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SUSTAINABLE REMOVAL OF ORGANIC MICROPOLLUTANTS THROUGH RIVERBANK FILTRATION (RBF) AND ARTIFICIAL RECHARGE AND RECOVERY (ARR)

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ABSTRACT: River bank filtration (RBF) is a natural process that has been used for public and industrial water supply in Europe for more than a century and for nearly half a century in the United States to treat a variety of water-borne contaminants. In the U.S., RBF is becoming increasingly recognized over the past years as a viable option for water utilities required to meet stringent regulations for the direct use of surface water of impaired quality. Recent research revealed that RBF can effectively attenuate organic micropollutants of concern, which might be present in impaired source water, although a fundamental understanding of the removal mechanisms for organic micropollutants in RBF systems is still missing. One of the major concerns regarding the use of surface water sources of impaired quality for drinking water supply is the survival and accumulation of organic micropollutants, such as endocrine disruptors (EDCs), pharmaceutical residues, personal care products, pesticides, or N-nitrosamines. The purpose of this study was to investigate the role of RBF and artificial recharge and recovery (ARR) as a sustainable, cost-effective pre-treatment to remove bulk organics and organic micropollutants as part of the City of Aurora's proposed drinking water facility using the South Platte River as source water. The main focus of study findings reported here was directed to understand the role of hydraulics, geology, river water quality, subsurface conditions, and operational conditions on the attenuation of select constituents of concern. Several emerging micropollutants were selected for this study that differed regarding physico-chemical properties, such as molecular size and hydrophobicity (indicated by KOW), and their reported biodegradability. Removal of these compounds was investigated using controlled soil-column experiments simulating saturated anoxic, unsaturated oxic and abiotic flow conditions. These systems allowed delineating whether attenuation was based upon biotransformation or adsorption. The experiments provided a basis to derive biodegradation rate constants for a variety of organic micropollutants of concern. Laboratory results were verified through monitoring campaigns at a demonstration-scale RBF facility at the South Platte River. Study findings support that RBF and ARR systems can provide a reliable barrier for a majority of organic microcontaminants.

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