Developing and Assessing Fucose-Based Water-Soluble Bioplastics

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Since their invention decades ago, single-use plastics have shaped the way people live. However, in recent years, light has been shed on the dangers they pose to marine ecosystems due to released toxins. Despite the environmental hazards surrounding single-use plastic waste, there is little research regarding the development of water-soluble bioplastics from renewable sources to mitigate these effects. The purpose of this study was to develop water-soluble bioplastics from algae and other natural materials. This work expands upon previous methods of developing bioplastics, but the composition of the polymer itself is novel. It was hypothesized there would be a difference in the dissolution and pH alteration of the fucose-based products in comparison to previously developed PVA-based plastics. Four trials were performed, each with varying amounts of fucose by mass. Additionally, these trials were directly compared to previously studied polyvinyl alcohol-based plastics with different compositions of PVA by mass. Each product was tested in both freshwater and 3.5% saline media; pH level was recorded after each 24-hour interval. I found that the 90% fucose-based plastic dissolved the most with 63.24% dissolution; this was less than the 72.55% of the 90% PVA plastic's dissolved mass. Chi-Square tests comparing the fucose and PVA plastics, showed no significant difference in the dissolutions. The PVA plastics did not significantly alter their freshwater environments' while the fucose-based plastics significantly altered pH after both 24 and 48 hours of testing, as supported by P values of 0.0002 and 0.001, respectively.

Awards Won:
United States Environmental Protection Agency: The Patrick Hurd Sustainability Award covers travel for the ISEF finalist to attend and participate in EPA's National Sustainable Design Expo