

**LEVELS OF THE PHYSICO-CHEMICAL PARAMETERS IN
THE LIQUID EFFLUENTS FROM PAN AFRICAN PAPER
MILLS AT WEBUYE AND IN RIVER NZOIA. //**

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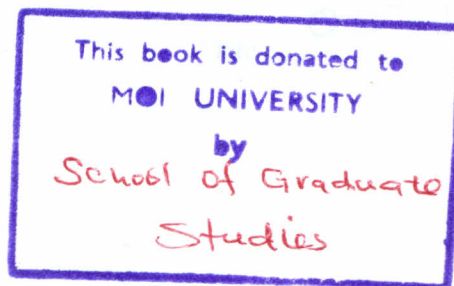
(Dip. Ed.(Sci), B. Ed.(Sci), M. Sc)

A Thesis submitted in Fulfilment of the Requirements of the Degree of

**Doctor of Philosophy
in
Environmental Education**

of

**Moi University
Faculty of Education**



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ABSTRACT

The treated wastewater from Pan-African Paper Mills (PPM) discharged into River Nzoia affects the concentrations of chemicals in the water, sediments and life forms of the river.

In this study some of the chemical and physico-chemical, heavy and alkaline metals in the wastewater, river water, sediment materials and fish were determined. On the basis of their levels effects of wastewater on River Nzoia was assessed.

The concentrations of Cd ($0.81 \pm 0.015 \text{ mgL}^{-1}$), Cr ($0.027 \pm 0.024 \text{ mgL}^{-1}$), Cu ($0.008 \pm <0.004 \text{ mgL}^{-1}$), Pb ($0.53 \pm 0.09 \text{ mgL}^{-1}$) and Zn ($0.106 \pm 0.045 \text{ mgL}^{-1}$) at EDP were higher than at WIP and DSN. The concentration of Ni ($0.227 \pm 0.036 \text{ mgL}^{-1}$) at WIP was higher than at both DSN and EDP, while the concentrations of Cu ($0.008 \pm 0.002 \text{ mgL}^{-1}$), Pb ($0.419 \pm 0.068 \text{ mgL}^{-1}$) and Zn ($0.076 \pm 0.022 \text{ mgL}^{-1}$) were higher at DSN than at WIP [Cu ($0.003 \pm 0.001 \text{ mgL}^{-1}$); Pb ($0.413 \pm 0.106 \text{ mgL}^{-1}$); and Zn ($0.067 \pm 0.015 \text{ mgL}^{-1}$)]. However the concentrations of Cr ($0.010 \pm 0.006 \text{ mgL}^{-1}$) and Ni ($0.194 \pm 0.064 \text{ mgL}^{-1}$) at DSN were lower than those at WIP (Cr, $0.018 \pm 0.009 \text{ mgL}^{-1}$ and Ni, $0.227 \pm 0.036 \text{ mgL}^{-1}$).

The concentrations of Ca ($29.27 \pm 5.55 \text{ mgL}^{-1}$), K ($9.62 \pm 2.04 \text{ mgL}^{-1}$), Mg ($2.13 \pm 0.98 \text{ mgL}^{-1}$) and Na ($248.48 \pm 95.91 \text{ mgL}^{-1}$) at EDP were significantly higher than at both WIP and DSN. The concentrations of Ca ($4.94 \pm 0.76 \text{ mgL}^{-1}$), K ($2.65 \pm 0.32 \text{ mgL}^{-1}$), Mg ($0.47 \pm 0.13 \text{ mgL}^{-1}$) and Na ($19.06 \pm 6.86 \text{ mgL}^{-1}$) at DSN were higher than at WIP.

The levels of physico-chemical parameters at EDP were higher than at WIP and DSN except for dissolved O_2 which was not detected at EDP. The conductivity ($325 \pm 70 \text{ } \mu\text{Scm}^{-1}$), pH (8.38 ± 0.08) and temperature ($20 \pm 0.77^\circ \text{C}$) at DSN were significantly higher than at WIP. The levels of the total solids were higher at WIP than at DSN. The dissolved O_2 level at DSN was $6.40 \pm 0.45 \text{ mgL}^{-1}$ compared to $7.26 \pm 1.36 \text{ mgL}^{-1}$ at WIP thus reflecting the impact of wastewater from PPM on River Nzoia.

The concentrations of heavy and alkaline metals in the dissolved and suspended solids at EDP were higher than at both WIP and DSN (Table 3.1). The concentrations of heavy and alkaline metals in the sediments at DSN were also higher than at WIP. Similarly, the concentrations of metals in gills of fish at DSN were higher than in gills of fish at WIP.

Therefore the wastewater from PPM discharged into River Nzoia increased the concentrations of heavy and alkaline metals and the levels of the physico-chemical parameters in River Nzoia water. The wastewater also increased the concentrations of the heavy and alkaline metals in the sediments at DSN as shown by their I_{geo} (Table 4.4) and enrichment values (Fig. 4.14). The levels of heavy metals in fish from WIP and DSN show that the wastewater has contributed to the bioaccumulation of heavy and alkaline metals in organisms in the river.