ELECTROCHEMICAL CHARACTERIZATION OF INDIGO/LEUCOINDIGO

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Indigo is known to be mostly used vat dye agent for various textile industries, especially in denim applications. Its application involves three consecutive steps; reduction, dyeing and oxidation. It must be reduced to leucoindigo before being applied to textile product, since the affinity against cellulose fibre could only be provided in its reduced form [1]. In conventional applications, the reduction is achieved with sodium dithionite (Na₂S₂O₅) in highly alkaline aqueous solutions [2]. Also the solubility of oxidized indigo is extremely low that it cannot be transported through the fibres, if it is not reduced properly. In the last stage, re-oxidation of leucoindigo on textile fabric is achieved by a simple aeration process. The oxygen present in the air can easily provide the oxidation, in the mean time the dye pigment is fixed inside the fibres.

The redox behaviour of indigo

The use of sodium dithionite is pronounced to be harmful for environment, since the dyeing process involves the use of huge amount of water. Once, the waste water is discharged to surrounding, the residues of this salt constitute an important issue for consideration [3]. On the other hand, during the dyeing process, the products of oxidation gives rise some problems about the quality of dyeing. Therefore, alternative methods have been studied for reduction and dyeing process. In this study, the reduction of indigo was achieved with an electrochemical process (in alkaline solution, under cathodic constant potential) which does not involve any additional chemical. The employed electrochemical design and technique is novel, when compared to similar methods (also patents) present for electrochemical reduction of indigo. Also, the amount of leuco indigo was analyzed with cyclic voltammetry. This is another important point of consideration, since it could allow monitoring the concentration of leucoindigo in situ conditions. The research studies are a part of ongoing TEYDEB Project (No:3100420) with BOSSA Denim & Sportswear Research and Development Center. In this paper, the cyclic voltammetry studies subjecting the analysis of leuco indigo concentration are presented.

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References