

**ANALYSIS OF POLYCHLORINATED BIPHENYLS (PCBs) IN SEDIMENTS
AND WATER IN NAIROBI RIVER BY GAS CHROMATOGRAPHY**

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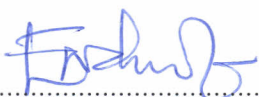
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of Master of Science in Environmental Chemistry of the University of Nairobi**

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Declaration

This thesis is my original work and has not been submitted for examination to any other university



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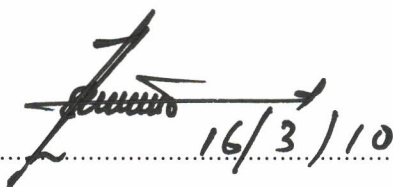
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Abstract

Industrial production of PCBs dates back to the period between 1929 and 1977, contributing to over 1.5×10^9 kilograms of the chemicals, a third of which has been released into the global environment. The production and use of these chemicals have been banned through the Stockholm Convention due to their adverse effects on human health and the environment. However, due to weak regulatory and management structures, PCBs contamination remains widespread in the environment.

This study investigated the spatial and temporal trends in the levels of seven Stockholm Convention indicator PCBs including PCBs 105 and 156 in water and sediments from Nairobi River. The river constitutes one of the three main tributaries that drain Nairobi. The river management is facing challenges ranging from rapid urbanization, industrialization, poor urban planning and weak legislation of environmental laws leading to serious environmental degradation. Untreated industrial effluents, raw sewage and waste from commercial activities drain in to the river and this has adversely compromised the river water quality.

Samples were collected on a monthly basis over a period of 6 months from February to July 2008. Water samples were collected into 2.5 L amber glass bottles then extracted by liquid-liquid partitioning using dichloromethane. Sediments were collected in aluminium foil and soxhlet extracted using hexane: acetone (3:1, v/v) mixture for 16 hours. The extracts were then cleaned by eluting through alumina deactivated column and analysed by gas chromatography equipped with electron capture detector.

In total 54 sediment samples and 54 water samples were screened for PCBs. PCB levels in sediments samples ranged from BDL to 157.64 $\mu\text{g}/\text{kg}$ while levels in water ranged from BDL to 718.78 ng/l . PCB 28 levels were the highest in both sediments and water samples, whereas the lowest were PCB 118 and 101 for sediments and water respectively. The most frequent PCB congeners in sediments were PCB 156 and 180 with percentage detection frequency of 100% whereas PCB 105 and 180 were the most frequent in water with detection frequency of 100%. The least frequent congeners were PCB 118 for sediments and PCB 101 for water with detection frequency of 5% and 56% respectively. The general trend observed was increase in PCB levels downstream of Nairobi River.

High PCBs levels in water were detected at the onset of rainy season while PCBs levels in sediments were highest during the dry season. Correlation analysis of the PCB levels and the physical-chemical parameters showed insignificant relationship as Pearson regression coefficient r (values) were all low, falling in the range of $-0.463 < r < 0.145$.

This study provides a baseline data on the levels of PCBs in Nairobi River, and will be important in the formulation of the monitoring activities of the river's pollution status. The data will also be important to the policy makers, industrialists and the community in the formulation of appropriate policies and mitigative measures to clean up Nairobi River in order restore the river as a source of drinking, irrigation, industrial and recreational water.