Response Surface Methodology for Optimization of Rotating Biological Contactor Combined with External Membrane Filtration for Wastewater Treatment

ABSTRACT

A large amount of wastewater is directly discharged into water bodies without treatment, causing surface water contamination. A rotating biological contactor (RBC) is an attached biological wastewater treatment process that offers a low energy footprint. However, its unstable removal efficiency makes it less popular. This study optimized operating parameters in RBC combined with external membrane filtration (RBC-ME), in which the latter acted as a post-treatment step to stabilize the biological performance. Response surface methodology (RSM) was employed to optimize the biological and filtration performance by exploiting three parameters, namely disk rotation, hydraulic retention time (HRT), and sludge retention time (SRT). Results show that the RBC-ME exhibited superior biological treatment capacity and higher effluent quality compared to stand-alone RBC. It attained 87.9 ± 3.2% of chemical oxygen demand, 45.2 ± 0.7% total nitrogen, 97.9 ± 0.1% turbidity, and 98.9 ± 1.1% ammonia removals. The RSM showed a good agreement between the model and the experimental data. The maximum permeability of 144.6 L/m2 h bar could be achieved under the optimum parameters of 36.1 rpm disk rotation, 18 h HRT, and 14.9 d SRT. This work demonstrated the effective use of statistical modeling to enhance RBC-ME system performance to obtain a sustainable and energy-efficient condition.