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Analysis of elemental profiles in selected industrial effluents reaching Kelani River using inductively coupled plasma spectrometry

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As industrial effluents are complex mixtures with a multitude of chemical substances, chemical characterization is difficult especially when raw materials are unknown. The present study was undertaken to investigate the trace elemental profiles of selected industrial effluents reaching the Kelani River basin, the largest industrial waste recipient of Sri Lanka. The tested samples included treated effluents collected from two textile industries, three rubber based industries, two multiple industrial complexes and two water treatment plants along with the source water and, distribution water for drinking purposes and upper stream water collected from Hatton / Nallathanniya area in August 2012. Digested effluent and water samples were analyzed for 28 elements including the elements not covered under the national environmental (protection and quality) regulations using inductively coupled plasma atomic emission spectroscopy (excluding arsenic, mercury and selenium) and inductively coupled plasma mass spectroscopy (excluding boron, phosphorous, sodium, sulfur and potassium) following standard procedures. Variations of element profile of the effluent samples were as follows: aluminum, 0.06-438 mg/L; antimony, 0.04 – 2.7 µg/L; arsenic, < 0.04 – 7 µg/L; barium, 0.011 – 1029 mg/L; boron, < 0.02 – 245 µg/L; cadmium, 0.1 – 1.1 µg/L; calcium, 7 – 47 mg/L; chromium, 3.2 – 332 µg/L; cobalt, <0.23 – 134 µg/L; copper, 2 – 371 µg/L; iron, 0.2 – 409 mg/L; lead, 1 – 340 µg/L; magnesium, 1 – 25 mg/L; manganese, 12 – 7834 µg/L; molybdenum, < 0.1 – 1.5 µg/L; mercury, < 0.07 – 1.3 µg/L; nickel, 2 – 61 µg/L; phosphorous, 0.7 – 32 mg/L; potassium, 2 – 133 mg/L; selenium, < 0.25 – 17 µg/L; sodium, 5 – 353 mg/L; sulfur, 1 – 189 mg/L; silicon, 2 – 88 mg/L; strontium, 9 – 211 µg/L; stannous, 0.04 – 2.7 µg/L; titanium, < 0.01 – 3.4 mg/L; vanadium, 1 – 675 µg/L and zinc, 48 – 978 µg/L. Except for arsenic, antimony, boron, cadmium, cobalt, mercury, molybdenum, phosphorous, selenium, and titanium, all the tested elements were detected in the upper stream water. Overall, in most of the tested effluents and water samples, the measured levels were within the specified tolerance limits of elements covered under the national environmental (protection and quality) regulations.

Keywords: Element profile, ICP-OES, ICP-MS, industrial effluents, Kelani River

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