

Onsite wastewater Treatment by Modified Anaerobic Baffled Reactor

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Problems with sanitation, water, and hygiene account for over 98.8% of fatalities in developing countries. Septic Tank (ST) is extensively used as an on-site wastewater treatment system for black water, but it can only remove about 50-55% of the BOD & COD from the black water. Present study demonstrated a possible future application of the Modified anaerobic baffled reactor (MABR) for blackwater treatment are presented. For this purpose, a MABR system inoculated with enriched microorganism and bio augmented with microbial consortium was optimized and treatment efficiency of MABR was simultaneously compared with the common septic tank. MABR and Septic Tank (ST) were operated for more than seven months to treat synthetic faecal and real human faecal at water temperatures ranging from 10°C to 30°C.

Performance of MABR & ST was evaluated in terms of removal efficiencies of COD, BOD, TSS, NH₄⁺-N, TN, & TP in MABR & ST on the basis of different OLR were calculated. The COD, BOD and TSS removal efficiency for MABR was 94±1.2%, 95±1.2%, and 92±3.2% respectively while for ST was 75±4%, 74±3.9% and 75±1.2% respectively, for OLR 0.5 Kg COD/ m³.day. The COD BOD, and TSS removal efficiency for MABR was slightly decreased to 90±3.2%, 89±1.9%, and 80±4.5% and while for ST was slightly increased to 78±6.5%, 77±4.6%, and 81±3.5%, for OLR 0.25 Kg COD/ m³.day. There was no removal of TP and TN in modified ABR and ST at both OLR. After the stabilization phase, MABR was performing well in terms of COD, BOD and TSS, with a removal efficiency of more than 90%. The efficiency was not affected by the variation of organic loading to half, i.e., 0.25 kg COD/m³. d. The TN, TP and coliform removal efficiencies was insignificant in MABR and ST both.

The minimal changes in COD values in summer were registered compared to the winter conditions in both tested systems. VFA levels decreased in successive compartments, especially from compartment 2 onwards, and this explains the increase in pH in these compartments together with the increasing alkalinity

Metagenomic analysis revealed that the top 5 most abundant bacterial phyla in all the steady-state digester samples were Firmicutes, Bacteroidetes, Proteobacteria and Chloroflexi. The phylogenetic tree demonstrated that the bacterial population of MABR is more or less homogenous than for ST. Hence, the COD, BOD & TSS removal efficiency of MABR was observed to be higher than the ST in the stabilized period.