PROJECT FACT SHEET

PROJECT – FOAM FILTRATION WITH NATURAL FIBERS

Objective

The foam filtration project uses renewable natural fibers (wool, hair, feathers, etc.) as a simple, cost-effective media for removal of surfactants from firefighting effluent. This effluent surfactants from Aqueous Film Forming Foam (AFFF) that cannot be released to wastewater treatment facilities if excessive foaming occurs during treatment. The original target of the project, generically stated, was to remove surfactants to the point that the effluent could be released to wastewater treatment facilities. However, that goal dramatically changed upon changes in USAF policy with regard to perfluorinated surfactants. Hence this project switched to measuring the removal efficiency of human hair, dog hair, and alpaca wool for removal of per- and polyfluroalkyl substances (PFAS) from a highly contaminated effluent stream (firefighting wastewater). The DoD is working aggressively to address the national PFAS issue in a cohesive, consistent manner while coordinating and communicating with external stakeholders. We are making substantial progress toward understanding the Department's use of AFFF, researching fluorine-free alternatives to AFFF, and containing and minimizing firefighting effluent at firefighter training sites. This project on foam filtration with renewable natural fibers works to further those goals in research and development.

Technology Description

In partnership with Matter of Trust, renewable fibers were sourced and first tested in the lab for removal of foam, perfluorooctonanesulfonic acid (PFOS), perfluorooctonoic acid (PFOA), and other contaminants found in wastewater such as heavy metals and nitrogen. After this initial proof of concept was successful in the lab, a larger-scale system was designed and built to demonstrate scale-up at the Silver Flag fire pit at Tyndall AFB, FL. System treated 20,000 gallons per week, with 200 lbs of dry material per line in each of three lines, with 200 lbs of granular activated carbon (GAC) as a comparison. The first tests involved human hair, as hair is easiest to get in large amounts, but the next round of tests will be conducted with alpaca hair.

Benefits

The project successfully demonstrated removal of PFAS by adsorption to renewable fibers. Fibers conditioned at low pH removed >6500 ng/L of total PFAS (>90+% of original concentration) in a single step, comparable to an equivalent amount of GAC by weight. That concentration of removed PFAS is nearly 100 times the currently acceptable drinking water levels. Additional optimization of the filtration matrix will continue to build adsorption capacity and efficiency. The bulk adsorption material fits well with other steps in waste water management, e.g., other bulk materials for physiochemical removal and concentration of the contaminants. Being able to filter the water with inexpensive, renewable fibers as opposed to the more expensive alternatives of ionic resins will result in a substantial cost savings for the DoD. The present bulk fiber mix can be supplied at approximately $4/lb, while GAC is available for as little as $1/lb. Those costs for natural fibers will undoubtedly decrease with the economy of scale and new practices. Moreover the binding chemistry for natural fibers differs from GAC and will provide means to treat additional contaminants in the waste stream. Expanded trials will reveal an improved approach (or combination of approaches) for the treatment regimen.