Case Study

Sulphur free reducer in liquid sulphur black dyeing

Substitution of Sodium Sulphide in sulphur black color dyeing of cotton fabrics, to reduce the amount of sulphide in mill's effluent

Industry

100 % cotton based composite textile mill

Company

Century Textiles and Industries was established in Bombay, India as early as in 1897. Its Textile division has an employment of 6500 workers per day and instrumentation includes 1,34,264 spindles, 2,124 rotors, 3,042 looms including 470 Air-jet looms and a full fledged process house. The company is the largest exporter of 100% cotton fabrics to various countries around the world. Present annual export amounts to US $ 72 million (80% of the total production) out of the total turnover of US $ 100 million (1991-92). Product range includes 100% cotton yarn and fabrics. The Mill was adjudged as ***International Textile Mill of 1990*** by ***Textile Horizon*** of Textile Institute, Manchester, UK.

Background

Black dye is an important member of sulphur series, on account of excellent washing fastness and good light fastness. Besides, it is fairly cheap among the synthetic dyes.

Sulphur dyes, like vat dyes, are water insoluble compounds and have to be converted into water soluble substantive form (viz. leuco form) before application to textile materials. Traditional method of this conversion is a treatment with aqueous solution of sodium sulphide. This application however contributes to 'sulphide' in the mills effluent. On ac-

count of its toxicity to the receiving water bodies, the State Pollution Control Board prescribes a limit of 2 ppm (maximum) for sulphide in the treated effluent of the mills.

Clean Technology

To achieve the above stipulated limits, a critical study of available methods of sulphur black color dyeing and the treatment options was made. It was thought that it would be better to substitute sodium sulphide by other suitable reducing agent which does not contribute to sulphide in the effluent, instead of providing extra treatment to achieve the stipulated limit. Thus, the idea of reducing the sulphide concentration by chemical substitution was carefully explored.

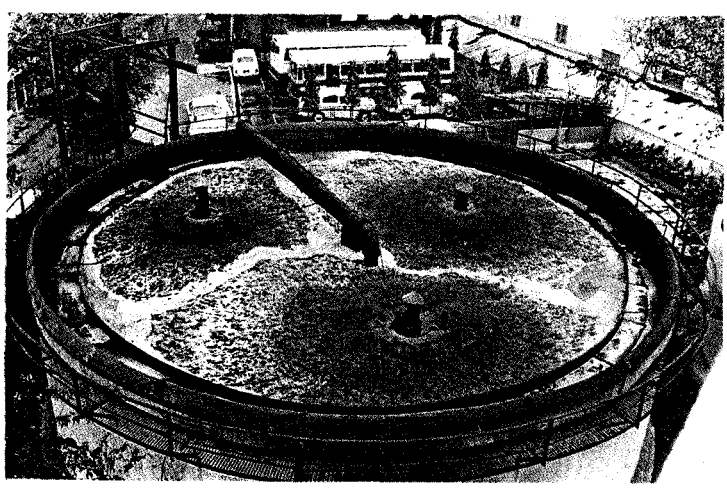
During these studies, it was observed that the alkaline solution of glucose can bring about satisfactory reduction of sulphur colors and thus could be considered as potential substitute for sodium sulphide. However, high cost of glucose became the main constraint in practical application.

As a next step, a market survey was conducted for procuring an equivalent chemical at a competitive price. This lead to identification of a 'hydrol'; a by-product of a maize starch industry, which contained about 50% of reducing sugars. Further, experiments revealed that 100 parts of sodium sulphide can be substituted by 65 parts of this substitute plus 25 parts of caustic soda.

Above substitution was gradually implemented by carefully designing the mixing strategy of alkaline solution of this hydrol in the jigger trough. The dyeings obtained after this substitution were observed to be equivalent to conventional dyeings in depth of shades, fastness properties etc. In addition, an improved quality of the dyed fabric was observed in terms of reduction in its bronziness. This process is in use since April, 1990 and has resulted in the reduction in the sulphide concentration of the effluent from 30 ppm to less than 2 ppm. The above substitution however resulted in slight increase in the BOD load on the plant but this increase was found not at all critical and was easily manageable in the existing biological treatment system.

Advantages

After this substitution, in addition to reduction of sulphide in the effluent, which was a statutory requirement, settling characteristics in the secondary settling tank of the activated sludge unit were found to be improved. The reduced sulphide levels in the effluent were expected to result in less corrosion of the treatment plant equipment as well.



In addition, foul smell of sulphide in the work place (dyeing department and effluent treatment plant) was eliminated. The material requirements of the identified hydrol (plus caustic) were found to be only a one third of the corresponding sodium sulphide liquid. This re-

sulted in less process floor storage and handling. Importantly, no capital expenditure was involved in this substitution and in fact the operating costs were found to be marginally lower.

Economic Benefits

Capital Expenditure	:	Nil.
Operating Costs	:	No increase.

By employing this substitution the company saved about US $ 20,000 towards cost of sulphide removal unit by precipitation with US $ 30,000/year operating cost.

Further, substitute chemical used was essentially a waste stream (now as a by-product) from a maize starch industry thus alleviating its waste treatment problems. Presently, Century Textiles and Industries Ltd. purchase about 11 tons of this chemical from a local maize starch unit on a monthly averaged basis. This adds the benefit to the maize starch unit of saving US $ 12,000 towards the capital cost of 11 ton starch bearing effluent to meet the sewer discharge standard of BOD 150 mg/l with US $ 2,400/year as operating cost.

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Cleaner Production promotion activities worldwide and news from our members

ATI Special Issue on Industry and Environment

The leading American textile journal America's Textiles International which claims the largest worldwide circulation has dedicated its March 1992 issue to the theme of ***The Industry and the Environment*** which has an explicit emphasis on Waste Minimization and Cleaner Production. Apart from various articles on Legislation, Textiles Effluent Treatment and Cleaner Production activities in Textile Industry an excellent article by one of our members Prof. Dr. Brent Smith titled ***Source Reduction : Alternative to Waste Treatment*** is the highlight of the issue.

Environmentally safe preservative for size mix and finishing formulations.

Sizing of warp yarn is carried out for increasing the strength and resilience to ensure lesser warp-breaks and higher productivity. As such woven fabric is susceptible to bacterial and fungal attack on storage. Preservatives form an essential part of sizing recipes. The commonly used preservative pentachlorophenol (PCP) has been recently included in the Red List of banned chemicals for fabrics exported to EC countries. Hence, there is urgent need for an economically efficient substitute for PCP, formaldehyde and other toxic products.

The Navdeep Research Center has been able to develop two such preservatives — Navdeecide D-12 and D-13. These are free from toxic chemicals and active at low concentration of 1% on the weight of adhesive.

Laboratory trials showed more than one month stability for pastes of adhesives (e.g. Starch, CMC, Gums) with 1% Navdeecide D-12 and sized yarn showed no middle growth

Useful reports and bibliographic references on cleaner production in textile industry

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toxic constituents in color.

- ❑ Environmental training and technology demonstration programs tailored to Thai Textile Industry.

In response to the cooperative effort between industry and the government, FTI proposed new environmental standards to MOI on July 28, 1992. This proposal included a mixture of environmental regulations, voluntary measures and a balance between pollution prevention, waste minimization and pollution control. As a result of the success of this collaborative program, the MOI issued new environmental standards based on the industry proposal by September 12, 1992.

The program has also assisted implementation of a demonstration project of Cleaner Production equipment in a manner that will assist Thai Textile Mills. Presently, FTI is conducting two such Cleaner Production Demonstration Projects. Another ongoing demonstration project includes low cost pollution prevention and waste minimization audit at one textile dyeing and finishing mill.

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