

Membrane filtration as post-treatment of rotating biological contactor for wastewater treatment

ABSTRACT

A rotating biological contactor (RBC) offers a low energy footprint but suffers from performance instability, making it less popular for domestic wastewater treatment. This paper presents a study on an RBC integrated with membrane technology in which membrane filtration was used as a post-treatment step (RBC–ME) to achieve enhanced biological performance. The RBC and RBC–ME systems were operated under different hydraulic retention times (HRTs) of 12, 18, 24, and 48 h, and the effects of HRT on biological performance and effluent filterability were assessed. The results show that RBC–ME demonstrates superior biological performance than the standalone RBC. The RBC–ME bioreactor achieved $87.9 \pm 3.2\%$ of chemical oxygen demand (COD), $98.9 \pm 1.1\%$ ammonium, $45.2 \pm 0.7\%$ total nitrogen (TN), and $97.9 \pm 0.1\%$ turbidity removals. A comparison of the HRTs showed that COD and TN removal efficiency was the highest at 48 h, with $92.4 \pm 2.4\%$ and $48.6 \pm 1.3\%$ removal efficiencies, respectively. The longer HRTs also lead to better RBC effluent filterability. The steady-state permeability increased respectively by 2.4%, 9.5%, and 19.1% at HRTs of 18, 24, and 48 h, compared to 12 h. Our analysis of membrane fouling shows that fouling resistance decreased at higher HRTs. Overall, RBC–ME offered a promising alternative for traditional suspended growth processes with higher microbial activity and enhanced biological performance, which is in line with the requirements of sustainable development and environment-friendly treatment.