REMOVAL MECHANISMS OF SOME RESISTANT MICROPOLLUTANTS FROM RAW HOSPITAL WASTEWATER VIA ANAEROBIC/AEROBIC SEQUENTIAL, UF AND RO PROCESSES

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ABSTRACT

Removal mechanisms of some brominated (α-Hexabromocyclododecane; α-HBCDD and 3,3′,5,5′-Tetrabromo bisphenol A; TBBPA) and fluoro (Perfluorooctanic acid; PFOA and Perfluorooctanesulfonic acid; PFOS) micropollutants were compared using biological and membrane processes from raw hospital wastewater in this study. An anaerobic UASB/aerobic CSTR sequential biological reactor system was operated at different sludge ages (5, 30, 45 and 55 days SRT) under mesophilic conditions in the biological process. The removal mechanisms (biodegradation, adsorption, sorption and volatilization) were evaluated. The maximum biodegradation yields were determined for α-HBCDD, TBBPA, PFOA and PFOS as 18.26%, 20.59%, 27.96% and 47.33%, respectively, at 55 days SRT and at pH 7.5. UF was operated at constant transmembrane pressure (2.75 bar TMP), while RO was operated at different TMPs (2.75, 3.75 and 4.75 bar TMP). The removal mechanisms (size exclusion, electrostatic repulsion and adsorption) were investigated and it was found that adsorption is the main removal phenomenon on the membrane surface for RO. The maximum total removal efficiencies were obtained as 99.0%, 98.0%, 97.7% and 96.0% for α-HBCDD, TBBPA, PFOA and PFOS, respectively, at 4.75 bar TMP, 104.17 L/m^2/h of membrane flux (Jv), 0.10 m/h of cross flow velocity (CFV), 60 min operating time, pH 8.00 and 25 °C in RO. The contribution of adsorption mechanism to the total removal efficiencies was calculated as 97.67%, 95.73%, 95.09% and 94.24% for α-HBCDD, TBBPA, PFOA and PFOS, respectively, for the same experimental conditions in RO. The cost required to treat 1 m^3 of raw hospital wastewater was calculated for anaerobic/aerobic sequential (3.14 €/m^3), UF (0.66 €/m^3) and RO (0.67 €/m^3) treatment options. RO was found to be the most feasible process for the treatment of studied micropollutants.

Keywords: *adsorption, anaerobic/aerobic sequential, biodegradation, micropollutant, UF, RO*

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