



Slovak Society of Chemical Engineering
Institute of Chemical and Environmental Engineering
Slovak University of Technology in Bratislava

PROCEEDINGS

51st International Conference of the Slovak Society of Chemical Engineering SSCHE 2025

Hotel DRUŽBA
Jasná, Demänovská Dolina, Slovakia
May 27 - 30, 2025

Editors: Assoc. Prof. Mário Mihaľ

ISBN: 978-80-8208-158-2, EAN: 9788082081582

Published by the Faculty of Chemical and Food Technology Slovak Technical University in Bratislava in Slovak Chemistry Library for the Institute of Chemical and Environmental Engineering; Radlinského 9, 812 37 Bratislava, 2024

Gloc, M., Paździor, K., Mrozińska, Z., Żyła, R., Ledakowicz, S.: Biodegradation of Ibuprofen Salt in SBR Reactor with Activated Sludge under Aerobic Conditions, Editors: Mihaľ, M., In *51st International Conference of the Slovak Society of Chemical Engineering SSCHE 2025*, Jasná, Demänovská Dolina, Slovakia, 2025.

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

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Key words: pharmaceuticals in wastewater; biological treatment; bioreactor SBR; ibuprofen salt; biodegradation

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 metabolized 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.

Acknowledgement: Financial support from the National Science Centre (Poland) under project number 2021/43/B/ST8/001854 is acknowledged.