Influence of Gel Content on the Strength of Produced Amylose Bioplastic Films

Wong, Jake

Starch-based bioplastics and amylose films play vital roles in modern engineering industries. While much is known about the effects of certain substances on the quality of plastic produced, the scientific community lacks a cumulative, quantifiable method to analyze the effects of gel content on the quality of plastic. Thus, the goal was to bridge the gap between qualitative predictions and quantitative evidence. To gather data, four ingredients in the plastic-gel mixture were manipulated: glycerol content, acetic acid content, water content, and cornstarch content. These quantities were adjusted throughout the experiment, and the tensile strength of plastic film produced was recorded. The force of gravity stressed pre-measured plastic sheets of uniform thickness until they ripped. Six samples were taken for each combination of gel content. Ninety-five percent confidence intervals were constructed with these samples, and regression equations modeled the lower and upper boundaries of these intervals. Next, the effects of plasticizers (glycerol, water, and excess acid) and the effects of increasing amylose percentage were successfully combined to create a more comprehensive model for tensile strength analysis and optimization. Because this experiment did not test the effect of changing more than one variable at once, inaccurate extrapolation limits its usefulness. Still, the model is built on ninety-five percent confidence intervals, so one is able to optimize a certain strength, under predetermined concentrations of gel content and a specified confidence level. When combined with a study of residual patterns and further stochastic modeling, the final model provides a baseline for a reasonably accurate, baseline, quantitative analysis.

Awards Won: