Chapter I

Introduction

Waste water discharged from dyeing industries contains many dyestuffs which cause highly colored, resulting from wastage and washing during dyeing and printing process. The degree of coloring is varied dependent on the color/shade depth of dyeing and the type of dye used. Water-insoluble dyes (e.g. disperse and vat dyes) generally exhibit good exhaustion properties (i.e. most of the dye is bonded to the fiber) and can be removed from the effluent by physical means such as flocculation[1]. When this effluent is discharged to a conventional sewage treatment works, most of the color is removed by adsorption to the biomass[1]. However, since the introduction of water-soluble dyes, e.g. reactive dyes, conventional biological treatment processes are no longer able to achieve adequate color removal.

Reactive dyes are colored molecules capable of forming a covalent bond between the dye molecule and the fiber, and they are used to dye cellulose fibers. The reactive dyes react with ionized hydroxyl groups on the cellulose substrate. However, hydroxyl ions present in the dye bath due to the alkaline dyeing conditions compete with the cellulose substrate, resulting in a percentage of hydrolyzed dyes which can no longer react with the fiber. Thus between 10 and 50% of the initial dye load will be present in the dye bath effluent[1], giving rise to highly colored effluent which is difficult to treat due to the water-soluble nature of the hydrolyzed dyes.

In addition, high electrolyte concentrations in dye bath discharges are undesirable, as increased salinity in rivers upsets the delicate balance of aquatic flora and fauna[2]. Sodium chloride is commonly used as an electrolyte, but the alternative sodium sulfate is even more suspect, as it attacks concrete pipes, and also has been associated with increased acidity of waterways.

To improve the efficiency of dye uptake of cellulose fibers, three main areas might be considered; upgrading the dyeing machinery, selecting the dyestuffs having distinct properties such as high degree of fixation and low amount of salt consumption, and modifying the cellulose fibers. Focusing on the last aspect, the modification of cellulose to improve dyeability is an interesting approach in this study to dye modified

fibers with the reactive dye without requirement of salts. There are several possible modifying agents that could modify cellulose fibers significantly to enhance dyeability. The general characteristic of those compounds is that they contain the quaternary ammonium group that plays an important role in promoting dye absorption. The fixation of these compounds to cellulose usually can be achieved by either alkali assisted covalent bonding in the case of low molecular weight compounds or in-situ polymerization in the case of cationic reactive polymers. Even though the dye uptake by the modified fibers is greatly enhanced in the absence of dyeing auxiliaries, this process is still proven to be unpopular due to an additional production process leading to high energy and water consumption. In addition, in some cases the dyeing properties of modified fabric particularly the fastness to light is reduced.

Modification of cotton fabric during bleaching in order to improve dyeability of cotton could be achieved without the requirement of additional process is the main objective of this research work. [3(Methacryloylamino)propyl]trimethyl ammonium chloride (MAPTAC), the cationic based vinyl monomer, is employed as the modifying agent which is fixed onto cellulose via graft co-polymerization mechanism using persulfate as a redox initiator.

The co-application of modifying agent and hydrogen peroxide bleaching agent onto scoured cotton fabric during preparation process in the presence of sodium hydroxide will be studied. The bleaching performance of hydrogen peroxide and the optimum fixation of modifying agent on cellulose in the single bath process are then investigated. Characterization of modified fabric is carried out using elemental analysis technique to determine nitrogen content. The dyeing properties including color strength, the degree of dye fixation and color fastness to light will be evaluated and compared to those obtained from the conventional dyeing of unmodified cotton fabric in the presence of salt.