

Title: ICP-MS Determination of Potentially Toxic Trace Elements in Little Akaki River of Addis Ababa, Ethiopia". Journal of Environmental Toxicology, Communicated.

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Abstract

In this study, river water samples taken from 26 different locations in along the route of the river of Addis Ababa, were analyzed to determine potentially toxic trace elements (Fe, Co, Cd, Hg, Pb, Zn, Sb, Cu, Ba, B, As, Ni, Sr, Cr, Mn and V) using ICP-MS. The concentrations in $\mu\text{g L}^{-1}$ ranged between for Mn 38-3950, Fe 175-4800, B 0.5-6135, Sr 92-465, Ba 55.5-280, Cr 1.25-485, Sb 9.45-66.5, Zn 8.35-77.5, Ni 2.85-14, Cu 2.1-11.55, V 1.5-10.9, Pb 1.15-11.35, Co 0.5-8.85, As 0.5-3.05, Cd 0.03-0.12 and Hg <0.05. Overall decreasing metal concentration order was Mn > Fe > B > Sr > Ba > Cr > Sb > Zn > Ni > Cu > V > Pb > Co > As > Cd > Hg. Besides analytical analysis spatial relationships related to these metal elements were also examined. A strong positive correlation is generally observed between Cu-Pb, Cu-Zn, Zn-Fe, Cu-Cd, Cd-Fe, Cd-Pb, Pb-Zn, Cu-Fe, Co-Fe, Co-Pb, Ni-Zn, Fe-Pb and Mn-Ba. The concentrations of Cr, Mn, Sb, B and Pb exceeded the permissible limits of the Ethiopian, European Community and WHO for drinking water quality guidelines. Fe and Sr exceed the permissible limits of the Ethiopian drinking water guideline and Sr exceeds permitted by WHO. The concentration of Cr, Zn, Cu and Pb exceed the annual average thresholds for surface waters set in SI 272 of 2009 EQS guideline. The concentration of Cr, Mn and Sr were also higher concentration than the international guidelines value for irrigation. Both natural and anthropogenic sources were found to be contributing to the pollution load of the river with the anthropogenic activities dominating the influence. The pollution of the river water is increasing alarmingly and that it has created serious threat to human health. It is, thus, necessary to take serious and essential measures from the concerned bodies. Adoption of adequate measures to remove the heavy metal load from the industrial waste water and renovation of sewage treatment plants are suggested to avoid further deterioration of the river water quality.

Keywords: ICP-MS, river water, potential toxic elements, drinking water standard

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