Recycled Carbon Fiber Composites in Permeable Pavement

A Game Changer for the Environment

The same light-weight carbon fiber that will improve the efficiency of Boeing aircraft may also clean the polluted rain water that dirties Puget Sound and rivers in our region.

Washington State University is collaborating with Boeing and the Washington Stormwater Center to research the use of recycled carbon fiber composites to strengthen permeable pavement, a porous paving material that can mitigate pollution from stormwater runoff.

This research, supported by Boeing with a $212,000 grant to the Stormwater Center, relies on donated carbon fiber composite material from aircraft production operations. The grant supports research programs at the WSU Puyallup Research and Extension Center and on the Pullman campus through the university's Composite Materials and Engineering Center (CMEC).

Stormwater – or polluted rainwater, as John Stark, environmental toxicologist, Director of the Stormwater Center, and WSU professor and administrator likes to call it – is a particularly challenging byproduct of urban life.

Rain beats down onto conventional roads and parking lots picking up contaminants as it is channeled into local creeks, rivers, lakes, the Puget Sound, and the Pacific Ocean. Approximately 85 percent of the water pollution in the United States is caused by this kind of runoff, according to the US Environmental Protection Agency.

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"Water is one of our most precious resources, and we need to treat it as such," says Ursula English, vice president of Boeing Environment, Health, and Safety. "Creating the opportunity to expand the use of permeable pavement is good for the environment and the communities in which we live and work."

According to the EPA, permeable pavement allows the polluted stormwater to percolate and infiltrate through the surface into the soil below, where the water is naturally filtered and pollutants removed. Since 2010, Stark and his colleagues have been relying on grant money from the Washington Department of Ecology and the City of Puyallup to study the positive impacts of permeable pavement.

"The water trickles through the pavement to a gravel base below. Over time, the water seeps into the ground where many impurities are filtered out," says Stark. "We've been closely monitoring data. It's 100 percent effective at filtrating water and stopping runoff."

Though permeable pavement is effective in parking lots and side roads, it's generally not strong enough for heavily travelled highways or high-use surfaces that have heavy equipment running back and forth on the pavement. The new collaborative research will test whether recycled carbon fiber composite material can strengthen permeable pavement and expand its potential use.

"If we find this material safely strengthens permeable pavement, resulting in an increase in its use, this could be a game changer in terms of reducing the impact of pollutants in stormwater on the environment," says Stark. "Preliminary results look promising in terms of increasing the strength of the pavement and reducing the toxicity of the pollutants."

Stark and his colleagues are working with engineers at the WSU CMEC and at Boeing on the next phase of the research. They will be evaluating the durability of the modified pavements on experimental stretches of asphalt exposed to vehicle traffic. Researchers will examine whether the addition of carbon fibers increases pollution filtering and how long the filtering process lasts with wear and tear on the permeable pavement material.

John Stark is an ecotoxicologist specializing in ecological risk assessment of threatened and endangered species. He was recently named Director of the Washington Stormwater Center, located at WSU Puyallup Research and Extension Center.