



Dissertation Fact Sheet

Benzotriazole and Sulfamethoxazole: Biodegradation of polar, non-adsorptive xenobiotic micropollutants with activated sludge communities, pure cultures and consortia thereof



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Referees -

The polar, xenobiotic micropollutants 1-H-benzotriazole, 4- and 5-tolyltriazole (BTri, 4-TTri, 5-TTri, summarized as BTs), and the sulfonamide antibiotic sulfamethoxazole (SMX) are due to their widespread applications almost omnipresent in aquatic systems, including drinking water. This work is conducted to evaluate the biodegradation potential of activated sludge communities (ASCs) and pure cultures towards these pollutants.

Firstly, the biodegradation potential of ASCs towards the three benzotriazole species is evaluated. Secondly, the biological removal of SMX by pure cultures isolated from ASC is investigated under different nutrient conditions.

For that purpose the Bavarian State Ministry of the Environment and Public Health (StMUG) granted a 3-year research project that is conducted in cooperation with the Institute of Water Systems Engineering (TUM) and the Bavarian Environment Agency (LfU, department 77, Prof. Dr. Lemmer).

To study the biodegradation potential of different activated sludge communities (ASC) three different wastewater treatment plants were sampled and monitored for their BTs concentrations. This monitoring approach will extend our knowledge of BTs removal during wastewater treatment by considering the contribution to removal of both different treatment stages and treatment systems.

Biodegradation experiments are known from literature but the influences of nutrients or the concentrations of carbon and nitrogen sources were never investigated in detail but might lead to a better understanding on how to improve BTs removal. To further improve the biodegradation capacity of ASC, especially towards 5-TTri, specific experi-

ments to increase 5-TTri biodegradation are performed. Acclimation (Figure 1) was used to increase 5-TTri removal with ASCs that already had the ability to biodegrade 5-TTri. Additionally, experiments with high concentrations of nitrogen and a sludge-derived supplement are assumed to show the effect of nutrients on the ASCs' 5-TTri degradation capacity.

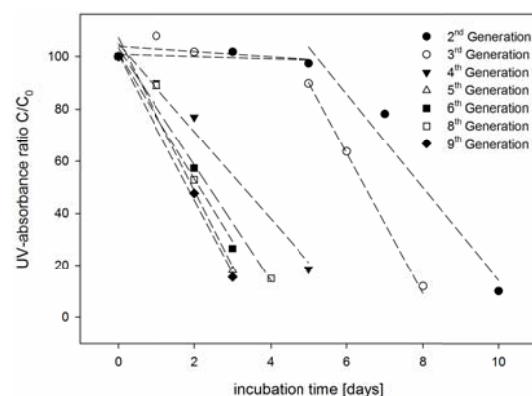


Figure 1– 5-TTri biodegradation in acclimated ASC. Dashed lines represent linear removals calculated by a linear function (R^2 values ranging from 0.71 to 0.98).

Although many studies are available on BTs' removal in WWTPs, no study up to now describes the bacterial structure of a BTs biodegrading community. In this approach the structure and composition of a 5-TTri biodegrading ASC shall be characterized by means of metagenomic and metatranscriptomic analyses that are compared to commonly used DGGE approaches.

In a final approach, SMX biodegrading organisms shall be isolated and characterized. The species found are compared regarding their biodegradation potential by using different nutrients especially focusing on the effect of carbon and nitrogen supply.