

## ABSTRACT

Heavy seasonal use of specific organophosphate and carbamate in the catchment area of Lake Naivasha is a potential cause of pollution of sediment, water and fish in the lake. However, there is lack of data on the potential pollutants, their levels in the aquatic ecosystem and monitoring strategy. The objectives of this study were to identify the commonly used pesticides and the timing of their application in Lake Naivasha catchment area through a survey; to evaluate the performance of chlorpyrifos ethyl (CPF) Enzyme-Linked Immunosorbent Assay (ELISA) kit as an alternative analytical tool for rapid monitoring of CPF residues and to determine the occurrence, spatial and temporal distribution trends in concentrations of residues of selected organophosphate and carbamate pesticides in water, sediment and fish (*Oreochromis leucostictus*) sampled from the lake and their potential health and environmental risks. The survey and sampling of water and sediment were done by target systematic sampling method. Water and sediment samples were solvent extracted, cleaned up by solid phase extraction cartridges (SPE) and analyzed comparatively by ELISA kit and HPLC diode array detector (DAD). The survey showed that CPF, diazinon and carbofuran were the commonly used pesticides with a higher potential to cause pollution of the lake. The accuracy, sensitivity and cross reactivity of the ELISA kit showed satisfactory performance. CPF ranged between 6.8-35.8 ng/g dry weight (dw) and 2.6-24.9 ng/ml in sediment and water, respectively. Diazinon ranged between  $\leq 0.14$ -33.3 ng/ml and  $\leq 0.30$ -9.3 ng/g dw in water and sediment, respectively. Carbofuran and 3-ketocarbofuran in sediment ranged from  $\leq 0.22$ -11.4 and  $\leq 0.22$ -17.1 ng/g dw, and from  $\leq 0.11$ -15.3 and  $\leq 0.11$ -18.2 ng/ml, respectively, in water. Out of the pesticides analyzed, only CPF was detected in fish at a mean concentration of 2.1 ng/g wet weight (wwt), with the levels being too low to present any health risk to consumers. Significantly ( $p \leq 0.5$ ) higher levels of pesticide residues were recorded in the wet than dry season. Levels detected in water and sediment were above the maximum standard European Union guideline limits for protection of aquatic life thus posing long term biodiversity threat in Lake Naivasha. Although levels found in fish currently do not present any risk to consumers, regular monitoring is still recommended. Use of ELISA kit in regular monitoring programs as an alternative to HPLC is recommended. Overall, there is need develop adequate mitigation interventions to protected the lake from pesticide residue pollution especially during wet season when levels of carbofuran, chlorpyrifos ethyl and diazinon are elevated.