

Performance assessment of Mabula municipal wastewater plant: Zvishavane town, Zimbabwe

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Abstract

The characterisation and performance assessment of municipal wastewater treatment plants is very important as it provides information regarding the types of contaminants present in the water and their subsequent concentrations. It is also important in assessing gaps within the treatment process and is thus an essential step in needed when recalibrating and redesigning a plant to improve its efficiency. However, in Zimbabwe there is lack of comprehensive current data characterises effluent and influent from municipal wastewater treatment plants. The aim of the study was to assess the quality of wastewater from Mabula wastewater treatment plant, Zvishavane Zimbabwe, infer the performance of the plant and assess the implications of municipal effluent discharge on the water quality of Musavezi River. Composite water samples were collected over a 21-week sampling period from December 2022 to April 2023 from five sampling points, two from the treatment stages within the plant and three points along the course of the Musavezi River. Samples were taken to an independent laboratory and analysed for pH, Biological Oxygen Demand (BOD₅), Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), Total Nitrogen (TN), Total Phosphorous (TP) and Ammonium-Nitrate (NH₃-N) in line with standards set by the American Public Health Association (APHA). Results from the study indicate that the plant receives and treats effluent that is of medium to high strength. Mean values of the effluent at discharge point indicated organic and nutrient concentrations that were higher than the Zimbabwe effluent discharge standards as prescribed by the Environmental Management Agency. Removal efficiencies for the plant varied from 83.01%, 83.02%, 88.26%, 36.21%, 67.43% and 51.6% for BOD₅, COD, TSS, TN, TP, and NH₃-N respectively. This indicates that the treatment plant is not performing very well with regards to nutrient removal. Effluent disposal was revealed to have implication on the water quality of the Musavezi River as indicated by water quality index (WQI). There is need to consistently monitor and regulate the performance of Mabula wastewater treatment plant so that it meets the national effluent discharge regulations.