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Development and characterization of palmyrah (*Borassus flabellifer* L.) tuber starch and gelatin incorporated edible composite biodegradable packaging material

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Abstract

Non-biodegradable synthetic packaging materials cause tremendous harmful effects on ecosystem. Hence, biodegradable packaging materials processing research is essential for the food and allied industries globally. Starch is one of the most important polysaccharides used in the formulation of edible biodegradable packaging such as edible films and coatings. Palmyrah (*Borassus flabellifer* L.) tuber is a rich source of starch, widely available in Northern, Eastern and Southern provinces in Sri Lanka. Although the Palmyrah tuber starch is available as a low - cost ingredient in Sri Lanka, scientific investigations and product development of bio-degradable packaging are scanty. The objective of the present research was to formulate, develop and characterize edible bio-degradable films for coating or packaging the food products. In addition to palmyrah tuber starch, gelatin and glycerol were used as ingredients. Treatment formulations with 60, 70, 80, 90, 100% (w/w) total solids were Palmyrah tuber starch. Gelatin and glycerol were added as hydrocolloid and plasticizer respectively. The thickness, moisture content, solubility, tensile strength, elongation at break and water vapour transmission rate of films were measured. Data analysis was done using Analysis of Variance (ANOVA) and Tukey's test using Minitab 17 statistical software. Palmyrah tuber starch yield extracted from fresh tubers was 15.6 %. The tensile strength increased, while increasing the gelatin concentration and reducing the water solubility of the composite films. The elongation behaviour at break was uniform. And the water vapour transmission rate increased with the higher gelatin concentration. The optimized formulation with palmyrah tuber starch (4%), gelatin (1.0%) and glycerol (1.5%) of the film - forming solution has exhibited significantly high tensile strength (10.0 ± 0.0 MPa) and low water vapour transmission rate (4.10 ± 0.00 g/m².d). Thickness (0.14 ± 0.01 mm), moisture content (14.43 ± 0.02 %), solubility (63.09 ± 0.03 %) and elongation at break (41.00 ± 1.41 mm) were measured. The composite edible film has been exhibited biodegradability in soil within six days. In conclusion, the optimized formulation with palmyrah tuber starch, gelatin and glycerol has high potential as the edible composite biodegradable packaging material for food products. Further investigation on application on different nature of food products is recommended.

Keywords: Biodegradable film, Edible, Gelatin, Palmyrah tuber, Starch

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