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Study on Submerged Anaerobic Membrane Bioreactor (SAMBR) treating hypersaline raw tannery wastewater for biogas production

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A pilot-scale submerged anaerobic membrane bioreactor treating fine screened and equalized raw tannery waste water without any pretreatment was investigated in this paper to explore the biogas yield from both particulate (COD_p) & soluble organic pollutants (COD_s). Flat sheet anaerobic membrane with pore size of $0.4\ \mu m$ was used in this study and evaluated its performance of biogas production with Organic Loading Rate of $12\ g\ of\ COD.L^{-1}.d^{-1}$. Anaerobic microbial growth in the SAMBR was measured and compared with VSS ($mg.L^{-1}$) at elapsed time intervals which was further evaluated using membrane fouling characteristics by scanning electron microscope picture (SEM) of membrane, permeate velocity, COD_{in} , COD_{out} , COD in the reactor, biogas yield and composition of biogas, etc. The biogas generation started from the 9th day and reached the maximum by 27th day. Initially, volatile suspended solids (VSSs) and total suspended solids (TSSs) in the reactor were $4\ g.L^{-1}$ and $5\ g.L^{-1}$ respectively with ratio of 0.80. On the 27th day, the VSS and TSS in the SAMBR have reached a maximum value of $24\ g.L^{-1}$ and $27\ g.L^{-1}$ respectively with ratio of 0.89. The permeate flux was maintained at 7.06 LMH which is less than the critical flux discussed in literature and due to that fact, there was no reduction in permeate flux till the end of the experiment. Also at steady conditions, high treatment efficiency was achieved by the SAMBR with COD removal efficiency of approximately 97.14%. The methane content in the biogas was observed between 60 to 70%. High R^2 value was observed between NH_3 levels and alkalinity during high fouling conditions attributed to precipitation of ammonium acetate salt or struvite responsible for membrane fouling. The optimum VFA/Alkalinity ratio was 0.5, which was consistent with the peak gas yield conditions. The study recommends the removal of NH_3 to avoid the membrane fouling at high OLR of $12\ g\ of\ COD.L^{-1}.d^{-1}$ treating raw tannery waste water.

Biography

Umaiyaakunjaran R has completed his UG in Civil Engineering from Annamalai University, Tamilnadu, India in 1985 and completed his PG in Civil/Environmental Engineering in Indian Institute of Technology, Madras, India in 2000. He is pursuing PhD in Anna University, Chennai, India from January 2011. He has been working as an Environmental Engineer in Pollution Control Board, Tamilnadu, India.

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