Moving bed biofilm reactors (MBBRs) for removal of pharmaceuticals in biological wastewater treatment

Torresi, Elena; Polesel, Fabio; Smets, Barth F.; Andersen, Henrik Rasmus; Plósz, Benedek G.; Christensson, Magnus

Publication date: 2017

Document Version
Publisher's PDF, also known as Version of record

Link back to DTU Orbit

Citation (APA):
MOVING BED BIOFILM REACTORS (MBBRs) FOR REMOVAL OF PHARMACEUTICALS IN BIOLOGICAL WASTEWATER TREATMENT

Elena Torresi1,2, Fabio Polesel3, Bethan F. Smets4, Magnus Christensson1, Benedek Gy. Plósz5, Barth F. Smets4, DTU Environment, Technical University of Denmark (DTU), Kongens Lyngby, Denmark
1 DTU Environment, Technical University of Denmark (DTU), Kongens Lyngby, Denmark
2 Veolia Water Technologies AB, AnoxKaldnes, Lund, Sweden
3 Technical University of Munich, Munich, Germany
4 Leuven University, Leuven, Belgium
5 IAS Centre for Environment Research, University of Szeged, Szeged, Hungary
6 Technical University of Denmark (DTU), Kongens Lyngby, Denmark

The post-denitrifying (e.g., 1.5 to 2.5 L MBBR) was bioavailable in the MBBRs (activated sludge) due to the high bioavailability of the primary substrates (carbon and nitrogen) and for a number of pharmaceuticals (e.g., chloramphenicol, diclofenac). This was observed for the three MBBR systems, supporting the removal via cometabolism.

Conclusions

The findings support that MBBRs can be a valuable alternative to CAS in reducing the amount of pharmaceuticals and their biodegradation products in wastewater.

References


Three different operations of MBBR

MBBR 1: Pre-denitrification

The nitrification rate (rmax) increased in S2 compared to the other 2 configurations, with Z50 MBBR compared to the other MBBR configurations, for 14 out of 22 compounds, not significantly correlated with the MBBR thickness. However, the relationships based on the biofilm thickness were non-linear.

MBBR 2: Nitrification

During continuous-flow operation the removal was enhanced in the MBBR dosed with ethanol compared to MBBR 1, exhibited the highest removal efficiencies for 14 out of 22 targeted compounds.

MBBR 3: Post-denitrification

The reduction observed in MBBR 1 (of 1.5 to 2.5 L) was not observed in MBBR 2 (of 1.5 L to 2.5 L) and MBBR 3 (of 1.5 L to 2.5 L) suggesting a cometabolism. Commonly, denitrification was found to be the rate-limiting step in the MBBR systems, suggesting the removal via nitrification.

Comparison with CAS

The three MBBR systems presented a greater removal of pharmaceuticals than the CAS, which is in agreement with previous findings. However, the effectiveness of the MBBR systems in removing pharmaceuticals is dependent on the specific compounds and the wastewater characteristics.

Contact information

Technical University of Denmark

Water Technologies