Determining the Toxicological Effects of Polyurethane Foam and Complex Leachate on Artemia nauplii

Worrell, Virginia (School: Southwest Virginia Governor's School)

Plastics are of increasing concern in the marine environment. When plastics break down into microplastics (<5mm), they release additives. A specific microplastic of interest is polyurethane foam (PUF), used in many applications, because it contains a high concentration of additives. These additives have never been examined as a mixture, as they would appear in the environment. For this project, triphenyl phosphate (TPP), tris (1,3- dichloro -2- propyl) phosphate (TDCPP), compound mixture DE-71 (contains various polybrominated diphenyl ethers), PUF leachate, and a mock leachate (containing a mixture of individual additives) were evaluated at different concentrations for toxicity to the model assay organism, Artemia sp. It was hypothesized that toxicity of additives would be amplified when combined with others. At the conclusion of 96-hour acute bioassays, PUF leachate and DE-71 were not toxic to Artemia at concentrations tested. However, significant mortalities were recorded in the mock leachate, TPP, and TDCPP (ANOVA p-value of <0.0001). Statistical testing determined a significant difference between the controls, high and medium concentrations of mock leachate, and between the controls and the high concentrations of TPP and TDCPP. LC50 for each of these treatments were calculated to be at environmentally significant concentrations below their water solubility. This shows the magnified toxicity of chemicals as a mixture, which should continue to be researched in the future. Another topic of interest for future work would be the long-term effects of these additives and the mixture of additives, as they are very slow to degrade and can persist for long spans of time.

Awards Won: