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Towards a novel wastewater treatment process: a submerged membrane electro-bioreactor (SMEBR)-simultaneous biodegradation, electrocoagulation, and membrane filtration

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ABSTRACT

The limited freshwater resources make the need for wastewater treatment and reuse a mandatory option in many countries around the world specifically in arid and semi-arid regions like the Arab Gulf area due to severe water scarcity. Therefore, focusing on advanced wastewater treatment methods has become a hot issue in recent years. Membrane processes belong to this group and attract a high degree of attention from researchers in different academic institutions. In the last few decades, membrane bioreactor (MBR) technology, specifically the submerged membrane bioreactor (SMBR) which integrates membrane filtration with an activated sludge process (ASP) has exhibited promise as a very attractive method for various kinds of wastewater treatment. The SMBR has many advantages in comparison with ASP such as superior effluent quality, higher mixed liquor suspended solids (MLSS) and organic pollutant loading, independent control of hydraulic retention time (HRT), and sludge retention time (SRT). However, the phenomenon of membrane fouling is still considered one of the main obstacles to SMBR technology. Many methods have been developed and investigated to overcome this serious problem. Among the different proposed approaches, using the electrochemical methods by applying a direct current (DC) field on the activated sludge has been shown as a promising and novel approach. One of the early developed electrochemical methods with SMBR is called Submerged Membrane Electro-Bioreactor (SMEBR). The SMEBR integrates three processes in one reactor unit: biological treatment, membrane filtration, and electrocoagulation. The method was developed at Concordia University, Montreal-Canada in 2008 and later registered as a patent in the USA in 2010. This paper presents a comprehensive review of the conducted studies on SMEBR and its application in wastewater treatment and the potential of reducing the membrane fouling phenomenon. The paper summarizes the advantages of SMEBR in comparison with other treatment technologies and highlights the last findings of SMEBR.

Keywords: Submerged; Membrane fouling; Electro-bioreactor; Activated sludge; Wastewater

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