

Sustainable Development and Characterization of Starch-Based Bioplastics

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Abstract

Single use plastic packaging materials and other plastic waste originating from petroleum-based sources are continuously increasing in landfills and leaching into the environment. Managing plastic waste remains an urgent crisis in the environment and switching to biodegradable plastics can help to reduce waste, petroleum usage as well as carbon dioxide emission. Biodegradable films are made from natural compounds, such as proteins, lipids, and polysaccharides. Among polysaccharides, starch is considered one of the most potent material for producing bioplastics due to its high capacity to form good film, besides the advantage of being low cost, abundant, environmental eco-friendly, and renewable. Four research papers were reviewed to evaluate the physical and biodegradable properties of biodegradable films developed from starch. Starch mixed with 'green' plasticizers (glycerol) and other polymers were used to prepare the films, which were studied for physicochemical properties, crystallinity, thermal properties, mechanical properties, visual appearance, and surface morphology, respectively. In addition, soil and sea water degradation tests were conducted to determine the biodegradability properties of the films. Moreover, the effects of different concentrations of starch and glycerol in films properties were evaluated by a rotational central composite 2² experimental design. Starch-based films degraded in compost soil within 7 days whereas films mixed with other polymers (carrageenan, bentonite) completed biodegradation after 30 days. However, addition of polymers exhibited higher tensile strength, water solubility, and barrier properties of the film. Hence, this study will help to develop the biodegradable films, which could play an important role in environmental sustainability by replacing synthetic plastics.

Key words: Biodegradable film, environment, plastic, polysaccharide, starch



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References

- Abdillah, A. A., and A. L. Charles. 2021. "Characterization of a natural biodegradable edible film obtained from arrowroot starch and iota-carrageenan and application in food packaging," *International Journal of Biological Macromolecules*, 191: 618-626.
- Moustafa, M., M. A. Abu-Saied, T. H. Taha, M. Elnouby, E. A. El Desouky, S. Alamri, A. Shati, S. Alrumman, H. Alghamdii, M. A. Khatani, R. A. Qthanin, and A. A. Emam. 2021. "Preparation and characterization of super-absorbing gel formulated from κ -carrageenan–potato peel starch blended polymers," *Polymers*, 13: 24.
- Nogueira, G. F., F. M. Fakhouri, and R. A. Oliveira. 2018. "Extraction and characterization of arrowroot (*Maranta arundinaceae* L.) starch and its application in edible films," *Carbohydrate Polymers*, 186: 64-72.
- Shanmathy, M., M. Mohanta, and A. Thirugnanam. 2021. "Development of biodegradable bioplastic films from Taro starch reinforced with bentonite," *Carbohydrate Polymer Technologies and Applications*, 2: 100-173.