The Development of an Oleophilic and Hydrophobic Polystyrene Synthetic Polymer Coated Cotton for High Efficiency Marine Oil Spill Absorption

Oil spills are an increasingly growing environmental threat and current forms of remediation are costly, inefficient, and toxic. The purpose of this project was to develop a novel absorbent, by functionalizing cotton with polystyrene, for purposes of remediating a marine oil spill. The novel polystyrene coated cotton was synthesized in a laboratory environment at 80 degrees Celsius in an isolated sand bath for even heat distribution. In addition, a different semi-synthetic polymer, cellulose acetate, was synthesized in a water bath at 90 degrees Celsius, for comparison purposes. The oil spills were simulated in petri dishes with 30 mL of water and 5 mL of crude oil. Five different absorbents were tested for efficiency in oil spill absorption: two absorbents that were synthesized in this project, two natural absorbents (raw wool and non-functionalized cotton) and a commercial oil-absorbing polymer (Enviro-Bond 403). Fifty data trials were collected, ten trials for each absorbent. The polystyrene coated cotton, that exhibited hydrophobic and oleophilic properties, was the most efficient of the five absorbents, averaging at 81% absorption efficiency, plus or minus 2%, deeming this project successful and validating the hypothesis. Non-functionalized cotton, the control, had an average efficiency of 24 %, plus or minus 4%, showing that it is on an average 56.3% less efficient than the polystyrene coated cotton. Future work including cost analysis using data extrapolation would need to occur before large-scale commercial implementation. However based on these initial results, this novel absorbent has a strong potential for efficient marine oil spill remediation.

Awards Won:

Third Award of $1,000