Chapter 27
Demethylation of Arsenic and Nickel From Tannery Effluent

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ABSTRACT

The tanning Industry is considered to be a major source of pollution and tannery wastewater in particular is a potential environmental concern. Wastewaters produced by tanneries contain high concentration of inorganic and organic pollutant. The pollutants of concern within the tanning industry include Azodyes, Cadmium compounds, Cobalt, Copper, Antimony, Barium, Lead, Selenium, Mercury, Zinc, Arsenic, Polychlorinated Biphyenls (PCB), Nickel, Formaldehyde resins, and Pesticides residues. Because tannery wastewater contains a complexity of pollutants including chromium and chlorinated phenols as indicated earlier, it is vital to dissect the toxic nature of such wastewater both to understand its environmental impacts and identify potential remediation strategies. Furthermore, there are strict regulations imposed for the environmental control of pollutants such as heavy metals and persistent organic pollutants. In this chapter, the authors discuss the demethylation process of Arsenic and Nickel from Tannery Effluent.

INTRODUCTION

The setback of environmental pollution on report of vital industrial growth in practical requisites is the problem of disposal of industrial wastes in the form of solid, liquid, or gas. These forms are responsible for ultimately polluting water. The polluted water indeed affects the soil of industrial areas along with the fertile agricultural soils. In addition to these effects, secondary pollution is also prominent by mixing with the ground water. Industries are the one of the main cause of environmental pollution. The major of quantity and type of pollutants released into the environment depends on the type of industry. The effluent discharged from the industries cause severe metal pollution in the environmental. Most of the metals released into the environment cause severe risk to the human and animal's health. Many

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metals including arsenic, copper, mercury, chromium, cadmium, aluminium, nickel, zinc, and uranium affects the environment. These metals impose severe concerns to the organisms due to their persistence, biomagnification and bioaccumulation in food chain. So to avoid these effects, prior treatment of industrial waste is necessary. The exposure to these metals affects the health of an organism by retarding the development and growth, organ damage, neurological damages, cancer and at higher concentration may leads to death. The exposure to mercury leads to minamata syndrome. In addition to this, mercury and lead causes autoimmune disease along with kidneys, circulatory system (Barregård et al., 1999; Barsoum, 2006; Soderland et al., 2010).

The release of industrial effluents containing soluble or insoluble compounds into the ground water, streams, ponds, rivers, and oceans leads to cause primary and secondary water pollution (Akcil & Koldas, 2006; Gupta et al., 2012). However, the released pollutants are either removed or transformed to the less harmful compound by microbial approach termed as 'bioremediation'. Biotransformation is an enzymatic process which includes oxidation, reduction, methylation or demethylation of highly toxic pollutants. The microbes involved in maintaining the biogeochemical cycle of arsenic by demethylation process include *Candida humicola, Mycobacterium neoaurum, Bacillus sp.* etc. Most of the water pollution in the developing countries occurs because of the poor management of wastes generated in huge quantity due to many anthropogenic activities (Giusti, 2009; Goel, 2006).

ENVIRONMENTAL POLLUTION AND ITS EFFECTS

Globally environmental pollution is now days a big challenge, due to the usage of huge amount of chemicals and discharge of untreated industrial effluents into the water bodies. Heavy metals which are used in the various industries or produced as by-products like mining industries becoming the major challenge due to their persistent nature in the environment (Duruibe et al., 2007; Khan et al., 2008).

Water Pollution and Toxic Heavy Metals

Effluents from chromium-based industries are mostly becoming source of pollution of ground water and surface water creating the scarcity of safe drinking water in most of the countries (Gadgil, 1998; Urbansky & Schock, 1999). In the developing countries like India, most of the rural and urban areas utilize ground water as the first priority. However, since 2-3 decades, the safety of drinking water has been affected due to the untreated discharge of wastewater containing toxic heavy metals from the industries (Chatterjee et al., 1995; Chowdhury et al., 2000). Globally, effluents from tannery and metal plating industries containing chromium metal pose severe cause of pollution of water (Akbal & Camcı, 2011; Owlad et al., 2009). Wastewaters containing heavy metals are hazardous to the nature which indeed affects organism's habitats. Bioremediation treatment of wastewaters by using microorganism or in consortium can be applied to remove the hazardous metals. Bioremediation approach can be used without affecting environment over the conventional process. Bioremediation of chromium is vital, because it is released from many industries and also it is present in various forms of oxidation states. Cr (III) is naturally available in the environment which acts as a vital nutrient element to organisms; however Cr (VI) acts as a carcinogen to humans in addition to kidney and liver damages. So to prevent these effects, Cr (VI) must be significantly converted to Cr (III) (Lytle et al., 1998; Zhitkovich, 2005).