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Translating polymer physics from the lab to the field

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Recent years witnessed increased activity in the application of fundamental principles of polymer physics and polymer chemistry in helping solve pressing environmental issues using eco-friendly approaches. We will describe examples of two polymer material platforms, i.e., surface-anchored polymer grafts and silicone elastomers, and their utilization in 1) minimizing non-specific bioadsorption, and 2) removal of metals/toxins and volatile organic compounds (VOCs) from contaminated waters. Optimal performance of such materials requires detailed knowledge and tunability of their chemical composition and topology. We will demonstrate that non-specific bioadsorption is heavily reduced on substrates made of PEG-ylated or zwitterionic chemistries whose topologies comprise either gels or polymeric grafts with high areal densities. We will also present an effective method utilizing organic mimics of metallothioneins, high cysteine containing peptides, for removing heavy metals and toxins from contaminated waters. Finally, we will discuss a simple, yet powerful, method of removing VOCs from waters by utilizing silicone elastomers that act as effective “sponges”.