Investigations into the occurrence of polycyclic aromatic hydrocarbons and pesticide residues in surface waters of the Mau-Mara ecosystem of South Rift Valley, Kenya

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Résumé

The Mau-Mara ecosystem in the Southern Rift Valley of Kenya rely on surface waters mainly from rivers for domestic use, livestock and plant farming. Increased anthropogenic activities such as charcoal burning and agrochemical practices near riparian areas in the ecosystem have led to environmental and ecotoxicological concerns of people and animals that rely on these waters. We aimed to determine the presence and levels of polycyclic aromatic hydrocarbons (PAHs) and pesticide residues in surface waters from the ecosystem; and further explore the bio-sorption of these pollutants using locally available biochar adsorbents. The surface waters of the ecosystem were sampled via a two-factorial design based on geographical distribution and proximity to point-source pollutants during both wet and dry seasons. PAHs and pesticides were extracted by solid-phase extraction and analyzed by gas chromatography hyphenated to mass spectrometry (GC-MS) and GC- time of flight mass spectrometry (GC-ToFMS) respectively. There were 38 different types of pesticides detected in the ecosystem. The pesticides chlorpyrifos, cypermethrin, cyfluthrin and cyhalothrin were more prevalent in Narok County while triazine, semicarbazone and epinephrine were more prevalent in Bomet County. There were significantly more pesticides detected during the wet season ($p \leq 0.05$). Four of these posed serious ecotoxicology concerns with risk quotients above 1.0 (high risk). Seven United States Environmental Protection Agency (US EPA) priority PAHs were detected in concentrations of up to 31.42 μgL-1 (dibenzo(a,h)anthracene). The surface waters were significantly polluted with dibenzo(a,h)anthracene with risk quotients above 1.0 in the surface waters and were found to be hazardous, with hazard quotients above 10.0, thus indicating potential environmental risks. The findings indicate the need for stringent measures to be put in place to mitigate the risks posed by these PAHs.

Mots-Clés: Mau, Mara ecosystem, water pollution, pesticides, polycyclic aromatic hydrocarbons, ecotoxicology

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