Comparative Geochemical Evaluation of Toxic Metals Pollution and Bacterial Communities of Industrial Effluent Tributary and a Receiving Estuary in Nigeria

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Abstract

Toxic metals/metalloid contaminations of estuarine sediments due to compromised tributaries arouse significant interest in studying bacterial community that triggersnatural attenuation processes. Geo-accumulation index (I_{geo}), contamination factor (CF), pollution load index (PLI), and Hakanson potential ecological risk index (RI) as a sum of risk factors (Er) were used to quantify toxic metal/metalloid-pollution status of Lagos Lagoon (2W) and 'Iya-Alaro' tributary (4W) sediments in comparison with pristine 'Lekki Conservation Centre' sediment (L1-B). Bacteriology of the ecosystems was based on culture-independent analyses using pyrosequencing. 2W and 4W were extremely contaminated with mercury ($I_{geo} > 7$), whereas, cadmium contamination was only observed in 4W. The two ecosystems were polluted with toxic metal based on PLI, where mercury (Er = 2900 and 1900 for 4W and 2W, respectively) posed very high ecological risks. Molecular fingerprinting revealed that Proteobacteria, Firmicutes, and Acidobacteria predominately contributed the 20 most abundant genera in the two ecosystems. The 240 and 310 species present in 2W and 4W, respectively, but absent in L1-B, thrive under the metal concentrations in the polluted hydrosphere. Whereas, the 58,000 species missing in 2W and 4W but found in L1-B would serve as indicators for systems impacted with metal eco-toxicity. Despite toxic metal pollution of the ecosystems understudied, bacterial communities play vital roles in self-recovery processes occurring in the hydrosphere.

Keywords: bacterium, micro-organisms, seawater, subsaharan Africa, sulphate reducing bacteria

DOI: https://doi.org/10.1016/j.chemosphere.2019.04.048

Journal of Chemosphere

Published by: Pergamon, on 2019/7/1