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Occurrence, removal and health risk assessment of phthalate esters: A case study of two different wastewater treatment processes in Lagos and Ogun State

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Phthalate esters (PEs) are ubiquitous organic pollutants that have been found to possess endocrine disrupting potential. This study assessed the levels of PEs in influent and effluent from Covenant Oxidation Pond (COP) and Ikeja Wastewater Treatment Plant (IWWTP) and the efficiencies of the two treatment processes at removing PEs congeners. Water samples were collected using amber bottles, acidified and stored at 4°C prior to extraction. The potential health risk arising from the usage of effluent-polluted river water as well as the physical and chemical characteristics of water samples were determined using standard methods. Liquid-liquid extraction method followed by column clean-up and Gas Chromatography-Flame Ionization Detector (GC-FID) were employed for the determination of the PEs. The mean values for physical and chemical parameters analyzed in samples from the two processes ranged from 7.1 to 7.5 for pH, 30.1°C to 30.5°C for temperature, 0.97 to 5.01 mgL⁻¹, 118 to 302 mgL⁻¹, 249 to 556 mgL⁻¹ and 522 to 794 µScm⁻¹ for Dissolved Oxygen, Biochemical Oxygen Demand, Chemical Oxygen Demand and Electrical Conductivity, respectively. The pH and temperature ranges were within the WHO acceptable limits while DO, BOD, COD and EC were above the limits. Monomethylphthalate, Dimethylphthalate, Diallylphthalate, Diethylphthalate, Diisobutylphthalate, Butylbenzylphthalate, Di-n-butylphthalate and Di-(2-ethylhexyl) phthalate were present in all the samples. The monthly mean concentrations varied between 1.63 (Diisobutylphthalate) and 46.9 µgL⁻¹ (Di-(2-ethylhexyl) phthalate) in influent and between 0.64 (Diallylphthalate) and 38.9 µgL⁻¹ (Di-(2-ethylhexyl) phthalate) in effluent at COP and from 2.33 (Diisobutylphthalate) to 40.6 µgL⁻¹ (Di-(2-ethylhexyl) phthalate) in influent and 0.81 (DAP) to 27.8 µgL⁻¹ (DEHP) in effluent at IWWTP. The mean removal efficiency of PEs at IWWTP was higher (54%) than COP (43.3%) during the study period. The health risk assessment of PEs did not suggest non-cancer effects in adults and children as values varied from 3.42x10⁻⁴ (DAP) to 0.138 (DEHP) at COP and from 4.32x10⁻⁴ (DAP) to 9.8x10⁻² (DEHP) at IWWTP. However, communities downstream may be exposed to potential carcinogenic effects as values obtained for adults and children ranged from 2.39 x 10⁻⁷ (DAP) to 3.84x10⁻⁵ (DEHP) at COP and from 3.02x10⁻⁷ (DAP) to 2.74x10⁻⁵ (DEHP) at IWWTP. Dermal absorption route may pose more carcinogenic risk than ingestion of effluent-polluted water.

Biography

Olujimi O O is an emerging researcher and a lecturer in the Department of Environmental Management and Toxicology, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria. He recently completed his PhD at Cape Peninsula University of Technology, Cape Town on the determination and health risk assessment of Endocrine Disrupting Chemicals (Phthalates, phenols and heavy metals) in freshwater systems of Cape Town Environment. He has over 7 years of teaching and research experience with over 30 publications as book chapters, peer-reviewed journals and conference proceedings.

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