



## Master Thesis Abstract

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## EVALUATION OF SLOW SAND FILTRATION FOR MUNICIPAL WASTEWATER WITH A TRICKLING FILTER AS PRIMARY TREATMENT

Trickling filters and slow sand filters are low-cost treatment technology for wastewater that decreased in popularity due to the development of more complex systems that included aeration and deal better with higher organic and hydraulic loads. For small communities, the cost involved in the construction and operation of different systems, such as activated sludge technology, has affected the long-term viability of the systems or has forced the implementation of decentralized systems where the reuse of treated wastewater is not considered. In addition, slow sand filtration is a method mainly used for drinking water treatment, and its use for wastewater has been so far limited. Municipal wastewater treatment and reuse in agriculture for small communities is one of the most effective ways to fulfill treatment requirements, reduce pollution risks and reduce water demand in vulnerable areas. The present study aimed to combine two low-cost treatment alternatives, such as trickling filter and slow sand filter technology, to determine its viability for pollutant removal for water reuse. The pilot scale system included a trickling filter with a hydraulic load of  $1.1 \text{ m}^3/(\text{m}^2 \cdot \text{h})$  and three different organic loads (0.9, 0.64 and  $0.67 \text{ Kg BOD}/(\text{d} \cdot \text{m}^3)$ ) for three different phases, a rapid sand filter and three slow sand filters of 0.10 m diameter, 0.6 m of sand column and three different hydraulic loads of 0.15, 0.3 and  $0.6 \text{ m/h}$ .

The trickling filter reported removal rates for COD, TN, TP, E. coli, Total Coliforms (TC) and Enterococcus of between 80—88 %, 30—40 % and 16—32 %,  $0.9—2.3 \log_{10}$  and  $1.2—2.3 \log_{10}$ ,  $1.5—3.3 \log_{10}$ , respectively. Regarding the slow sand filters, the removal rates for COD, TN, E. coli, Total Coliforms (TC) and Enterococcus of 18—23 %, 3—6 %,  $0.8—1.35 \log_{10}$ ,  $0.3—1.58 \log_{10}$  and  $0.1—1.3 \log_{10}$ . There was not removal of TP by the slow sand filter. Although, the slow sand filter with the lowest hydraulic load ( $0.15 \text{ m/h}$ ) was proved to be the most effective for contaminant removal, the filter with a hydraulic load of  $0.3 \text{ m/h}$  showed similar removal values with pathogen removal values below the limits set by the World Health Organization ( $1000 \text{ CFU}/100 \text{ mL}$ ), and less maintenance requirements as the filter with  $0.6 \text{ m/h}$ .

**Keywords:** trickling filter, slow sand filter, municipal wastewater treatment, nitrogen removal, phosphorus removal, bacteria removal.