

# Polymeric Environmental Cycle: Synthesis of Crystals from Expanded Polystyrene to Solve Problems in the Petroleum Industry

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This research aims solving two different problems. The first one is the non-complete recycling of expanded polystyrene (EPS) which, due the delay in its decomposition – around 150 years, leads to environmental problems such as: clogging in sewers and occupation of large areas in dumps. The second problem shows that the oil spill in the seas is assessed as an environmental catastrophe that affects marine life and its environmental cycles. In this case, it is verified that there is a lack of good equipment for oil removal, which is usually originated by accidental spillage and by the ballast water management. Thus, the objective of this work was to develop new applications for polystyrene foam in a polymeric environmental cycle, transforming EPS into crystalline materials able of reducing maritime pollution by oil. In the first part of the methodology, a smooth crystal structure was produced from EPS which repel nonpolar liquids by 94.5% at different angles. It is suggested that this material would be useful for coating of tanks and for tubes transporting oil and derivatives. In the second part, the membrane obtained from EPS reaction with ammonium chloride and a porous crystal was obtained, when coated with polypropylene could adsorb 85% of the oil in the water and the adsorbed liquid could be recovered with simple distillation. Tests showed the crystals degraded in 3-4 months using *Pseudomonas putida* and the residue generated by the bacteria could be transformed into polystyrene by polymerization, thereby forming a cycle of the polymer. These new products from EPS represent a new alternative to solve environmental, economic and social problems. The products developed are 56 times more efficient and 120 times more economic than the methods currently used.

## Awards Won:

Arizona State University: Arizona State University Intel ISEF Scholarship

University of Arizona: Tuition Scholarship Award