. $AgNO_3$ using adsorption indicator

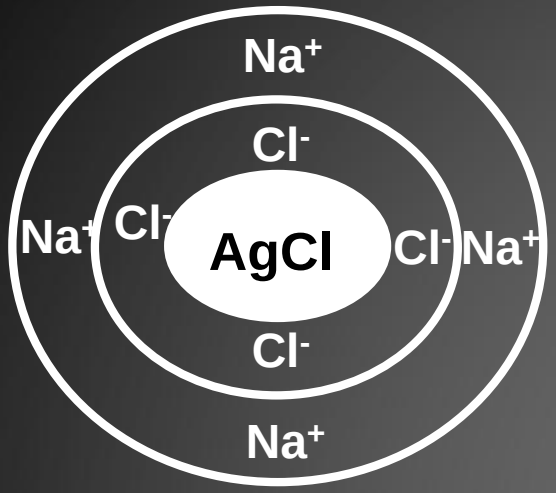


2ry adsorption layer Na^+
(counter ion)

1ry adsorption layer
(Cl^- excess in the medium)
(common ion)

Double electric layer (keeps particles in colloidal dispersed form)

Before end point



AgCl ppt & excess Cl^- is adsorbed to form 1ry Adsorption layer

↓ promotes

2ry adsorption of oppositely charged ion

↓ form

Double electric layer keeps the particles as colloidal ppt

At end point

$AgNO_3$ precipitate Cl^- in primary adsorption layer

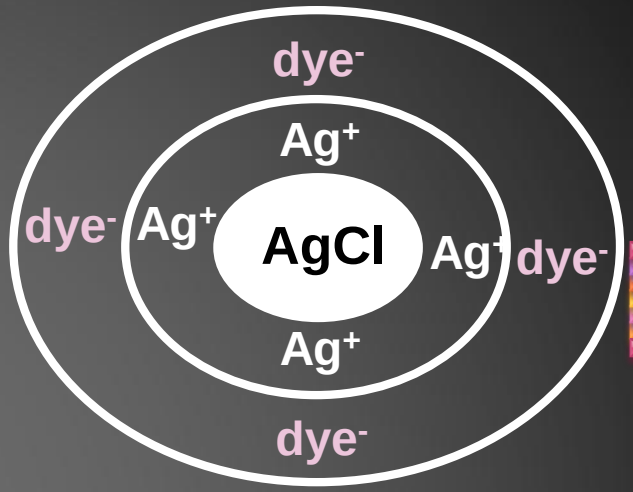
↓

destruction of double electric layer

↓

Flocculation starts

1st drop xss after end point



Ag^+ is Adsorbed on the ppt which promote 2ry adsorption either of NO_3^- or Acidic dye

Depending on the more electronegative & which form more stable insoluble salt

Eosin can NOT be used in determination of chloride .. Why?

Eosin is strongly adsorbed on AgCl ppt. and would replace some of the Cl^- before the end point in the primary adsorbed layer ⟶ giving earlier end point

Determination of Chloride/Iodide sample

Fajan's Method

This method involves the use of <u>adsorption indicator</u>.

At the end point first excess of $AgNO_3$ causes adsorption of indicator on the precipitate (colloidal) → change in color of the indicator

2- Procedure

I^- In Conical Flask

10 ml Sample + 5 dps Eosin + Titrate against $\frac{N}{40}$ $AgNO_3$

End point: Orange pink ⟶ Red Blue ppt

mls A

Total In Conical Flask

10 ml Sample + 10 dps Fluorescein + Titrate against $\frac{N}{40}$ $AgNO_3$

End point: From yellowish green ⟶ Pink Flocculates with relatively clear supernatant

mls B

Gentle shaking (rotation) during titration so as not to break double electric layer

To determine the color, look from above on white background

Avoid direct exposure of the flask to the light


250
200
150
100
500 ml

3- Calculation

$$\text{Concn. of } I^- = \frac{\text{mls}A \times F \times 1000}{10\ (sample\ volume)} = \text{g/L}$$

$1\text{ml}\ \frac{N}{40}\ AgNO_3 = 0.00415\ \text{g KI}$

$$\text{Concn. of } Cl^- = \frac{(\text{mls}B - mlsA) \times F \times 1000}{10\ (sample\ volume)} = \text{g/L}$$

$1\text{ml}\ \frac{N}{40}\ AgNO_3 = 0.00146\ \text{g NaCl}$