SETAC EUROPE 35TH ANNUAL MEETING

11–15 MAY 2025 | VIENNA, AUSTRIA | SETAC.ORG/VIENNA

INNOVATION FOR TOMORROW: PROGRESS IN SAFE AND SUSTAINABLE CONCEPTS

PROGRAMME BOOK

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3.10.P-Th171 - Biodegradation of Sulfonamides and Fluoroquinolones in Domestic Sewage using an Anaerobic Fixed-Bed Biofilm Reactor

Abstract

Among emerging contaminants, antibiotics have particular significance, since they can modify the microbial community, promoting antimicrobial resistance. Fluoroquinolones and sulfonamides are two important classes of antibiotics widely used in human and veterinary medicine worldwide. In this work, the removal of 7 antibiotics frequently detected in urban wastewater was evaluated in an anaerobic fixed-bed biofilm reactor (AnFBBR) treating domestic sewage during 60 days. The antibiotics consisted of 3 sulfonamides sulfamethoxazole (SMX), sulfadimethoxine (SDX) and sulfamerazine (SMZ); and 4 fluoroquinolones ciprofloxacin (CIP), pefloxacin (PEF), enrofloxacin (ENR), and ofloxacin (OFL). The domestic sewage was collected directly from the sewer pipes located near the Environmental Engineering campus of University of Sao Paulo (Sao Carlos, SP, Brazil). The bioreactor's performance was monitored through physical-chemical analyses: pH, alkalinity, volatile acids, chemical oxygen demand (COD), biogas composition (methane and carbon dioxide), and antibiotics. The antibiotics concentration was determined by using a column-switching online solid phase extraction coupled to a liquid chromatography/tandem mass spectrometry (SPE-LC-MS/MS) method - Chromatograph Agilent 1200 LC series and hybrid triple quadrupole-linear ion trap mass spectrometer AB SCIEX QTRAP 5500. A mixed solution of internal standards (SMX-C13, SDX-C13, CIP-D8, ENR-D5) was used to quantify the analytes and correct for matrix effects. The sewage had the following physical-chemical characteristics: COD = 525 ± 27 mg L-1; pH = 7.47 ± 0.17; alkalinity = 172 ± 16 mg L-1. The results indicated high performance of the bioreactor in biodegrade organic matter, with COD removal efficiency = 87 ± 3%, and methane content in the biogas > 70%. The antibiotic removals were: SMX = 83 ± 8%, SDX = 22 ± 25%, SMZ = 55 ± 24%, CIP = 56 ± 21%, PEF = 80 ± 10%, ENR = 82 ± 9%, OFL = 73 ± 6%. SMX, PEF, ENR, and OFL were the most easily biodegradable, while SMZ and CIP showed moderate biodegradation, and SDX showed high recalcitrance. AnFBBR proved to be feasible in removing antibiotics from sewage. However, complementary technologies that can be coupled to the AnFBBR should be further implemented in order to mitigate the effects of antibiotics on the environment, especially the spread and development of antimicrobial resistance genes.

Disclaimer/Disclosure: This work was supported by the São Paulo Research Foundation (FAPESP - grant numbers 2022/10615-1, 2019/22532-0, and 2017/02147-0); and the Coordination for the Improvement of Higher Education Personnel (CAPES - Finance Code 001).

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