Sustainable Bioplastics for Marine and Terrestrial Biomes

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Currently, plastic pollution is one of the major environmental challenges faced due to the mass presence of synthetic polymers and their degradation into microplastics and nanoplastics, which impact natural biomes and contribute to climate change. Only 9% of plastic is recycled, while approximately 79% ends up in landfills (Varela, 2023), prompting measures such as Puerto Rico Law No. 247-2015, which promotes the use of reusable bags and regulates plastic bag consumption (Act to Promote Reusable Bags and to Regulate the Use of Plastic Bags in the Commonwealth of Puerto Rico, 2015). As a result, this research aims to design two fully organic bioplastics as sustainable prototypes for the future development of biodegradable commercial bags. The formula designed by the student researchers is based on organic components and pulverized agar, combined with water and honey as natural plasticizers, replacing processed glycerin. The researchers conducted the experimental process six times to optimize the formulation and improve mechanical strength. The resulting prototypes were evaluated by students through spring scale testing, pH measurement, environmental simulations, and analysis of eight samples under controlled terrestrial as well as aquatic conditions. Results showed maintained functionality of the designed bioplastics and complete biodegradation within approximately 15 days, supporting the approval of the research hypothesis by the significant contrast of the biodegradation cycle linked to polymer bags. However, the original aquatic variant exhibited chemical instability due to acidic pH levels, leading to the proposal of an optimized alternative with stable pH ingredients to achieve neutral and efficient results.

Awards Won:
Fourth Award of $600