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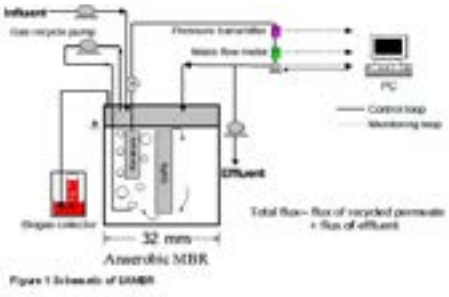
Organic shock loads effects (with and without alkalinity) in submerged anaerobic membrane bioreactors (SAMBRs): Changes in feed strengths at constant hydraulic retention time (HRT)

High strength wastewaters including effluents from distillery, brewery, sugar and maize products industries require treatment before discharge into aquatic environment. For carbon decontamination of food and beverage industries effluents, membrane bioreactors are being developed to decouple the solid retention time from the hydraulic retention time (HRT) and to produce solids free better quality effluents while the use of anaerobic biomass reduces the cost of excessive sludge disposal and produces methane as a source of renewable energy. Three litres submerged anaerobic membrane bioreactor (SAMBR) was used to study the effects of organic shock loads in the form of step change in feed strengths and alkalinity to different magnitudes (two and five times) at constant HRT to obtain an insight into microbial responses and chemical oxygen demand (COD) removal performance. The SAMBR was able to handle the high sludge loading rate (0.8 gCOD $gVSS^{-1}$ l^{-1}) and the organic loading rate (9.6 gCOD l^{-1} d^{-1}) with 90% COD removal at high gas sparging rate ($3m^{-3}$ m-2 h^{-1}) due to a uniform shear force. Settled and attached growth biomass inside SAMBR at low gas sparging rate (1.2 m^{-3} m^{-2} h^{-1}) survived an organic shock load of 20 gCOD l^{-1} (five times the steady state concentration) both in the presence and absence of moderate sodium toxicity (4.5 gNa^{+} l^{-1}). Acetate and propionate were the two most significant volatile fatty acids (VFAs) appeared at high substrate concentration, whereas butyrate appeared only at relatively low pH. Formate appeared for biomass acclimatised for above neutral pH and disappeared at low pH for similar flocs morphology. Substrate degradation depends upon active biomass and not on flow regime inside the bioreactor. However VFAs and soluble microbial products (SMPs) retention at low shear conditions (1.2 m-3 m-2 h^{-1}) confirm the concept of electrostatic "gel layer" formation. Based on the results of the specific methanogenic activity using batch assays a larger amount of methane production potential is observed in SAMBR at higher loading rate.



Biography

Aurangzeb Akram is performing academic research in the Department of Chemical Engineering and Chemical Technology Imperial College London United Kingdom, Department of Chemical and Biochemical Engineering, Technical University of Denmark (DTU), Denmark, NFC Institute of Engineering and Technology Pakistan and the Institute of Chemical Engineering and Technology Faculty of Engineering and Technology University of the Punjab Pakistan and pursuing his career in academics, research and government advisory services. He is performing reviews and publishing of research work for peer-reviewed international scientific journals and is a member of different international scientific societies. His research interest is on the topics of energy and fuels, environmental sustainability and the relevant treatment processes and performing research on novel membrane based bioengineering design for carbon decontamination of industrial and municipal effluents for discharge into fresh water streams using anaerobic consortium producing biofuel..

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