Blends of Thermoplastic Starch and Polyesteramide: Processing and Properties

L. AVEROUS,[1] N. FAUCONNIER,[1] L. MORO,[1] C. FRINGANT[2]

[1] Packaging Engineering School, ESIEC, Centre d'Etudes et de Recherche en Matériaux et Emballage, CERME, B.P. 1029, 51686 Reims cedex 2, France

[2] Agro industry Research and Development, ARD, Route de Bazancourt, 51110 Pomacle, France

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ABSTRACT: The blending of thermoplastic starch (TPS) with other biodegradable polyesters such as polyesteramide could be an interesting way to produce new biodegradable starch-based materials. Different mixes of wheat starch and polyesteramide (BAK) were melt blended by extrusion. After pelletization, granules were injection molded to produce test specimens. A range of blends was studied with glycerol (plasticizer)/starch content ratios varying from 0.14 to 0.54. BAK concentrations were up to 40 wt %, TPS remaining as the major phase in the blend**.** Various properties were examined with mechanical, thermomechanical (dynamic mechanical thermal analyzer) and thermal (differential scanning calorimetry) analysis. Hydrophobicity was determined with contact angle measurements. Thanks to the knowledge of the properties of each polymeric system, we analyzed the blends' behavior by varying each component concentration. The material aging was also studied. We showed that structural changes occurred during several weeks after injection. We noticed a certain compatibility between both polymeric systems. The addition of BAK to TPS matrix allowed us to overcome the weaknesses of pure thermoplastic starch: low mechanical properties, high moisture sensitivity, and high shrinkage in injection, even at 10 wt % BAK. © 2000 John Wiley & Sons, Inc. J Appl Polym Sci 76: 1117–1128, 2000

Key words: blend; thermoplastic starch; polyesteramide; mechanical properties; hydrophobicity

INTRODUCTION

The litter problem with regard to the environment pollution has created an urgent need to develop new biodegradable materials that have comparable properties with today's polymeric materials at an equivalent cost. An important number of biodegradable polymers, biopolymers, exist that are derived from both synthetic and natural sources,[1–3] but most of them are quite costly. The use of agricultural products in plastics applications is considered as an interesting way to reduce surplus farms products and to develop nonfood applications. Starch-based materials are low-cost biopolymers and are obtained from renewable agricultural resources. Several authors[4,5] have shown the possibility to transform native starch into thermoplastic materials under destructuring and plasticization conditions. Thermoplastic starch (TPS) is processed like synthetic plastics by extrusion and injection molding. Unfortunately, TPS is a very hydrophilic product. Some authors[6] tried to modify the starch structure, for example by acetylation, to reduce the hydrophilic character of the chains; this chemical way results in inferior mechanical properties and greater product cost.[7]

Correspondence to: L. Averous.

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