



Physicochemical, structural, and thermal characterization of biodegradable film prepared using arracacha thermoplastic starch and polylactic acid

Andrea Milena Sánchez Riaño¹ · Evelyn Melissa Alegría Vivas² · Helga Patricia Bermeo Andrade³ · Yanneth Bohórquez Pérez¹ · Héctor Samuel Villada Castillo² · Luis Daniel Daza^{1,4}  · Claudia Patricia Valenzuela Real¹

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Abstract

This work aimed to characterize the starch from arracacha at two phenological stages (S1: twelve months and S2: fourteen months) and assess its potential use blended with polylactic acid (PLA) for thermoplastic starch biodegradable film preparation using the extrusion technique. Arracacha starches showed high amylose content (25% and 24% for S1 and S2, respectively), which is related to its easy to cook properties, intermediate final viscosity, and the potential for its use as material for biodegradable films preparation. Production of Thermoplastic starch biodegradable films (SF1 and SF2) using arracacha starch blended with polylactic acid as raw materials were successful, the biofilms exhibited low solubility and water vapor permeability, which is due to the hydrophobic nature of polylactic acid, these results indicate its potential use for packaging of foods with intermediate or low water contents. Besides, biodegradable films showed good thermal properties, which are related to the stability of degradation. Arracacha for starch extraction and its use for biodegradable film preparation could be an alternative to add value to this crop. Likewise, the preparation of thermoplastic films using arracacha starch blended with polylactic acid is presented as an alternative to the use of plastic packaging.

Keywords Thermoplastic starch · Edible films · Polymers · Bio-based packaging · Tubers

Introduction

Plastic packaging has been used in the food industry to

facilitate the handling and transportation of products and to protect the food against environmental conditions such as temperature, moisture, light, and oxygen, thereby extending its shelf life. However, this type of packaging comes from non-renewable sources, is for single-use, and shows poor biodegradation which generates a negative impact on the environment. To replace existing plastic packaging, different materials have been evaluated about to their capacity as film formers [1, 2]. Starch has been used as a material for the preparation of biodegradable films due to its low cost, high bioavailability, and good film-forming properties [3]. However, the characteristics of the edible films based on starch depend on the botanical source, which makes it necessary to study the final properties of biodegradable films made with starches obtained from new botanical sources [4].

Arracacha (*Arracacia xanthorrhiza* Bancroft) is a native root plant from South America, belonging to the Apiaceae family. Its cultivation is located mainly in Brazil, Colombia, Venezuela, Ecuador, Perú and Bolivia at 1000–3000 masl

✉ Luis Daniel Daza
danieldaza08@gmail.com

✉ Claudia Patricia Valenzuela Real
cpvalenz@ut.edu.co

¹ Departamento de Producción y Sanidad Vegetal, Facultad de Ingeniería Agronómica, Universidad del Tolima, Ibagué, Tolima 730006299, Colombia

² Departamento de Agroindustria, Facultad de Ingeniería Agronómica, Universidad del Cauca, Popayán, Cauca 190003, Colombia

³ Facultad de Ingeniería, Universidad de Ibagué, Ibagué, Tolima 730002, Colombia

⁴ Department of Chemistry, University of the Balearic Islands, Ctra Valldemossa, km 7.5, Palma de Mallorca, Baleares 07122, España