**Effects of Solids Retention Time on Micropollutant Biotransformation Rates and Pathways in Activated Sludge**

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For the majority of polar micropollutants carried by the sewer system, biodegradation by microorganisms in aerobic activated sludge is the predominant removal pathway. This process is difficult to understand and predict because it depends as much on the composition and activity of the microbial consortium as on the molecular structure. In biological treatment stages of wastewater treatment plants (WWTPs), an important parameter is the solids retention time (SRT) or sludge age, defined as the time during which the suspended biomass, on average, is retained in the system. Since slow-growing prokaryotes such as nitrifying bacteria can only build up significant populations at higher sludge ages, the SRT significantly influences the microbial community composition. Within the last decade, several research groups reported an enhanced micropollutant removal capacity of different compounds at higher SRTs, e.g., (Clara *et al.* 2005). However, up to now it is not clear what compound classes and types of biotransformation reactions are affected by changes in sludge age.

In order to investigate the biotransformation rates as a function of sludge age, a series of six parallel sequencing batch reactors (SBRs) was operated at solids retention times between 1 and 15 days. In batch experiments, the resulting activated sludge communities were then exposed to a mixture of micropollutants. Chemical samples were collected over three days and analyzed using high-resolution tandem mass spectrometry. From the concentration-time series, biodegradation rate constants for 82 compounds were estimated using a pseudo-first order kinetic model corrected for reversible sorption to the suspended solids (Gulde *et al.* 2014). The estimated rates were normalized by the biomass concentration and compared across the different SRTs. Whereas some of the investigated compounds showed no significant differences in biotransformation rate constants as a function of SRT, others showed a clear trend of increasing rate constants with higher sludge age. For example, the biotransformation of pargyline shows a much faster transformation rate at higher sludge ages. Analysis of transformation pathways revealed that the predominant pathway for pargyline is oxidation of the tertiary nitrogen to form N-oxide. On the other hand, amines for which other transformation pathways were found to be more important, e.g., pheniramine, do not show an increase in rate constants along the SRT gradient. Also for other compound classes, e.g., chlorinated phenylureas or chloroacetanilides, higher biotransformation rate constants were observed at higher sludge ages. The results suggest that whether or not certain compounds show an increased removal with SRT depends on the type of transformation they are undergoing. These observations will also provide valuable hints towards identifying the underlying causes for the increased removal of certain micropollutants with increased SRT. As part of our ongoing research, the observed trends among different reactions types will be reassessed and confirmed in further experiments.

Clara M., et al. (2005). *Water Research* **39**(1), 97-106.

Gulde R., et al. (2014). *Environ Sci Technol* **48**(23), 13760-8.