Synthesis of Azo Dyes

Methyl Orange

- The first step is simply an acid base reaction.
- In order to dissolve the sulfanilic acid in the aqueous solution we add sodium carbonate.
- Then we form the diazonium salt by the same mechanism.
- When we add the HCl, the nitroso ion is formed from sodium nitrite and this reacts with the amine to form a nitrosoammonium adduct that loses water under the acidic conditions after proton transfer.
- This gives the diazonium salt. Aromatic diazonium salts are stable at low temperature.
- The terminal nitrogen of the diazonium salt is very electron deficient.
- It can be attacked by good nucleophiles.
- We dissolve the dimethylaniline in acetic acid.
- This forms the dimethylaniline acetate salt.
- Neutralize this in situ and the dimethylaniline becomes a good nucleophile due to the activating effect of the dimethylamine substituent.
- Attack is in the para position due to hindrance at the ortho position by the bulky dimethylamine substituent.

Application of Methyl Orange

1. Fabric Test of Methyl Orange

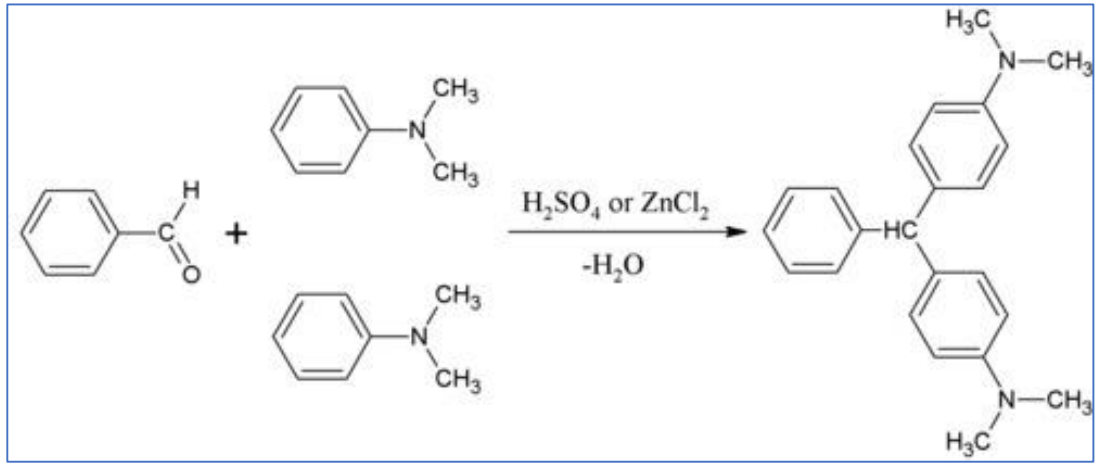
After treating Multifiber 43 cloth with a dye bath of methyl orange, 3 fabrics bound very strongly to the dye, producing a strong orange color: wool worsted, silk, and nylon 6.6. These fabrics are able to interact strongly with the polar sites of methyl orange because they have a high density of polar groups. All of the fabrics that bind strongly to methyl orange are polyamides. Cotton, which is cellulose, binds weakly to methyl orange while Creslan 61, which is polyacrylonitrile, does not bind to the dye. Polypropylene, a non-polar alkane polymer, does not bind to the polar dye. Poly acrylonitrile and SEF fire retardant (a copolymer made of mostly acrylonitrile) do not bind to the dye.

Acid-Base Properties of Dyes and Acid-Base Extraction

Many dyes have acid-base properties which can cause a change in color as pH changes. Many of these dyes are used as pH indicators for this reason. Depending on the pH, the dye may become protonated or deprotonated, which will give the molecule a charge. Charged organic molecules will be more soluble in an aqueous phase than an organic phase and vice versa for neutral molecules. To separate an organic acid, an organic base, and a neutral organic compound, an acid-base extraction can be used.

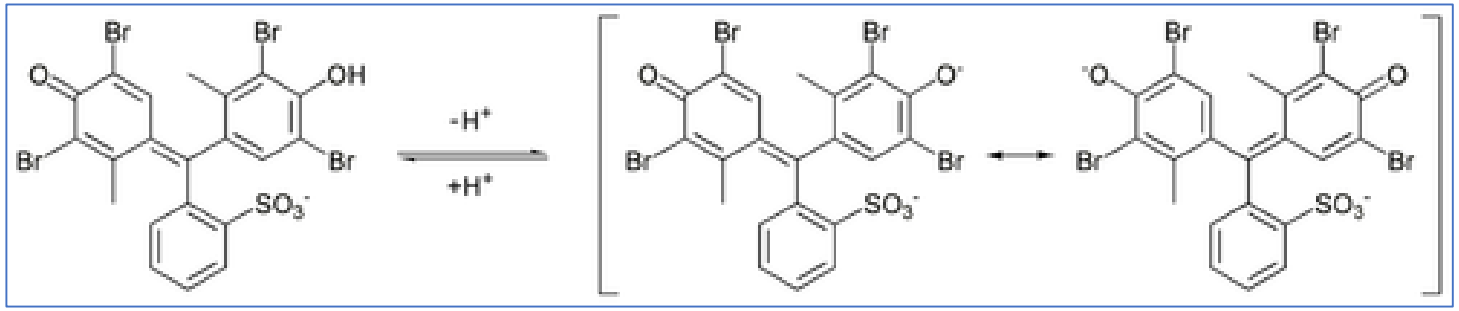
Triphenyl Methane dyes

The Friedel–Crafts alkylation reaction is a popular method to prepare triphenyl methane dyes:



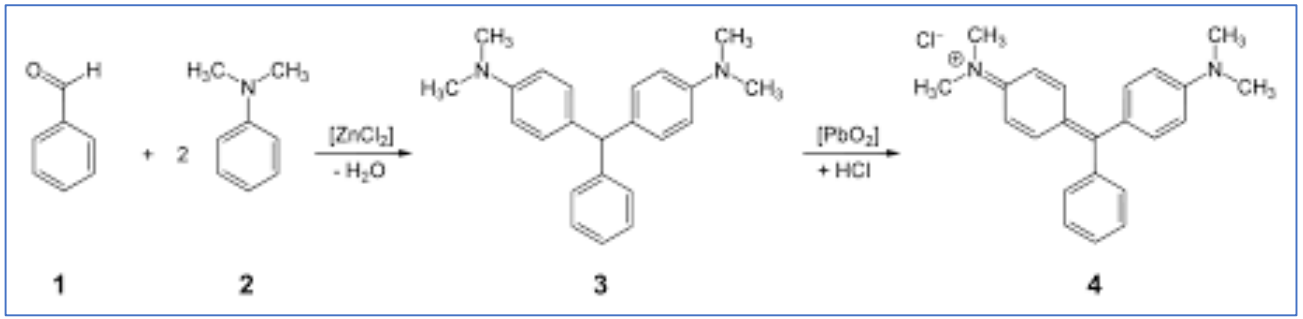
Application of Triphenyl Methane Dyes

In addition to their dominant use as dyes, many of these dyes react reversibly with acid and base, and thus serve as pH indicators



Malachite Green

The malachite green was prepared by condensing benzaldehyde and dimethylaniline in the molecular ratio 1:2 in the presence of sulfuric acid.



Application of Malachite Green

Malachite green is traditionally used as a dye. MG is active against the oomycete *Saprolegnia*, which infects fish eggs in commercial aquaculture, MG has been used to treat *Saprolegnia* and is used as an antibacterial. It is a very popular treatment against *Ichthyophthiriu_multifiliis* in freshwater aquaria. The principal metabolite, LMG, is found in fish treated with malachite green.

Synthesis of Rosaniline

It is prepared by the condensation of aniline and para-aminobenzaldehyde. Alternative it arises from the oxidation of 4,4'-bis(aminophenyl)methane in the presence of aniline.