The Role of Amphiphilic Substances in Improving the Compatibility and Performance of TPS-Based Blend Blown Films

Rangrong Yoksan[1]

e-mail: rangrong.y@ku.ac.th

[1]*Department of Packaging and Materials Technology, Faculty of Agro-Industry, Kasetsart University, Bangkok 10900, Thailand*

Thermoplastic starch (TPS) is a biobased and biodegradable material obtained from the plasticization of starch granules. It is widely used to reduce costs and enhance the biodegradability of other biodegradable thermoplastics, e.g., poly(lactic acid) (PLA) and poly(butylene succinate-*co*-butylene adipate) (PBSA), as well as to increase biobased content and reduce carbon emissions in conventional plastics, e.g., polyethylene (PE). However, blending TPS with these relatively hydrophobic polymers often leads to poor compatibility due to differences in polarity and viscosity. This presentation demonstrates the role of amphiphilic substances as compatibilizers in enhancing compatibility and improving the properties of three TPS-based polymer blend systems: (i) TPS/PLA/PBSA (40/30/30) with polyethylene glycol sorbitan monostearate (Tween 60, 0.5–2.5 wt%) [1], (ii) LLDPE/TPS (60/40) with stearic acid-grafted starch (ST-SA, 1–5 wt%) [2-3], and (iii) PLA/TPS (50/50) with oligo(lactic acid)-grafted starch (OLA-*g*-starch, 1–5 wt%) [4]. All blends were prepared via twin-screw extrusion, followed by film fabrication via blown film extrusion. The addition of 2–2.5 wt% Tween 60 significantly improved interfacial adhesion, resulting in improved mechanical, thermal, and barrier properties [1]. Similarly, 1–3 wt% ST-SA improved tensile strength, secant modulus, extensibility, UV-shielding capability, and barrier performance of LLDPE/TPS blends [2–3]. In PLA/TPS blends, 5 wt% OLA-*g*-starch markedly increased elongation at break (up to 280%) and improved barrier properties, water resistance, melt flowability, and thermal stability [4]. These results highlight the potential of amphiphilic compatibilizers to enhance interfacial compatibility and overall performance of TPS-based blends for packaging film applications.

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Biography (For Plenary, Keynote, and Invited Speakers)

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