

Pilot Scale Investigation on the Removal of Pollutants from Secondary Effluent to Meet Botswana Irrigation Standards Using Roughing and Slow Sand Filters

Authors : Moatlhodi Wise Letshwenyo, Lesedi Lebogang

Abstract : Botswana is an arid country that needs to start reusing wastewater as part of its water security plan. Pilot scale slow sand filtration in combination with roughing filter was investigated for the treatment of effluent from Botswana International University of Science and Technology to meet Botswana irrigation standards. The system was operated at hydraulic loading rates of 0.04 m/hr and 0.12 m/hr. The results show that the system was able to reduce turbidity from 262 Nephelometric Turbidity Units to a range between 18 and 0 Nephelometric Turbidity Units which was below 30 Nephelometric Turbidity Units threshold limit. The overall efficacy ranged between 61% and 100%. Suspended solids, Biochemical Oxygen Demand, and Chemical Oxygen Demand removal efficiency averaged 42.6%, 45.5%, and 77% respectively and all within irrigation standards. Other physio-chemical parameters were within irrigation standards except for bicarbonate ion which averaged $297.7 \pm 44 \text{ mg L}^{-1}$ in the influent and $196.22 \pm 50 \text{ mg L}^{-1}$ in the effluent which was above the limit of 92 mg L^{-1} , therefore averaging a reduction of 34.1% by the system. Total coliforms, fecal coliforms, and *Escherichia coli* in the effluent were initially averaging 1.1 log counts, 0.5 log counts, and 1.3 log counts respectively compared to corresponding influent log counts of 3.4, 2.7 and 4.1, respectively. As time passed, it was observed that only roughing filter was able to reach reductions of 97.5%, 86% and 100% respectively for faecal coliforms, *Escherichia coli*, and total coliforms. These organism numbers were observed to have increased in slow sand filter effluent suggesting multiplication in the tank. Water quality index value of 22.79 for the physio-chemical parameters suggests that the effluent is of excellent quality and can be used for irrigation purposes. However, the water quality index value for the microbial parameters (1820) renders the quality unsuitable for irrigation. It is concluded that slow sand filtration in combination with roughing filter is a viable option for the treatment of secondary effluent for reuse purposes. However, further studies should be conducted especially for the removal of microbial parameters using the system.

Keywords : irrigation, slow sand filter, turbidity, wastewater reuse

Conference Title : ICWPT 2018 : International Conference on Water Pollution and Treatment

Conference Location : London, United Kingdom

Conference Dates : May 14-15, 2018