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A Combined Approach to Measure Micropollutant Behaviour during Riverbank Filtration

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Riverbank filtration (RBF) systems are widely used as natural treatment process. The advantages of RBF over surface water abstraction are the elimination of for example suspended solids, biodegradable compounds (like specific micropollutants), bacteria and viruses (Hiscock and Grischek, 2002). However, in contrast to its importance, remarkably less is known on the respective external (e.g. industrial or municipal sewage) and the internal (e.g. wildlife and agricultural influence) sources of contaminants, the environmental availability and fate of the various hazardous substances, and its potential transport during soil and aquifer passage. The goal of this study is to get an insight in the behaviour of various micropollutants and microbial indicators during riverbank filtration. Field measurements were combined with numerical modelling approaches.
The study area comprises an alluvial backwater and floodplain area downstream of Vienna. The river is highly dynamic, with discharges ranging from 900 m3/s during low flow to 11000 m3/s during flood events. Samples were taken in several monitoring wells along a transect extending from the river towards a backwater river in the floodplain. Three of the piezometers were situated in the first 20 meters away from the river in order to obtain information about micropollutant behaviour close to the river.
A total of 9 different micropollutants were analysed in grab samples taken under different river flow conditions (n=33). Following enrichment using SPE, analysis was performed using high performance liquid chromatography-tandem mass spectrometry. Faecal indicators (E. coli and enterococci) and bacterial spores were enumerated in sample volumes of 1 L each using cultivation based methods (ISO 16649-1, ISO 7899-2:2000 and ISO 6222).
The analysis showed that some compounds, e.g. ibuprofen and diclofenac, were only found in the river. These compounds were already degraded in the first ten meters away from the river. Analysis of carbamazepine however showed just a slight decrease in concentrations from the river towards the backwater river. Indicator bacteria showed a clear decrease already along the first meters. In the samples taken from the monitoring groundwater wells and abstraction well, faecal indicators were not detected in sample volumes of 1 L each.
A combined approach using field measurements and a 3D groundwater transport model proved to be a suitable method to determine the behaviour of various micropollutants and faecal indicators.

References

Hiscock, K. M. and Grischek, T. (2002) Attenuation of groundwater pollution by bank filtration. Journal of Hydrology, 266(3-4), 139–144.

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