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Biodegradation of Ibuprofen Salt in SBR Reactor with Activated Sludge under Aerobic Conditions

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In recent decades, there has been a marked increase in the concentration of pharmaceuticals in wastewater, a direct result of their increasing availability and widespread use in the society. One of the most commonly detected substances is ibuprofen (IBF), a widely used nonsteroidal anti-inflammatory drug (NSAID) commonly used as a painkiller.

The present study analyzed the biodegradation process of a selected pharmaceutical over time. The study was conducted for three different concentrations of ibuprofen salt in the feed stream: 4, 10 and 20 mg IBF/L. The SBR cycle consisted of filling, aeration, settling and drawing phases. In addition, an adsorption test was performed using activated sludge inactivated with sodium azide – in order to assume the contribution this physico-chemical process to the overall removal efficiency of the bioreactor. The samples were analyzed using liquid chromatography (Nexera LC-2040C 3D Plus, Shimadzu, Kinetex column C18 100x3mm). The results showed the high efficiency of IBF stream treatment by biological methods. During one cycle, up to 90% (maximum 18 mg IBF/L) of the introduced NSAID was removed. The adsorption test revealed that maximum 2 mg IBF/L could be removed by adsorption on activated sludge. The samples were also analyzed for the potential products of ibuprofen metabolism, such as: 1-hydroxyibuprofen, 1-[4-(2-methylisopropyl)phenyl]ethan-1-ol, 4-ethylbenzaldehyde and ethyl-4-ethoxybenzoate. Although, probes were taken every 30 minutes during the aeration phase, none of the products were detected. The most likely explanation is that the above mentioned intermediates were rapidly metalobized to smaller products. This study, demonstrated that the process in the SBR type reactor is an effective method for IBF removal in which the biodegradation is the dominant mechanism responsible for the removal of the pharmaceutical.

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