Performance evaluation of stone-media pro-type pilot-scale trickling biofilter system for municipal wastewater treatment

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\textbf{ABSTRACT}

This research work was focused on the establishment and performance assessment of the locally designed pro-type pilot-scale stone-media trickling biofilter (TBF) system for the removal of pollution indicators (chemical oxygen demand (COD), biochemical oxygen demand (BOD\textsubscript{5}), ammonium nitrogen (NH\textsubscript{4}-N), and pathogen indicators) from municipal wastewater under increasing environmental temperature of 20\textdegree{}C\textendash{}40.5\textdegree{}C for 40 d. The results indicated that removal efficiency of the parameters, COD, BOD\textsubscript{5}, and NH\textsubscript{4}-N, from the wastewater considerably increased from 62.4, 56.4, and 33.8\%, respectively, at 20\textdegree{}C on 1st day to 98.1, 98.6, and 93.5\%, respectively, at 40.5\textdegree{}C on 40th day of the TBF operation. The removal of pathogenic indicators from wastewater was evaluated in terms of MPN index and an average reduction of 88.8\% of fecal coliforms in the effluent was recorded during the experimental period. The biofilms, which were responsible for wastewater treatment, were sampled from the top and deeper layers of stone bed of the reactor and were characterized. The \textit{Nitrosonomas} and \textit{Nitrobacter} sp. were identified in the deeper layers of the biofilms, while 13 bacterial strains viz. \textit{E. coli}, \textit{P. aeruginosa}, \textit{E. aerogenes}, \textit{S. typhimurium}, \textit{P. vulgaris}, \textit{S. dysenteriae}, \textit{K. pneumoniae}, \textit{B. subtilis}, \textit{S. aureus}, \textit{M. luteus}, \textit{S. epidermitus}, \textit{S. lactis}, and \textit{C. xerosis} were identified in the biofilm sample removed from top layer of the stone media. The overall results proved that the pilot-scale TBF has a great potential to be transferred to field scale for treating sewage for small communities in developing and underdeveloped countries even at extreme temperature conditions.

\textbf{Keywords:} Stone-media trickling biofilter; MPN index; Carboneous pollutants removal efficiency; Pathogenic indicators

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