Estimation of chloride as silver chloride in a given solution

To estimate chloride as silver chloride in the given solution of sodium chloride or hydrochloric acid.

Principal: The estimation of a soluble chloride is carried out by precipitating it as silver chloride in the presence of nitric acid using silver solution as a precipitating agent.

$Cl^- + Ag^+ \rightarrow AgCl$

The white curdy precipitate of silver chloride is filtered, washed with dil. nitric acid, dried and weighed.
Solution: Prepare a solution by dissolving 4.9g or 6.53 g or 8.157 g of sodium chloride per litre. 25 ml of such a solution will yield 0.3, or 0.4 or 0.5 g of AgCl residue respectively.

Reagents.

(a) Precipitating reagent : It is 0.1 N $AgNO_3$ solution which is prepared by dissolving 4.22 g of silver nitrate (A.R.) in 250 ml of distilled water. (b) Washing solution : (i) One is 0.1N HNO_3 which is prepared by adding 3 ml of conc. nitric acid (A.R.) to 497 ml of water, making the total volume 500 ml (ii) Other is 0.01N HNO_3 which is prepared by adding 10 ml of 0.1N HNO_3 (prepared as above) to 90 ml water making the total volume as 100 ml.

Procedure

(i) Precipitation : Measure out 25 ml of the given solution in a 500 ml beaker. To this add 50 ml of distilled water and 1 ml of conc. nitric acid (A.R.). Warm the solution at 70^0C and add 0.1N silver nitrate solution slowly with vigorous, constant stirring *until precipitation is complete*. Avoid a large excess of silver nitrate and carry out all operations in *subdued light*. Now wrap the beaker with a thick brown paper. Keep the beaker on a water bath for few minutes until the ppt. settles down and the supernatant liquid becomes clear. Allow the solution to cool a little and test the supernant liquid with a little more silver nitrate solution to ensure that precipitation is complete. If a ppt. appears, add more silver nitrate till the supernatant liquid yields a ppt. Again heat the beaker to 70 – 80^0 C

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and stir constantly to coagulate the ppt. In case no ppt. appears, there is no need for adding excess of silver nitrate. After doing this test for complete precipitation, heat the beaker on a water bath. Cover the beaker with a watch glass and keep it about 25 minutes. Cool the beaker and keep it in dark for 1 hour to allow the ppt. to settle down.

(ii) Filtration and washing : Now transfer the supernatant liquid through a sintered glass crucible G – 3 previously cleaned, heated in an oven and weighed after cooling in a desiccator. Wash the ppt. by decantation 3 – 4 times with 0.1N HNO_3 and the transfer the ppt. from the beaker to the crucible using a policeman to remove any adhering ppt. from the sides of the beaker. Now wash the ppt. in the crucible by 0.1N HNO_3 until washings are free from Ag^+ ions (when few-drops of dil. HCl are added to 10 – 15 drops of the filtrate, no turbidity should appear). Finally, wash

the ppt. with cold distilled water twice to free it from NO^-
(iii) Drying and weighing : Dry the ppt. by keeping the crucible in an electric oven at 110 – 120^0C

for an hour. Allow the crucible to cool in a desiccator and weight it. Repeat the heating and cooling until constant weight is obtained.

Calculations

The constant weight of the crucible = a g
The constant weight of the crucible AgCl = b g
Weight of AgCl = (b – a) g
Now AgCl (143.34) = Cl^- (35.46) = NaCl (58.46)

Here Simple Calculation is : 143.34 g of AgCl = 35.46 g of chloride

(b–a)gofAgCl = 35.46/143.34x(b–a)g of chloride or 25 ml of the given solution contains

= 35.46/143.34 (b – a) g of chloride

Amount of Cl^- ion present in one liter of the solution

= 35.46/143.34 x(b – a)x1000/25
= 35.46 x(b – a) x40 / 143.34 g

Similarly, the strength of NaCl solution in g/liter of the solution
= 58.46 x(b – a) x 40 / 143.34 g