

Transport and fate of microplastics in comparison to silica colloids: a karst aquifer field study.

FERRY SCHIPERSKI¹ AND TRAU GOTT SCHEYTT²

¹ Department of Applied Geosciences, Applied
Geochemistry, Technische Universität Berlin, 10587
Berlin, Germany

² Technische Universität Bergakademie Freiberg, Dept. of
Geology, Hydrogeology, 09596 Freiberg, Germany

Although karst aquifers are far more susceptible to contamination than porous aquifers, with the transport of particulate matter being an important factor, little is known about the attenuation of solutes within karst aquifers and even less about the attenuation of colloids such as bacteria, virus, and microplastics.

This study has therefore aimed at identifying processes that influence the transport and attenuation of selected colloids within a karst aquifer. A multitracer test using four different types of 1 µm large colloids (silica-plain, silica-carboxylated, polysterol-plain, polysterol-carboxylated) and the solute tracer uranine was performed in the catchment of the thoroughly investigated Gallusquelle karst spring in SW-Germany. Silica colloids were used as surrogate for the transport behavior of silicate minerals, whereas polysterol colloids were selected as surrogate for bacteria (similar size and surface charge). At the same time, the polysterol particles gave a crucial insight into the transport behavior of microplastics in this type of aquifer.

Both silica and polystyrene colloids were found to be mobile at the same transport velocity in groundwater over a distance of about 3 km. Yet, the transport behavior varied significantly between the various colloids and the uranine dye, with the breakthrough of colloids occurring slightly earlier than that of uranine. No attenuation was observed for plain silica colloids in contrast to the polysterol particles. However, the lowest particle recovery was still in the range of ~10% of the input mass.

Hence, microplastics and colloids with characteristics similar to those used in this study may pose a threat to karst spring water as they might contaminate groundwater as well as facilitate the transport of other contaminants.