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Passive Removal of Stormwater Polar Organic Contaminants in Geomedia-Amended Biofilters

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Next-generation stormwater drainage systems (e.g., green infrastructure) are increasingly implemented to enable runoff infiltration into the subsoil for aquifer recharge. Unfortunately, urban runoff can act as a major transport vector of pollution, and conventional infrastructure fails to remove polar organic contaminants. We studied the transport and removal of novel polar (mobile) stormwater vehicle-related organic contaminants of emerging concern, utilizing batch experiments and laboratory sand biofilters amended with granulated activated carbon (GAC) and biochar. Rapid small-scale column breakthrough curves and a 1D transport model demonstrated geomedia amendments can enhance target organic contaminant removal via sorption. However, contaminant transport was subject to kinetic effects, making it sensitive to infiltration flow rates and hydraulic retention times. To overcome these challenges, we developed pilot-scale 1-m length biofilters operating at relevant environmental conditions. These columns included a water retention zone equipped with various sensors to keep track of hydraulic and contaminant removal performance. Overall, our research contributes to understanding pollutant fate and transport during passive infiltration and enhancing conventional removal technologies for polar organic contaminants.