

Siriluk Phankhoksoong 2009: Determination of Suitable Processing Conditions for Injection Molding and Properties of Biopolymer Blends: Rice Starch/Rice Chaff/Polyethylene by Design of Experiments. Master of Engineering (Industrial Engineering), Major Field: Industrial Engineering, Department of Industrial Engineering.
Thesis Advisor: Mr. Chuckaphun Aramphongphun, Ph.D. 173 pages.

This research work is a study of the injection molding process and properties of biopolymer blends between (a) biomaterials: rice starch and rice chaff, which were prepared with 5% additive (commercial formulation) and (b) virgin and regrind low density polyethylene (LDPE). Specimens were prepared with the amount of the biomaterials varied from 0, 70, 75, 80, 85 and 100% by weight and were mechanically tested following the ASTM standard. The results showed that the mechanical properties of the rice starch blend were greater than those of the rice chaff blend. In addition, as the content of the biomaterials increased, tensile strength, flexural strength and moisture absorption increased while the elongation at break decreased. In addition, the biopolymer blends prepared by the regrind LDPE had slightly lower mechanical properties than the biopolymer blends prepared by virgin LDPE. Moreover, melt temperature (T_m) and crystallization temperature (T_c) were not changed while the heat energy (ΔH) decreased when the content of the biomaterials increased. Swelling of the biopolymer blends in the chemical solutions was less than 10% when compared to virgin LDPE.

The 2⁵ Full Factorial experiment was used to design the experiment and Analysis of Variance (ANOVA) was used to analyze the tensile strength. The biopolymer blends between biomaterial/LDPE content of 70/30 by weight was the most suitable blend. The results showed that the 70/30 content of the specimen minimized phase separation with mostly homogeneous surface and color as well as complete specimen. In addition, the suitable processing conditions for the starch/LDPE blend with tensile strength of 15.62 MPa were 80% injection speed, 40 bar injection pressure, 60 bar holding pressure, and 175°C melt temperature. The suitable processing conditions for the chaff/LDPE blend with tensile strength of 13.95 MPa were 45% injection speed, 85 bar injection pressure, 75 bar holding pressure, 175°C melt temperature.

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Thesis Advisor's signature

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