Paper 06
Heavy Metal Contamination in Kelani River

Jayalal L. P. R. Wijesinghe
National Water Supply & Drainage Board, Ratmalana, Sri Lanka

Pathmalal M. Manage,
Department of Zoology, University of Sri Jayewardenepura, Gangodawila, Sri Lanka

INTRODUCTION

The National Water Supply & Drainage Board, Regional Support Centre of Western production distributes 1.0 million m^3 of water per day to Greater Colombo area and suburbs using Labugama, Kalatuwawa, Kadana, Kethhena, Biyagama and Ambatale purification plants. The Kelani River provides raw water to Ambatale and Biyagama purification plant for the supplying of almost 75% of the demand in the Greater Colombo area and suburbs. The river originates from the central hill country of the island and flows in a predominately westerly directions through industrial area until it reaches the sea at the northern limits of the city of Colombo.

Water pollution in the Kelani River derives from two main sources, industrial and domestic effluents enter the river directly from factories and houses located near its banks and indirectly from industries and human settlements located on waterways and canals which drain into the river. The effect of pollution on river water, quality depends on the amount and concentration of the pollutants, river discharge, tidal condition, water flow in the river, dilution of the effluents from industries and other factors. The protection of water quality in Kelani River has thus become a major issue. Although many parameters can be used to describe the water quality, the most significant for the Kelani River is heavy metals resulting from large volume of sewerage and industrial effluent from Biyagama Industrial Zone and also from Kelaniya area of Sri Lanka due to the presence of many industrial complexes in those regions.

MATERIALS AND METHODS

Water Sampling and Metal Analysis

Four water samples were collected from Ambatale water intake each month for a period of four years, using cleaned acid-washed plastic bottles and acidified with concentrated nitric acid to reduce pH<2.0. Flame Atomic Absorption Spectrometer GBC 905 (GBC Scientific Equipment Pvt. Ltd. Australia) AA model was used to measure heavy metals at Central Laboratory, National Water supply and Drainage Board. Lead (Pb), Cadmium (Cd), Chromium (Cr), Zinc (Zn), Manganese (Mn) and Copper (Cu) concentrations were measured.

RESULTS AND DISCUSSIONS

High Pb levels were detected throughout the study and the concentrations exceeded with the chemical requirement for potable water. On average, the measured Pb levels in year 2001, 2002, 2003 and 2004 were 0.080 mg/dm^3, 0.266 mg/dm^3, 0.155 mg/dm3 and 0.080 mg/dm^3 respectively. The Pb concentration range recorded in the study was high even for the recommended inland water sources used for drinking water supply.

Mean total Mn in year 2001, 2002, 2003 and 2004 were 0.08 mg/dm^3 and 0.086 mg/dm^3 0.056 mg/dm3 and 0.149 mg/dm3 respectively. Cd concentrations also exceeded the potable water standards (Cd - 0.005 mg/dm^3) during the study period. Low concentrations of Zn, Cu and Cr were detected and values have remained within the Sri Lankan standards for drinking water quality. As we are aware, most of the heavy metals are toxic to animal and they can concentrate via bio-accumulation and bio-concentration. Heavy metals can be removed from water as insoluble metal hydroxides at the proper pH conditions. Most of the heavy metals can be treated with the combination of coagulation sedimentation and filtration. Providing optimum pH condition for each metal is not practical as a water treatment procedure. Thus, providing a safe drinking water is a challenge with environmental pollution as most of the metals can bio-accumulate through food chain via fish and plants. Also it may be possible to ingest them directly by consumption of contaminated water which may lead to create chronic toxicity conditions.

REFERENCES

Specification for potable water part 1: Physical & Chemical requirement SLS 614: Part 1:1983.

Gunawardhana, H.D., Analytical aspects of Environmental Chemistry., CARD., Department of Chemistry, Universiy of Colombo, p.171

Sri Lanka Standard Tolerance Limits for Inland surface waters used as raw water for public water supply SLS 722: 1985.

Arnoold, E., Greenberg, R., Rhodes Trussell., Lenores, S., Clesceri., Standard Methods for the Examination of water and wastewater – 1985, 16 th Edition APPPH, AWWA, WPCF.

GBC Scientific equipment Flame Methods Manual for Atomic absorption by GBC scientific equipment PVT Ltd.