

Turning Trash Into Treasure: Creating Sustainable Bioplastic Products From Food Waste Through Innovation

Lai, Jonathan (School: Bartlesville High School)

Microplastics persist in the environment, move across the food chain, and are easily ingested because of their tiny sizes, harming aquatic organisms and posing health risks to humans. As part of United Nations Sustainable Development Goals, this project aims to develop an innovative process utilizing 100% renewable materials and recycled fruit peel waste to create sustainable bioplastic products with enhanced strength. In this project, a variety of bioplastics were produced from various fruit peel waste, including orange, grapefruit, lemon, apple, and pear. The impact of fruit peel content and the type of fruit peel has been studied systematically. The results indicated that the strategy of adding recycled fruit peel waste significantly enhanced the strength of cornstarch bioplastics by 70% through leveraging the interaction between pectin from fruit waste and cornstarch. The optimal fruit peel to cornstarch ratio was determined to be 1.5 : 8.5 that maximizes the strength. Orange peel was identified as the best fruit peel waste for bioplastic strength. Citrus family was discovered as the optimal type of fruit for bioplastic strength. The light transmittance varied with both the types of fruit peels and their contents, providing the flexibility to meet different packaging requirements. Microscope images validated the uniformity and quality of fruit powders and bioplastics. Finally, tangible prototype sustainable bioplastic products have been produced with purpose to eliminate microplastic's adverse health impact. This research paved the way for a circular economy through recycling fruit waste to create renewable and eco-friendly bioplastic products to achieve long-term sustainability.

Awards Won:

