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Characterization of a hybrid powdered activated carbon-dynamic membrane bioreactor (PAC-DMBR) process with high flux by gravity flow: operational performance and sludge properties

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Abstract: Three PAC-DMBRs were developed for wastewater treatment under different PAC dosages with biomass concentrations averaged at 2.5, 3.5 and 5.0 g/L. The DMBRs could be continuously operated at 40-100 L/m²h, while higher fluxes were obtained within the PAC-DMBRs with hydraulic retention times varying in 4-10 h. A dose of 1 g/L PAC brought about obvious improvement in the sludge particle size distribution, settling, flocculating and dewatering properties due to the formation of biological PAC, and the sludge properties were further improved at a higher PAC dose (3 g/L). The addition of PAC notably shortened the DM formation time after air backwashing and enhanced pollutant removal. Moreover, under a long solid retention time (approximately 150 d), the concentrations of both soluble and bound extracellular polymeric substances (EPS) decreased substantially because of the adsorption and biodegradation effects of the biological PAC. No obvious impact on biomass activity was observed with PAC addition.

Keywords: PAC-DMBR hybrid process; powdered activated carbon; wastewater treatment; sludge property; filtration resistance

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