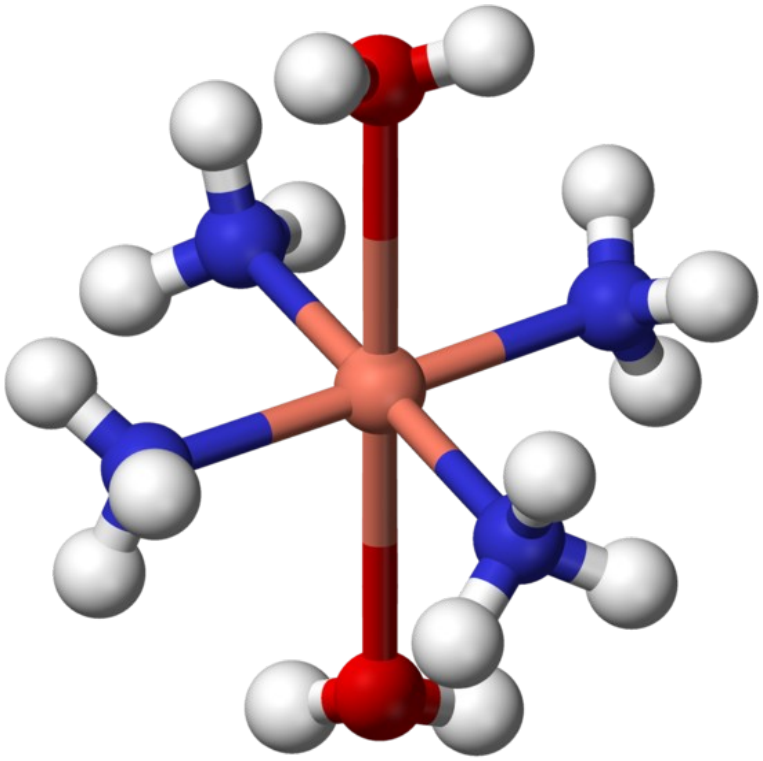
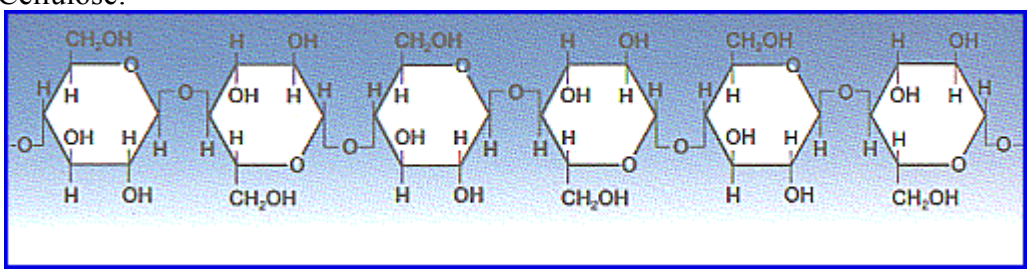
Synthesis of Schweizers Reagent then Precipitation of Rayon by Acidification
by Disulfideprotein

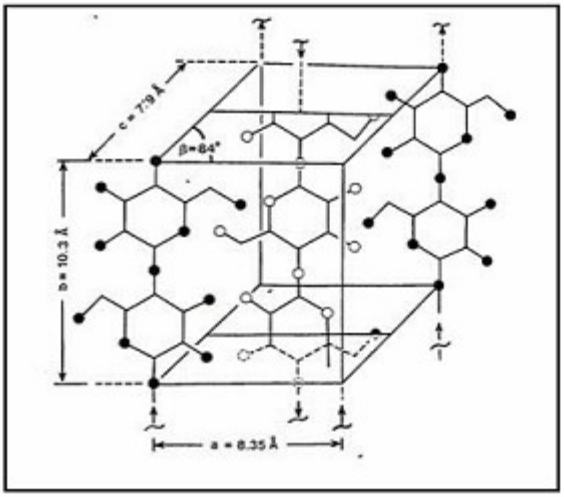
The synthesis of Schweizers reagent is interesting. To synthesize it you must be able to synthesize cupric hydroxide. Cupric hydroxide is usually formed by dissolving copper sulfate in water and then adding sodium hydroxide. The problem with this method is that it is quite sloppy and you must rinse and wash the cupric hydroxide because a black product also forms along with other contaminates. I found a different method of synthesizing Schweizers reagent using only copper sulfate and ammonium hydroxide. The use for this is a less time consuming easier done method of making Schweizers reagent. Why? Schweizers reagent is used in the process of making rayon (artificial fiber). Many home chemists could use the 3 step technique for synthesizing Schwiezers reagent but it is less time consuming and messy to just use the 2 step process. Now, as you might know Schwiezer reagent is: $[Cu(NH_3)_4(H_2O)_2](OH)_2$ **(Shown Above^).** The equation for this reaction is as follows: $CuSO_4 + 2\ NH_4OH = Cu(OH)_2 + (NH_4)_2SO_4$ then: $Cu(OH)_2 + 4\ NH_4OH = [Cu(NH_3)_4(H_2O)_2](OH)_2 + 2\ H_2O$ the great part about this reaction is that the ammonium sulfate does not interfere with the rest of the chemical reactions in making rayon or other fibers.



Now, why this is great for making rayon is because of the fact that cellulose is soluble in Schweizers reagent but can be regenerated by acidification of the solution. Cellulose is a sugar and has the chemical formula: C6H10O5. It is a polysaccharide and is a bunch of Beta D-Glucose linked together. We are incapable of metabolizing cellulose and derivatives of it such as rayon but we do produce it for clothing. It (rayon) is just the rearrangement of cellulose, they are chemically identical to each other. Cellulose:



Rayon: The only difference is the structure of the cellulose and in such we are not ever altering the formula of the cellulose.



Why does this work? Well because cellulose is insoluble in acidified conditions of this specific solvent. Here are the steps:

- Needed equipment: 2 beakers, a syringe or a pipet.
- Chemicals needed: Copper sulfate, ammonium hydroxide, hydrochloric acid.
- Stoichiometric amounts (first reaction): CuSO4: 159.610 g NH4OH: 70.0918g = Cu(OH)2: 97.5611 (NH4)2SO4: 132.1402 g
- Stoichiometric amounts (second reaction): Cu(OH)2: 97.5611 NH4OH: 140.1836g = [Cu(NH3)4(H2O)2](OH)2: 201.7139 g
- That in turn gives the theoretical yield for Schweizers reagent.

1. Measure out the stoichiometric amounts of each chemical needed for the first reaction.
2. Put the copper sulfate in one beaker and then add the NH4OH to the other.
3. Pour the ammonium hydroxide into the copper sulfate.
4. Stir vigorously for 2-5 minutes.
5. After that pour the stoichiometric amount of ammonium hydroxide needed for the second reaction in the beaker with the Cu(OH)2.
6. Stir if necessary.
7. There should be a very noticeable change in color.
8. Add water if needed.

Now onto the rayon:

1. Get toilet paper or another source of cellulose and dissolve it into the solution.
2. Take a syringe and fill it up with hydrochloric acid.
3. Put it into the cellulose solution
4. Keep adding until no more rayon precipitates.

Conclusion: Rayon precipitated out of the solution when it was acidified. It made fiber strands in the solution that could be gathered by filtration.

Sources:

- http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/C/Carbohydrates.html (for the second picture)
- Wikipedia.org (for the first picture)
- http://web.utk.edu/~mse/Textiles/Rayon%20fibers.htm (for the third picture)