Chapter 2
Prospective Sustainability of Utilization of Effective Techniques for Remediation of Heavy Metals From Textile Effluents

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ABSTRACT

Textile industries are one of the prevalent water consumers and contaminators ensuing high generation of waste water. Wastewater from dyeing and printing units is often rich in organic compounds, colours, and heavy metals containing residues of various dyes and chemicals. Among these waste water pollutants, heavy metals are of serious environmental concern in recent years. Metals are extensively used for manufacture of synthetic dyestuffs and for colouration of natural dyes on textiles to achieve different shades and hues. Heavy metals such as lead (Pb), chromium (Cr), cadmium (Cd), iron (Fe), zinc (Zn), copper (Cu), etc. are widely used for production of colour pigments of textile dyes. These heavy metals, highly toxic, get conveyed to the environment, and can bio-accumulate in the human body, aquatic life, natural water-bodies, and also possibly become trapped in the soil. The chapter deals with the utilization of heavy metals in textile wet processing, their important characteristics, various toxic aspects, and different methods for their elimination from the textile effluent liquors.

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INTRODUCTION

A vital role is played by the textile industry not only in the day-to-day activities of human beings but also in the world economy. The textile industries have been categorized as one of the major consumer of water (up to 150 L of water to dye 1 kg of cotton) and is also the nastiest delinquents of pollution contributors since more than 2000 types of chemicals and over 7000 types of synthetic dyestuffs are being consumed by these industries (Nemerow, 1978; Ghoreishi and Haghighi, 2003; Hai et al., 2006). Among various textile production processes, the chemical wet processing of textiles consumes relatively large amount of water. The textile chemical wet processing industries, particularly printing and dyeing industries, have expanded rapidly in recent years. Their effluents are discharged either directly (mostly untreated/partially treated) or along with domestic wastewater. Apart from enormous heat evolved from the discharged liquors and high pH value, the textile wastewater is often saturated with a mixture of colourants (dyes and pigments) containing carcinogenic amines, de-foamers, chlorine bleaching agents, halogen carriers, detergents, optical brighteners, free formaldehyde, biocides, fire retardants, softeners, equalizers and various organic compounds used as cleaning solvents, plasticizers, etc. (Correia et al., 1994). It also contains high concentrations of toxic heavy metals, total dissolved solids, and possess high chemical and biological oxygen demand. Sediments, suspended and dissolved solids are important depositories for noxious dyes and heavy metals, instigating rapid depletion of dissolved oxygen and leading to oxygen sag in the receiving water (Ali et al., 2008).

Environmental pollution is one of the major and most important problems of the modern world. Among the various textile wastewater pollutants, heavy metals are of serious environmental concern in the recent years. This is because of their toxicity, bio-accumulation and bio-concentration in the living organisms. Also, their persistence in the environment and non-biodegradable nature has intensified its concern. The treated and untreated wastewater effluent from textiles processing units contain toxic metals as well as metal chelates; and among the chemical pollutants, heavy metals, being non-biodegradable, can be concentrated along the food chain, producing their toxic effects at points after far removal from the source of pollution. “Heavy metal” is demarcated as any metallic element that has a comparatively high density and is toxic or poisonous at even low concentrations. They are naturally occurring elements of the Earth’s crust, present in varying concentrations in all ecosystems, and they cannot be degraded or destroyed. There is a huge number of heavy metals, found in elemental form as well as variety of other chemical compounds; each form or compound has different characteristics. Stimulatingly, minor amounts of these elements are common in our environment and nutrition and are fundamentally desirable for good health. It has been testified