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Extracting microplastics from water using biofilms grown on pervious concrete

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Microplastics are ubiquitous contaminants where particle sizes are < 5 mm. They are easily mobilized and transported from terrestrial to aquatic environments via storm and surface water runoff and are consequently found globally in diverse ecosystems. In the effort to reduce microplastic transport, biofilms offer a promising solution. This work presents the first steps in integrating biofilms with concrete flatwork infrastructure, such as sidewalk pavers, by using pervious concrete as the substratum for biofilm growth. Unlike traditional concrete mix designs, pervious concrete omits the use of fine aggregates (i.e., sand) creating pore space within the concrete matrix which allows water to pass directly through it. The high porosity of pervious concrete can support stormwater management and benefit biofilm growth for particle trapping. Methods were developed to grow biofilms on different mix designs of pervious concrete in concrete-filled columns achieving cell densities of 10^7 cfu/g concrete, with the goal of injecting microplastic solutions through the biofilm to assess particle transport and capture. Microplastic solutions were initially passed through columns containing concrete without biofilms to determine any baseline particle capture with the concrete alone using FlowCam analysis to assess the particle concentrations. It is anticipated that biofilm will trap the microplastics above the particle capture by concrete without biofilm and FlowCam analysis on influent and effluent samples will be used to calculate removal efficiencies. Image analysis such as with SEM will be used to visualize plastic trapping in biofilms. These initial experiments indicate that biofilms integrated into pervious concrete infrastructure may offer a strategy to trap and extract microplastics from storm and surface water runoff events.

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References

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