

Effects of fluoxetine shock loadings in a aerobic granular sludge sequencing batch reactor

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Pharmaceuticals have received increasing attention as emerging organic pollutants due to their frequent occurrence in the environment and potential adverse effects on ecosystems and to human health. Pharmaceuticals may not be completely metabolized in the human body and can enter municipal sewage systems as the parent drug and as their “biologically active” metabolites. Some of these compounds cannot be easily removed at wastewater treatment plants (WWTPs) [1]. Fluoxetine (FLX) is a chiral fluorinated pharmaceutical indicated mainly for treatment of depression and is one of the most dispensed drugs in the world. There is a clear evidence of environmental contamination with this drug and its active metabolite norfluoxetine (NFLX) [2]. Granular sludge sequencing batch reactors (SBR) constitute a promising technology for the treatment of effluents containing micropollutants.

The main biological processes occurring in wastewater treatment plants - COD, N and P removal - can be inhibited by these pollutants. This study focused on the effect of FLX on the performance of granular sludge SBR and on the diversity of the microbial population under continuous and intermittent feeding of the compound. The COD removal was not markedly affected by FLX shock loads. Ammonium removal was initially affected but after ca. 20 days of FLX feeding, NH_4^+ was not detected in the treated effluent – maximum of 0.03 mM – indicating that ammonia oxidizing bacteria (AOB) became adapted to the presence of FLX. Nitrite was also practically not detected in the treated effluent - maximum of 0.01 mM - indicating that nitrite oxidizing bacteria (NOB) were not inhibited by the presence of the FLX, whereas nitrate accumulated in the effluent, indicating that denitrification was affected. Phosphate removal was markedly affected in the beginning of FLX feeding showing a gradual adaptation to the presence of FLX, being practically not detected in the treated effluent (maximum of 0.04 mM) after 70 days. There was no evidence of FLX biodegradation.

Changes in the bacterial community from aerobic granules were examined using denaturing gradient gel electrophoresis (DGGE) of 16S rRNA. Samples taken before starting the shock loadings with FLX clearly shift from other samples. Moreover, two main branches separate the samples taken during continuous FLX feeding from samples taken during intermittent FLX feeding.

Keywords: Fluoxetine; SBR; Aerobic Granular Sludge

References

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