



Club Alchemy
Practical 1
Synthesis of Rayon via Cuprammonium Process

Name: _____ Class: _____ Date: _____

Theory

Tetraaminecopper(II) hydroxide $[\text{Cu}(\text{NH}_3)_4](\text{OH})_2$ is prepared by first reacting saturated copper(II) sulphate solution with concentrated aqueous ammonia to generate copper (II) hydroxide. On addition of excess aqueous ammonia to the copper (II) hydroxide, the complex will precipitate out.

Cellulose (found in filter paper) dissolves in the complex and is regenerated upon acidification as the polymer rayon. Rayon is insoluble in aqueous solutions and can then be precipitated out of solution.

Procedure

1. Place 25 cm³ of water into a conical flask. Warm the solution and add CuSO_4 while stirring until a saturated solution is formed.
2. With constant stirring, add concentrated aqueous NH_3 dropwise. Greenish-blue $\text{Cu}(\text{OH})_2$ starts to appear. Continue adding conc NH_3 to obtain maximum amount of $\text{Cu}(\text{OH})_2$. The supernatant solution should be pale blue. If a deep blue supernatant forms instead from too much conc NH_3 added, add dilute H_2SO_4 dropwise.
3. Weigh a piece of filter paper. Use it to filter off the $\text{Cu}(\text{OH})_2$ formed. Wash the residue and filter paper three times and discard the filtrate.
4. Place the filter paper and the residue in a 200 cm³ glass beaker. Add 20 cm³ of concentrated NH_3 . Stir the mixture until the paper is all dissolved. This takes about 15 to 30 minutes. If the resultant solution is too thick, you may need to add a little aqueous NH_3 .
5. Place some bench dilute sulphuric acid (2.00M) into a petri dish.
6. Carefully fill a 1 cm³ syringe with the blue solution from (4). Place the tip of the syringe beneath the surface of the acid in the petri dish and gently squirt the blue solution into the acid.
7. Observe the rayon thread for a few minutes. After it turns white, remove thread. Wash it several times and dry it by pressing between filter papers.
8. Repeat step 7 until the solution is used up. Find the mass of rayon obtained.

Questions

1. Write equations to show the reaction between aq CuSO_4 and aq NH_3 .
2. Why is cellulose soluble in the tetraaminecopper(II) hydroxide complex?
3. Why did the dark blue solution fade in colour when placed into a solution containing dilute sulphuric acid?
4. What similarities and differences can you predict about rayon and cellulose?