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Effects of chain-extending stabilizer on bioplastic poly(lactic acid)/polyamide blends compatibilized by reactive extrusion

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Title

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Abstract

The immiscible bio-plastic blend of poly(lactic acid) (PLA) and polyamide11 (PA11 or Nylon11) was compatibilized, using a catalyzed the ester-amide interchange chemical reaction during reactive extrusion. The effects of screw configuration on mixing and reaction optimization were explored. It was found that effective mixing and minimized degradation were achieved when kneading elements were installed only near the die end of the extruder rather than near the beginning of the melt section. However, significant degradation of PLA could not be avoided during processing, which led to a decrease in mechanical strength of blend. To prevent the molecular weight reduction, tris(nonylphenyl) phosphite (TNPP) stabilizer was introduced to improve the thermal stability of PLA matrix. Improvement to both tensile strength and elongation were achieved in the resulting PLA/PA11/TsOH/TNPP blend.

Introduction

For the last few decades, concern over limited petroleum resources, environmental pollution from plastic packaging wastes, and advances in medical device design have been led many researchers to develop and improve bio-plastics to replace common petroleum-based polymers.[1–5] In addition to commodity and degradable packaging applications, high