Rethinking Our Roads: The Ability of Porous Concrete to Reduce Surface Runoff of Tire Wear Particles (TWP)

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This project investigates porous concrete as a potential mitigation tactic for the surface runoff of tire wear particles (TWP). To maintain grip on the road, a tire gradually wears down its outer tread, a composition of synthetic polymers, reinforcing agents, and a comparatively small percentage of natural rubber. In this process, particles are shed in sizes from 4 to 265 micrometers, which, because of their composition, are considered microplastics. Overtime, surface runoff transports TWP to roadsides and nearby bodies of water, where they directly penetrate the environment. In Part 1 of this study, 6 samples of roadside sediment were collected and analyzed using a microplastic-sediment isolation unit; TWP was detected in 5 of them, especially in areas of high and medium traffic with impermeable surfaces (asphalt or concrete). As expected, results suggest that impermeable surfaces are major factors that encourage TWP surface runoff. Thus, as a potential solution, a mix of porous concrete, which utilizes more large aggregate and little or no sand to increase void space, was compared against that of traditional concrete for its ability to reduce surface runoff of TWP. Using a custom testing apparatus, water flow tests with and without TWP were conducted. Results indicate that porous concrete could be effective in reducing surface runoff of TWP. However, further tests are needed to optimize the percolation to sequestering rate of the concrete to minimize clogging and prevent future issues. Although further testing is needed, porous concrete could pave the way to a more sustainable future.

Awards Won:

China Association for Science and Technology (CAST): Award of $1,200

Air Force Research Laboratory on behalf of the United States Air Force: First Award of $750 in each Regeneron ISEF Category