Testing the Safety and Viability of a Cross-linked Starch-Based Bioplastic in Food Packaging and Food Industry Applications

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Petroleum-based single-use plastic food packaging is currently one of the largest contributors to global plastic pollution, causing widespread environmental problems. Bioplastics are polymers that are made from non-petroleum ingredients. Bioplastic production is used on rare occasions in large manufacturing settings, but these materials often have non-degradable additives. There is a need for a plastic that is biodegradable, versatile, and can be realistically produced on a wide scale and eventually become the industry standard. Following the 12 Green Chemistry Principles, we wanted to develop a durable, biodegradable, and renewable alternative with Tapioca starch, glycerol, and citric acid; specifically, the bioplastic was modeled after polyethylene food packaging. Concentrations of tapioca starch ranging from 12% to 20% were heated with 10% glycerol. To test the effect of ester bond cross-linking, citric acid was added; strong heating (100C) and long reaction times (24h) were used to ensure the reaction. Through a series of physical and chemical tests, we found the optimal combination to be 10% glycerol, 20% starch, and no citric acid. In the future, we will adjust the preparation method to allow the plastic to be more water-resistant while remaining compostable. Additionally testing water permeability and possible antimicrobial preservative agents.

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