

ABSTRACT

The aim of this study was to determine variations in concentration of Pathogen Indicator Organisms (PIOs) namely total coliforms *Escherichia coli* and heterotrophic bacteria; Biochemical Oxygen Demand (BOD) in Egerton University Wastewater Stabilisation Ponds (WSPs) and the effect of substrate sizes on wastewater treatment. Sampling at the WSPs was done on weekly basis for one month from mid-Nov to mid-Dec 2017 using standard procedures for examination of water and wastewater. A mesocosm study imitating a vertical sub surface flow constructed wetland was conducted to determine the most efficient substrate size in removal of these pollutant indicators. Total coliforms (TC) and *E. coli* were isolated using selective and differential media following membrane filtration method Colonies were enumerated on chromocult agar. Heterotrophic bacteria (HPCs) were enumerated using standard pour plate method on plate count agar. Biochemical Oxygen Demand was determined by incubating samples in a cabinet whose room temperature ranged between 20 °C to 25 °C for 5 days. For the mesocosm study, three sets of experiments with different gravel aggregate sizes were set up in triplicates. Wastewater from SMP was introduced and settled for six weeks to enable micro-organisms to establish and stabilize, before collection of water samples for analysis on weekly basis for eight weeks. The highest concentration of both PIOs and BOD was in the inlet, and this reduced along the pathway towards the outlet. Apart from BOD₅, there was a significant difference between the influent and effluent in all the parameters ($p < 0.05$). The range for TC, *E. coli*, HPCs and BOD₅ was $5.5 \times 10^6 - 2.9 \times 10^{11}$, $4.4 \times 10^4 - 1.9 \times 10^{10}$ CFUs / 100 ml, $4.5 \times 10^6 - 5.0 \times 10^9$ CFUs / ml and 142.8 - 163.6 mg/l respectively. Removal efficiencies ranged between 99.8-99.9 % (3 log units) for both TC and *E. coli* in both First Maturation Pond and Second Maturation Pond. Heterotrophic Plate Counts reduced in concentration along the treatment pathway by 2 log units. In the mesocosm study, percentage reduction efficiency for TC for different substrate sizes was recorded as 95.3, 90.4 and 88.8 % for small, medium and large gravel aggregate respectively, while *E. coli* was recorded as 95.2, 94.3 and 88.4 % and HPCs was 99.8, 99.7 and 99.5 %. Furthermore, removal of organic matter was recorded as 15.9, 9.9 and 8.4 % for BOD₅ while TSS was 72.7, 56.6 and 52.4 % for small, medium and large sized gravel aggregates respectively. In conclusion, WSPs at Egerton University performed well in removal of PIOs. Heterotrophic bacteria levels indicated presence of pollution with easily degradable organic matter, while BOD₅ levels did not. In addition, none of the substrate sizes

employed in mesocosm study performed better than the other in removal of PIOs and organic matter

Keywords

Egerton University