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Hydrogeochemical Assessment of Metals Contamination in an Urban Drainage System: A Case Study of Osogbo Township, SW-Nigeria

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ABSTRACT

With increasing urban population, attention had been focused on environmental degradation of urban drain-age system with respect to trace/heavy metal contaminations. Such concerns underlie the ever-increasing impacts of urbanization and industrial activities on urban watershed in the developing regions of the world, especially in areas with inadequate land-use plan and poor waste disposal and management practices. Hence, this study highlights the hydrogeochemical assessment of surface water and bottom-sediment samples from an urban drainage system in Osogbo Township, SW-Nigeria with respect to trace metals contaminations. The results show that the surface water samples have generally low TDS with average value of 362mg/l, while the average dissolved concentrations of the trace metals (Cu, Pb, Zn, Ni, As and Cr) vary from 0.01 to 0.5mg/l. Cu, Cr and As exhibit concentrations similar to the local background concentrations (LBC) in the pristine stream water with low single metal contamination factor (CF ≈ 1). Pb, Zn and Ni are 5 folds enriched with contamination factor (CF) of >5 indicating moderate to high contamination. For the sediment phase, the adsorbed concentrations of the trace metals (Cu, Pb, Zn, Ni, As, Cr and Co) vary between 0.1 to 3.1mg/kg. These represent about 1 to 3% of the respective total metal concentrations with average values of 18.2 – 533.4mg/kg. Also low anthropogenic factor, AF (0.002 to 0.08) and mostly negative values (–5 to –15) of Mueller' s geo-accumulation index (Igeo) for adsorbed metal contents in the sediments suggest dominant geo-genic controls. However, the total metals concentrations in the sediment phase have high estimated AF of 1.1 to 9.3 and positive values of the estimated Igeo (0.9 – 2.0) and metal contamination index (MCI) of 2.5 – 8.3. All these suggest a medium to high level enrichment (of 2 to 10 factor) for most of the metals with respect to the local background concentration (LBC) in the basement bedrock units (with the exception of Cr and Ni). This is consistent with the preferential metal enrichment in the sediment phase as indicated by the estimated parti-tioning/distribution coefficient, Kd of >1 exhibited by the total metal concentrations in the stream sediment. Nonetheless, the correlated high peaks of electrical conductivity of the stream water samples and adsorbed concentrations of some trace metals within the urban stretches are indications of point source inputs of un-treated sewage into the drainage system.

KEYWORDS

Urban Drainage System, Heavy Metals Contamination, Bioavailability, Water Quality, Stream Sediments

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