

Ornwaree Ratcharak 2011: Coating of Biopolymer with Poly(Trifluoroethyl Methacrylate) using Rapid Expansion of Supercritical Solutions Process. Master of Science (Packaging Technology), Major Field: Packaging Technology, Department of Packaging and Materials Technology. Thesis Advisor: Ms. Amporn Sane, Ph.D. 88 pages.

The objective of this research was to improve moisture barrier property of a polymer blend consisting of thermoplastic starch and poly(butylene adipate-co-terephthalate) (TPS/PBAT) with poly(trifluoroethyl methacrylate) (PTFEMA) using rapid expansion of supercritical solutions process. This work was composed of two main sections. First, the study focused on determination of coating capacity of rapid expansion of supercritical solutions process and investigation of the effect of coating conditions on PTFEMA particle sizes and morphology, as well as the PTFEMA-coated surface characteristics of TPS/PBAT blend sheets. The second part involved the measurements of water and oil contact angle, water vapor and oxygen permeabilities, as well as chemical, thermal, and mechanical properties. It was found that PTFEMA particles obtained from the rapid expansion of supercritical solutions were spherical with a size range of ~20–2,500 nm and the coating layer thickness was ~60–740 nm, depending on the PTFEMA concentration and pre-expansion temperature and pressure (T_{pre} , P_{pre}). Increasing the concentration of PTFEMA resulted in decreasing particle sizes while increasing the surface coverage of PTFEMA coating. However, increasing T_{pre} resulted in significantly increased the particle sizes and the particles were further apart from each other. In addition, increasing P_{pre} resulted in decreased particle sizes whereas increased the particle agglomeration in network form. Coating layer thickness increased with increasing PTFEMA concentration, T_{pre} and P_{pre} . Coating by rapid expansion of 1.0 wt% PTFEMA solution at T_{pre} and P_{pre} of 40°C and 331 bar, respectively, provided the smoothest coating layer. Moreover, it was found that coating with PTFEMA using rapid expansion of supercritical solutions process can improve hydrophobicity and moisture barrier property of TPS/PBAT blend sheet, as shown by the increase of water contact angle and the decrease in water vapor permeability, without affecting oxygen permeability as well as thermal and mechanical properties.

Student's signature

Thesis Advisor's signature