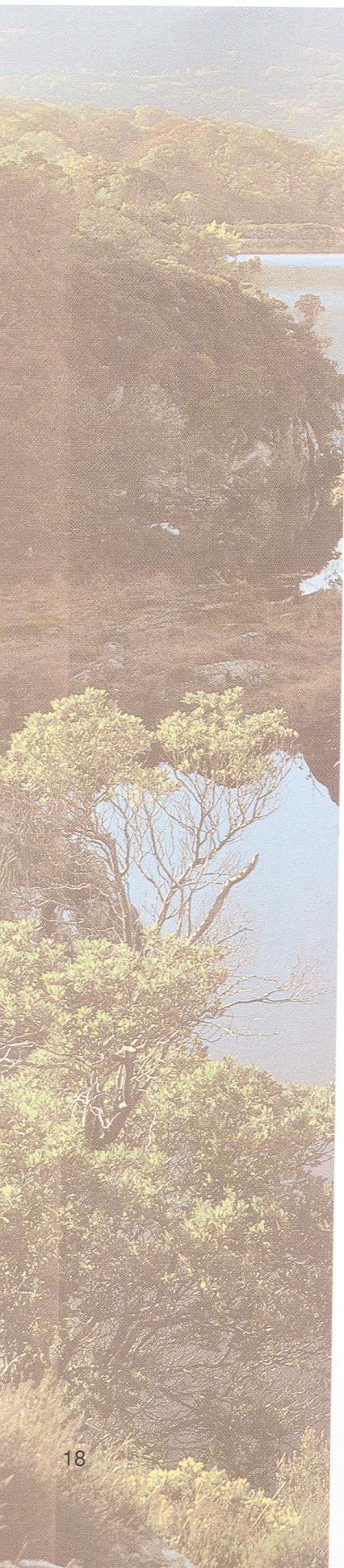


Reduction of Sulphide in Effluent from Sulphur Black Dyeing



Background

Sulphur dyes are an important range of dyes yielding a range of deep colours, but they cause a pollution problem due to the traditional reducing agent used with them. The black sulphur dye has excellent washing fastness, good light fastness and is relatively cheap.

Sulphur dyes are water insoluble compounds that have first to be converted into a water soluble form and then into a reduced form having an affinity for the fibre to be dyed.

In the diagram representing the chemical equations involved, D represents the part of the molecular structure of the dye that produces the colour. The original dye (**1**) is dissolved in an alkaline solution of caustic soda or sodium carbonate. The dye (**2**) is then reduced to the affinity form (**3**). After dyeing the fabric the dye is converted back into the insoluble form (**1**) by an oxidation process. This last reaction prevents washing out of the dye from the fabric.

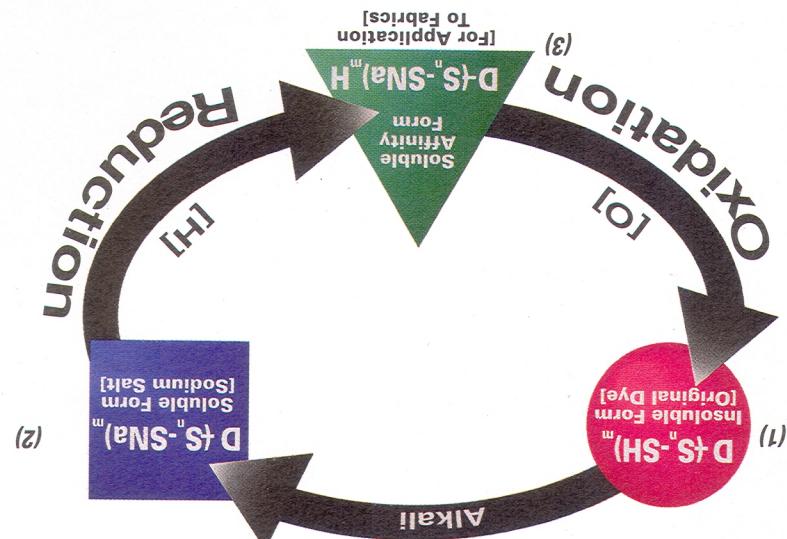
The traditional method of taking the original dye to the affinity form is treatment with an aqueous solution of highly polluting sodium sulphide. This causes an increase in the sulphide content of the mill's effluent. On account of its toxicity the State Pollution Control Board prescribes a limit of 2 ppm for sulphide in the treated effluent.

Economic Benefits

No capital expenditure was involved in this substitution and in fact the operating costs were found to be marginally lower. The saving in not having to install additional effluent treatment facilities was about US\$20,000 in capital expenses and about US\$3,000 in running expenses per annum. The substitution has not incurred any additional operating costs and there has been a considerable but unquantified saving in money and convenience due to the reduction in handling and storage.

The substitute chemical used was essentially a waste stream from the Maize Starch industry, which saved them an estimated US\$12,000 in capital expenses with running costs at about US\$1,800 per annum.





THE DIFFERENT FORMS OF SULPHUR DYE

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Company Century Textiles and Industries Limited was established in Bombay, India in 1987. Its Textile Division employs 7,000 workers. The Company manufactures 100% cotton yarn and fabrics and is the world's largest exporter of 100% cotton fabrics. The turnover of the textile division for the year 1991-92 was US\$9.75m, with 80% of its production being exported. The company has won many national and international awards for export performance and energy conservation.

Textiles
Industry
Country India

Theoretic underrstanding of the chemistry involved and a search for suitable reagents.

delayed product. The process has been in use since April 1990 and has resulted in the reduction in sulphide concentration of the effluent from 30 ppm to less than 2 ppm. The substitution of oxygen demand (BOD) load on the plant but this increase was found not to be critical and was easily manageable with the existing biological treatment system.

A study of the available methods of sulphur black colour dyeing and the treatment options was made. An investigation was also made into an alternative to sodium sulphide. It was found that an alkaline solution of glucose could bring about satisfactory conversion of sulphur dyes. However, the high cost of glucose was the main constraint in practice.

A market survey was conducted for procuring an equivalent chemical at a competitive price. This lead to the identification of a by-product of the maize starch industry, hydrol, which contained about 50% of reducing sugars. Experiments revealed that 100 parts of sodium sulphide could be substituted by 65 parts of this alternative plus 25 parts of caustic soda. The dissolving agent obtained after this substitution were seen to be equivalent to conventional dyehells in depth of shades, fastness properties, etc., plus there were some other improvements in the quality of the dyed fabric.

With a redesigned mixing strategy, The dyehells with the substitution with hydrol was implemented. The substitution with hydrol was implemented at the single stage.