ABSTRACT

The removal of colour from effluent after dyeing of cellulosic fibres is a major problem due to the difficulty in treating such effluents by conventional treatment methods. Cellulosic fibres of a specific shade (colour) are produced by reacting the fibres with a mixture of reactive dyestuffs, salt and auxiliary chemicals. Reactive dye exhaustion to the fibre is about 80% i.e. 20% remains in the effluent; this is hydrolysed dye which cannot be reused for dyeing. The exhausted reactive dye bath together with first rinse represents 6 to 30 L effluent/kg of fabric and most of the colour and salt. The total water consumption for reactive dyeing ranges from 25 to 100 L effluent/kg fabric while the water consumption from total textile finishing ranges from 30 to 150 L effluent/kg fabric. Thus the concentration of the dye and salts are 5 times more concentrated when obtained at source.

The use of activated carbon adsorption for the removal of colour from exhausted dyebath for the re-use of water, salt and energy has been studied. Four different commercial reactive dye chemistries and associated auxiliaries were tested and commercial activated carbon was used as an adsorbent. Different temperatures (20˚C to 100˚C), pH values (acidic, neutral, basic) and salt concentrations (50 g/L to 100 g/L) were evaluated and the high adsorption results were achieved when using high temperature, low pH (acidic) and high salt concentrations. The Freundlich adsorption parameters were obtained for activated carbon adsorption capacity and adsorption bond strength between reactive dyes and activated carbon. The overall removal of the reactive dye shades was 36% to 53% (based on colour in the effluent), salt recovery was about 94% to 97%, the water recovery ranged from 14% to 25% and energy savings of 17% to 32% could be achieved. Column adsorption test were performed at different temperatures and flowrates. The saturated activated carbon was regenerated and repeatedly used by elution with 1.0 M NaOH. The regenerated carbon was found to be effective up to 3 cycles of operations. A column system for treatment of reactive dyes using activated carbon was designed. The outcome of this study showed that treatment of reactive dyebath with activated carbon adsorption technique can allow re-use of water, salt and energy, thus enabling environmental improvements with a savings in salt, energy, water and treatment costs.