

## Innovative Method to Reduce VAT Dyes Electrolytically

### Abstract

The objective: VAT dyeing is a process through which all insoluble commercial VAT dyes are taken up by cotton fibers in an alkaline or base-soluble form by reduction and made insoluble again through fixation by oxidation. In the case of the current experiment, indigo synthetic [ $C_{16}H_{10}N_{2}O_{2}$ ] is the example dye used.

When sodium hydrosulphite [ $Na_{2}S_{2}O_{4}$ ] is added to the solution of water, sodium hydroxide and indigo synthetic; and heated to a temperature of 75 degrees Celsius, indigo synthetic gets reduced to indoxyl [ $C_{16}H_{12}N_{2}O_{2}$ ], which is a highly unstable yellow compound.

When the cotton fabric is immersed in the indoxyl solution and exposed to air to dry, the yellow colorings in the fabric gets oxidized into indigo synthetic and turns blue. Here, handling sodium hydrosulphite (hydros) is injurious to health since a toxic smell involved during dyeing process seriously affects the health of the dyers by irritating their eyes, nose and skin.

Hence, it is thought worthwhile to study an electrolytic method for VAT dyeing; which is simple, economical, free from pollution and the costly handling of sodium hydrosulphite; during reduction.

### Methods/Materials

The experiment is setup in a H-Type electrolytic cell. Catholyte consists of 300mL of water; 5g of sodium hydroxide;

1g of sodium sulphate and 100mg of cerous sulfate as catalysts; and a lead sheet as cathode.

Anolyte consists of 40mL of water, 1.1mL of sulfuric acid and a lead sheet as anode.

The cell is heated to 75 degrees Celsius and 100mg of indigo synthetic is added.

A DC 12 volts power supply is taken; the positive alligator clip is connected to the anode while the negative alligator clip is connected to the cathode.

Hydrogen gas is released in the catholyte and indigo will get reduced to indoxyl.

## Results

As the electrolysis was allowed to run for 10 minutes, the catholyte barely changed color.

But when the experiment was continued for an hour, the catholyte had slightly turned green.

In order to save time, the catholyte was decanted and the sediments were found to be yellow in color.

When the sediments were allowed to dry and get oxidized, the color of sediments changed from yellow to blue.

## Conclusions/Discussion

Results show that an electrolytic method for reducing VAT dyes is indeed a very time consuming process but definitely a safe alternate method that actually works. In the years to come, this process will be further researched on how it can be sped up.

The project was to test whether or not electrolysis can reduce VAT dyes without the assistance of sodium hydrosulfite, which is the commercial toxic reducing agent used by VAT dyers.

## Bibliography

www.thechemistryguru.com