Diazonium Dyes

Summary
A series of different colored dyes are formed.

Hazards
- Aniline Hydrochloride is highly toxic and a cancer suspect agent.
- b-Napthol is an irritant.
- Sodium nitrite is an oxidizer and toxic.

Chemicals and Solutions
- 1.5 g b-Naphthol dissolved in 200 mL 0.1M NaOH (heat to dissolve)
- 300 mL 0.1 M Aniline Hydrochloride
- Sodium Nitrite

Materials
- Ice
- 600 mL beaker
- Strips of cloth or lab jacket
- Paint brush
- Tray Tongs or forceps
- Newspapers
- Spatula
- Stirring rod

Procedure
1. Fill the 600 mL beaker about 3/4 full of ice.
2. Add 300 mL Aniline Hydrochloride solution to the beaker.
3. Make the diazonium salt by stirring in sodium nitrite until the solution starts looking yellowish.
4. Paint b-naphthol onto the piece of cloth.
5. Pour the diazonium salt solution into the tray.
6. Using tongs or forceps, immerse the painted cloth into the diazonium salt solution.
7. Hold the cloth up to show the orange design. (You may want to spread newspaper in order to catch any drips.)

Alternate procedure
1. Repeat steps 1-3 as above.
2. Pour in 200 mL b-naphthol. The solution will turn bright orange.
3. Dip cloth into the solution.

**Discussion**

Aniline Hydrochloride, a primary arylamine reacts with nitrous acid (from sodium nitrite) to give Benzenediazonium chloride. This salt is stable if kept below 5°C. (Above this temperature, it loses N₂ thus forming phenol.) Diazonium ions are weak electrophiles: they react with highly reactive aromatic compounds like phenol to yield azo compounds. This electrophilic aromatic substitution is called diazo coupling. In this demonstration b-naphthol undergoes electrophilic aromatic substitution by the benzenediazaonium chloride in alkaline solution. The coupling takes place at the ortho position of b-naphthol. The azo compound, o-(phenylazo)naphthol is intensely colored because the azo linkage brings two aromatic rings into conjugation. This gives an extended system of pi electrons and allows absorption of light in the visible region.