



The synthesis of **malachite green** involves the condensation of **benzaldehyde** with **dimethylaniline** in the presence of an acid catalyst. This process is a Friedel-Crafts alkylation reaction.

## Reaction Steps:

### 1. Starting Materials:

- Benzaldehyde ( $C_6H_5CHO$ )
- Dimethylaniline ( $C_6H_5N(CH_3)_2$ )
- Acid catalyst (e.g., sulfuric acid or hydrochloric acid)

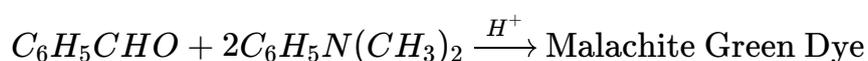
### 2. Mechanism:

- The carbonyl group of benzaldehyde undergoes protonation by the acid catalyst, making the carbonyl carbon more electrophilic.
- Dimethylaniline, acting as a nucleophile, attacks the electrophilic carbonyl carbon of benzaldehyde.
- This results in the formation of a condensation product.

### 3. Formation of the Dye:

- Through further reaction steps involving oxidation and coupling, the malachite green dye is formed.
- The product has a triarylmethane structure, which is responsible for its characteristic green color.

## Overall Reaction:



## Final Structure of Malachite Green:

The structure of malachite green includes a central carbon atom bonded to three aromatic rings, with one of the aromatic rings substituted with two methyl groups attached to the nitrogen atom. The dye is cationic, with a counterion (e.g., chloride) to balance the charge.

This method demonstrates the application of aromatic chemistry and electrophilic aromatic substitution in the synthesis of dyes.