Chapter 6
Dyeing Processing Technology: Waste Effluent Generated From Dyeing and Textile Industries and Its Impact on Sustainable Environment

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ABSTRACT

Among the different substances containing organic compounds, dyes are considered the most important class, and they are now an essential requirement in the modern world, mostly in the textile industries. In addition to the textile colouring, they are used in automobile, leather, paints, paper industries, etc., but their importance in the textile industries is maximum. Because of huge demand of dye, the production of a variety of dyes with advanced properties has drastically increased. Since dyes are complex aromatic organic compounds containing conjugated double bonds, they are highly toxic to the biological community of the world. In this chapter, more emphasis is given for synthesis technologies of various kinds of dyes, different kinds of hazardous pollutants generated from the dyeing industries, and their environmental impact along with the implementation of the technology developed to reduce the pollutant and its effect to our sustainable environment. Hence, more focus has to be given for manufacturing and application of dyes from renewable natural resources.

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INTRODUCTION

The chemical substances or the materials which are fastness to water, light, heat, moisture, dilute acids, alkalis and used for imparting colour in the materials like paper, textiles, lather etc. is known as dye. The dyes may be natural or synthetic which mostly dispersed in the liquid phase and produces paints, inks or it may be blended with other materials and enhances the colour and beauty of the manufactured products. Dyes are mainly organic aromatic complex compounds, whereas the pigments are organic or inorganic compounds, but both are given bright colour when imparted on any materials or textiles simultaneously. Dyes and colours both are different in natures. The colour is not resistant to acids, alkalis sunlight, water and all other environmental factors and is directly related to the structure of the molecules of the dye. The colour imparted by dyes is due to the following reasons.

- Due to absorption of visible light in the range of 400-700 nm
- It contains chromophore groups within its molecules, which are the colour imparting groups.
- Contains alternate single and double bond with the conjugated system in its molecular structure
- The stabilization of the dye is due to resonance within the aromatic ring of the molecule of the dye i.e. the migration of conjugated electrons will occur within the alternating single and double bond. If any of the features among these is not found, then the dye losses its property of imparting colour. Most of the dyes contain chromophores along with another group known as auxochrome, which has the property of enhancing the efficiency of auxochrome.(L.A. Thi et. al. 2018)

**Examples:** The groups like carboxylic, sulphonic, hydroxyl etc. are not responsible for imparting colour but if it is present in the molecule of the dye it can influence imparted colour i.e. shifting of the colour of the colorant present in the dye.

The organic aromatic conjugated systems of dyes contain chromospheres; the azo groups present in it are mostly responsible for yellow to orange colour due to bathochromic shift, which explains the extent of conjugation with the aromatic ring structure. Now-a-days people of the world are facing a great problem of rapid environmental degradation and the time may come in which the whole biological world will be destroyed. The major processing technology in textile industries is the fibre processing and dyeing and it requires large amounts of water for this purpose. During dyeing more than 50% of water along with the unused dye are generated in the form of effluent discharge. The coloured waste water discharged from the textile industries are of varying composition and the toxicity effect is also different and
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