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Influence of activated sludge characteristics on membrane fouling in a hybrid membrane bioreactor

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ABSTRACT

A pilot study was conducted in a domestic wastewater treatment plant for investigating the behaviour of a hybrid membrane bioreactor (HMBR) which was developed by adding biofilm carriers into a conventional membrane bioreactor (CMBR). As a result of long term operation, the HMBR performed organic, nitrogen and phosphorous removal much better than the CMBR under the same operation condition. The HMBR also showed a better property of membrane fouling control as it could be continuously operated without washing or chemical cleaning for about 140 d till the trans-membrane pressure (TMP) reached the prescribed value of 20 kPa while the continuous operation period for the CMBR was about 60 d. Investigations were further conducted on the characteristics of the activated sludge in the reactors regarding biomass quantity, SVI, particle size distribution, sludge particle structure and supernatant turbidity. It was found that the addition of biofilm carriers not only brought about a substantial increase of biomass quantity due to the growth of attached biomass, but also an improvement of the structure, size, flocculability and settleability of the sludge particles. A cake layer resistance model was developed to simulate the process of TMP increase in the cake layer forming stage. It was evaluated that the specific resistance of the cake layer in the case of the HMBR would only be 1/4 of that in the case of the CMBR.

Keywords: Hybrid membrane bioreactor; Biofilm carrier; Activated sludge; Membrane fouling; Particle size distribution; Cake layer resistance

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