Sewage treatment in an up-flow anaerobic sponge reactor followed by moving bed biofilm reactor based on polyurethane carrier material

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\textbf{ABSTRACT}

Comparison of the performance of an up-flow anaerobic sponge reactor (UASR) versus a classical up-flow anaerobic sludge blanket (UASB) reactor for sewage treatment was investigated. Both reactors were operated at a hydraulic retention time (HRT) of 6.0 h and organic loading rate (OLR) of 2.3 kg COD m\textsuperscript{-3}/d. The results obtained revealed that the UASR produced better effluent quality as compared to the UASB reactor. Residual values of COD\textsubscript{total}, COD\textsubscript{soluble} and COD\textsubscript{particulate} in the treated effluent of UASR were 170 ± 54, 88 ± 36 and 82 ± 41 mg/l, respectively. Corresponding values in the UASB reactor effluent were 247 ± 69, 120 ± 40 and 127 ± 74 mg/l respectively. Furthermore, residual values of VFA-COD, oil and grease were quite less in the effluent of UASR. The removal efficiencies of faecal coliform (FC) and faecal streptococci (FS), in both reactors did not exceed one log\textsubscript{10}. However, the geometric mean of residual bacterial count was less in case of UASR. Moreover; excess sludge production from UASR reactor was almost half that produced from the UASB reactor. Although, the UASR showed a better performance for COD fractions removal than the UASB reactor, the effluent quality still exceeds the limits for discharge and /or reuse in irrigation purposes. Therefore, moving bed biofilm reactor (MBBR) based on polyurethane carrier material was investigated as a post-treatment unit. The MBBR was operated at an OLR of 7.0 g COD m\textsuperscript{-2}/d and a HRT of 3.6 h. The reactor achieved a substantial reduction of COD\textsubscript{total}, COD\textsubscript{particulate} and COD\textsubscript{soluble} resulting in an average effluent concentration of 63 ± 27, 19 ± 15 and 44 ± 27 mg/l respectively. Nitrate and nitrite data reveal that 68% of the ammonia removed occurred through nitrification. Moreover, the system achieved 70 ± 13% for TKj-N removal resulting an average value of 9.3 ± 3.9 mg/l in the treated effluent. The MBBR system provided an effluent quality of 2.9 × 10\textsuperscript{4} MPN 100 ml\textsuperscript{-1} for FC and 1.8 × 10\textsuperscript{3} MPN 100 ml\textsuperscript{-1} for FS corresponding to the removal efficiencies of 99.87 and 99.85% respectively.

\textbf{Keywords:} Sewage; UASB; UASR; Sponge; MBBR; FC; Nitrification; Sludge

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