**ABSTRACT**

Sediment microbial fuel cells (SMFCs) can treat aquaculture water and organic rich pond sediment, thereby maintaining the water quality in aquaculture ponds along with production of electricity. The graphite plate SMFC gave higher COD, TKN and TN removal efficiency (79 ± 1 %; 94 ± 3 %; 62 ± 4 %, respectively) than stainless steel SMFC (69 ± 3 %; 74 ± 4 %; 30 ± 3 %, respectively). With aeration at cathode, the COD and TKN removal efficiencies were 79.4 % and 92.6 % in SMFC with short-circuited connection whereas, it was 84.4 % and 95.3 % in SMFC with external resistance. Without aeration and at lower operating temperature, the COD and TKN removals were slightly lower, yet satisfied aquaculture quality norms. COD removal was observed to be inversely proportional to influent pH as well as external resistance and directly proportional to the distance between electrodes. However, TN removal increased with increase in pH and distance between electrodes whereas it decreased with the increase in external resistance. Power production reduced with decrease in pH, but increased with decrease in external resistance and distance between electrodes. During validation, experimental SMFCs operated with non-catalyzed and catalyzed carbon felt as electrodes gave significant increase in COD removal, TN removal and power density than the SMFCs operated with graphite plate. The days of operation to meet the water quality for aquaculture was also reduced.

At 2 % cellulose content in the sediment, increment in COD and TN removal efficiencies and power density occurred. However, 4 % cellulose addition decreased the performance of SMFC. During the complete experimental period, acetic acid was the only short chain fatty acid detected in all three SMFCs. SMFCs demonstrated effective cellulose degradation from aquaculture pond sediment and maintained the oxidized sediment top layer favourable for aquaculture. The COD and TN removal from the sediment was high in half cell of SMFC operated with higher anode potential of -39 mV. SMFC operated with lower anode potential (-639 mV) released more nitrogenous compounds to the overlying water than the SMFC operated with higher anode potential (-39 mV). The total carbon felt area (cathode and anode) required for stocking densities 2 fish per $m^2$ and 5 fish per $m^2$ were found to be 834 $m^2$ and 2534 $m^2$. The BCR ratios for these two designs were 2.72 and 2.45 and the designs are found to be economically feasible.

Keywords: Sediment microbial fuel cell, aquaculture water remediation, COD removal, TN removal