

Evaluation of Heavy Metal Contamination and Assessment of the Suitability of Water for Irrigation: A Case Study of the Sand River, Limpopo Province, South Africa

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Abstract : The primary objective of this study was to determine heavy metal contamination in the water, sediment, grass and fish in Sand River, South Africa. This river passes through an urban area and sewage effluent is discharged into it. Water from the Sand river is subsequently used for irrigation downstream of the sewage treatment works. The suitability of this water and the surrounding boreholes for irrigation was determined. This study was undertaken between January, 2014 and January, 2015. Monthly samples were taken from four sites. Sites 1 was upstream of the Polokwane Wastewater Treatment Plant, sites 2, 3 and 4 were downstream. Ten boreholes in the vicinity of the Sand River were randomly selected and the water was tested for heavy metal contamination. The concentration of heavy metals in Sand River water followed the order $Mn > Fe > Pb > Cu \geq Zn \geq Cd$. Manganese concentration averaged 0.34 mg/L. Heavy metal concentration in the sediment, grass and fish followed the order $Fe > Mn > Zn > Cu > Pb > Cd$. The bioaccumulation factor from grass to fish was highest in manganese (19.25), followed by zinc (16.39) and iron (14.14). Soil permeability index (PI) and sodium adsorption ratio (SAR) were used to determine the suitability of Sand River and borehole water for irrigation. The PI index for Sand River water was 75.1% and this indicates that Sand River water is suitable for irrigation of crops. The PI index for the borehole water ranged from 65.8-72.8% and again this indicates suitability of borehole water for crop irrigation. The sodium adsorption ratio also indicated that both Sand River and borehole water were suitable for irrigation. A risk assessment study is recommended to determine the suitability of the fish for human consumption.

Keywords : bioaccumulation, bioavailability, heavy metals, sodium adsorption ratio

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