Biodegradation of pharmaceuticals in hospital wastewater by a hybrid biofilm and activated sludge system (Hybas) - DTU Orbit (07/12/2018)

Hospital wastewater contributes a significant input of pharmaceuticals into municipal wastewater. The combination of suspended activated sludge and biofilm processes, as stand-alone or as hybrid process, has been suggested as a possible solution for hospital wastewater treatment. Hybas™ is a hybrid process, based on the integrated fixed-film activated sludge technology, where plastic carriers for biofilm growth are suspended within activated sludge. To investigate the potential of a hybrid system for the removal of pharmaceuticals in hospital wastewater a pilot plant consisting of a series of one activated sludge reactor, two Hybas™ reactors and one moving bed biofilm reactor (MBBR) has been operated for 10 months, where after batch and continuous flow tests were performed for the degradation of pharmaceuticals. Removal of organic matter and nitrification mainly occurred in the first reactor. Most pharmaceuticals were removed significantly. The removal of pharmaceuticals (including x-ray contrast media, β-blockers, analgesics and antibiotics) were fitted to a single first-order kinetics degradation function, giving degradation rate constants from 0 to 1.49 h⁻¹, from 0 to 7.78×10⁻¹ h⁻¹ , from 0 to 7.86×10⁻¹ h⁻¹ and from 0 to 1.07×10⁻¹ h⁻¹ for first, second, third and fourth reactor respectively. Generally, the highest removal rate constants were found in the first and third reactor while the lowest were found in the second one. When the removal rate constants were normalized to biomass amount, the last reactor (biofilm only) appeared to have the most effective biomass in respect of removing pharmaceuticals. In the batch experiment, out of 26 compounds, 16 were assessed to degrade more than 20% of the respective pharmaceutical within the Hybas train. In the continuous flow experiment, the measured removal rates were similar to those estimated from the batch experiments, but the concentrations of a few pharmaceuticals appeared to increase during the first treatment step. Such increase could be attributed to de-conjugation or formation from other metabolites.

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