Short communication

Flame Atomic Absorption Spectrometric Analysis of Toxic Metals in Tannery Effluents: Effects on Buriganga River

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Abstract

Metals such as nickel (Ni), cadmium (Cd), cobalt (Co), copper (Cu), zinc (Zn), lead (Pb) and potassium (K) are considered essential in trace amounts in water whereas they become harmful or toxic above a certain concentration. Inappropriate treatment of industry effluents e.g. tannery effluents is a major contributor to such water pollution. In the present study, tannery effluents were collected from three different polluted sites of the river Buriganga, Dhaka, and ground water in dry and rainy seasons. The elemental analysis of the samples was conducted using Flame Atomic Absorption Spectrophotometer (FAAS). The concentrations of Ni, Cd, Co, Cu, Zn, Pb and K of tannery effluents were found in the range of 0.08-0.77, 0.98-1.42, 0.11-9.75, 0.75-0.82, 0.006-0.54, 0.05-0.85 and 1.42-21.24 ppm respectively. Concentrations of most of the elements in the water samples were higher than the WHO standards and DoE standards for effluent treatment plants. The concentrations of different metals were varied with the seasons. The dry season had significantly higher contamination loads, which were decreased during the monsoon season. Anthropogenic activities, as well as the variation in river water flow during different seasons were the main reasons for this high degree of water pollution.

Keywords: Flame atomic absorption spectrophotometer, elemental analysis, WHO, DoE

1. Introduction

In developing countries, industrial economy is rapidly increasing while Bangladesh is in a rising trend gradually. In Bangladesh, water pollution is on the rise with new industries are being built. Water has been used much as a recipient of toxic and solid waste from industry.

Water pollution by heavy metals due to human activities is causing serious ecological problems in many regions of the world. Metals which are discharged into natural water increased concentrations in sewage, industrial effluents or from mining operations can have severe toxicological effects on humans and aquatic ecosystems. Heavy metals are essential for all biological systems but their deficiency or excess could lead to a number of disorders [1]. In densely populated and industrialized countries, disposal of waste materials containing heavy metals presents an ever increasing problem. Effluents discharged from the textile and tannery contain a higher amount of metals especially Chromium (Cr), Copper (Cu) and Cadmium (Cd). These effluents released on the land as well as dumped in to the surface water which ultimately leach to ground water and lead to contamination due to accumulation of toxic metallic component sand resulted in a series of well documented problems in living beings because they cannot be completely degraded [2]. Hence, industrial effluents cause a wide-range of environmental problems and health hazards and that becoming more complex and critical not only in developing countries like Bangladesh but also in developed countries.

Tanneries, oldest industries in Bangladesh are mostly situated at the south western area of Dhaka city named Hazaribagh. This area and also the whole capital are being mainly contaminated with the untreated effluent ejected by the tanneries [3]. Specially, the water of the river Buriganga which is beside the area is being polluted adversely. Recently the area has been included at the list of top 10 most polluted places of the world [4]. The tanneries of Hazaribagh dump huge industrial wastes which are not treated simply by usual way [5]. Industrial development results in the generation of industrial effluents, if untreated, cause water, sediment and soil pollution [6]. Farmers are mainly interested in general benefits, such as increased agricultural production, low cost water source, effective way of effluent disposal, source of nutrients etc and are mostly unaware of the harmful effects of heavy metals contamination of soil, crops and their related environmental implication. Researchers have proven that industrial effluents contaminate soil to such an extent that it becomes toxic to plants and detrimental to health [7]. Studies on heavy metals in rivers, lakes, fish and sediments have been a major environmental focus especially in the last decade [8, 9]. At present the underground water is also unsafe for drinking purposes because of heavy metal contamination.

The need for the present study emerged from the results of the previous works [10]. These investigations showed that industrial effluents and wastes lead to environmental pollution around Hazaribagh area, Dhaka, Bangladesh. Heavy metals like Ni, Cd, Co, Cu, Zn, Pb and K are toxic for plants aquatic life as well as humans when it exceeds its permissible limits [11]. These metals, even in trace amounts, interfere with or inactivate enzymes of living cells. Therefore their discharge into the environment must be minimized and carefully controlled [12].

2. Materials and Methods

2. 1 Samples and Sampling Sites

Water samples were collected from a tannery industry

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