



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

Faculty of Applied Sciences

Department of Applied Biology and Biochemistry

**PHYSICO-CHEMICAL QUALITY OF OPAQUE BEER INDUSTRY WASTEWATER
AND METAGENOMIC CHARACTERIZATION OF ITS MICROBIAL DIVERSITY**

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DATE	ACCESSION	CLASS N
24/10/14	14/590	

**A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE
MASTER OF SCIENCE DEGREE IN APPLIED MICROBIOLOGY AND BIOTECHNOLOGY**

OCTOBER 2013

ABSTRACT

The physico-chemical quality of liquid effluent from fifteen opaque beer brewing wastewater treatment plants was determined using the basic methods for determining pH, Chemical Oxygen Demand, Total Settleable Solids, Chlorides and Permanganate Value. Findings were that physico-chemical parameters were variable between breweries and several wastewater treatment plants managed to bring pH, Chlorides and TSS parameters to levels permissible by the local Environmental Management Authority (EMA) but COD and PV values remained above limits indicating high organic load of treated opaque brewery liquid effluent and inefficient treatment by the treatment plants. Microbial diversity analysis of the most (Zvishavane) and least (Fairbridge) efficient wastewater treatment plant based on physico-chemical results was done by non-culturable metagenomic techniques whereby whole metagenomic DNA was extracted and sequenced using the next generation Illumina MiSeq® platform. Contigs (DNA reads) found were analyzed using the Basic Local Alignment Search Tool (BLAST) to classify them into the relevant species based on 16S rDNA sequences. Community taxonomic analysis of the data obtained was done using Metagenome Analysis (MEGAN) software and findings were that opaque beer brewery wastewater has a large diversity dominated by the Bacteria domain. The Proteobacteria and Firmicutes were most common in both samples but Zvishavane wastewater sample exhibited a larger diversity made up of acidogenic *Lactobacillus delbrueckii*, *Clostridium acetobutylicum*, *Pseudomonas putida* and organic degrading *Bifidobacterium* while dominance of the *Gamma-proteobacteria* in Fairbridge wastewater indicated heavy pollution of the water. Microbial diversity of the two wastewater treatment plants correlated with other studies done on wastewater microbial diversity and variations between the two plants correlated with their wastewater treatment efficiencies.