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Biofilms as a new environmental compartment: how most of the Ultraviolet Filters are retained in biofilm and soil in the context of Managed Aquifer Recharge

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Ultraviolet filters (UVFs) are constituents of a large number of personal care and hygiene products and other consumer goods. The most used are benzophenones, such as benzophenone-3 (BP-3), benzophenone-4 and avobenzone. All these compounds are characterized by a high photo-stability and lipophilicity. Although this, most of their monitoring has been traditionally centered on aqueous phase, but their high lipophilicity (high logKow)make foreseeable their accumulation in organic phases in porous media, such as biofilm or sedimentary organic matter. With this, this work is aimed at characterizing the fate of UVFs in the context of Managed Aquifer Recharge. We have performed a very intensive monitoring of benzophenones and transformation products in a pilot field MAR system in the three phases: water, biofilm and sedimentary organic matter. The presence of UVFs was associated to their presence in the recharge water, which came from a waste water treatment plant. The experimental results were also corroborated with a numerical model assessing the fate of UVFs in the three phases. This work has demonstrated that biofilm played a central role in the fate of UVFs, controlling both sorption and biodegradation. It acted as an additional environmental compartment favoring the retention and degradation of UVFs in porous media.