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**ABSTRACT**

The growing environmental devastation ascribed to the disposal of packaging plastic waste has led to an urgent need to develop environmentally friendly packaging materials to rescue our ecosystem. In an effort to resolve the ongoing environmental crisis caused by non-biodegradable plastics, natural biopolymers have been considered as potential alternatives to conventional plastics. Biodegradable films for packaging have been reported to have low water barrier resistance. Such drawback strongly limit their wide application, especially for food packaging purposes. Many studies have been undertaken by scientists to improve the water sensitivity of starch-based materials without compromising their biodegradability. The reinforcement of natural biopolymers with nanocellulose has been shown to be beneficial for water transmission properties of biodegradable film.

*Keywords:*water barrier, biodegradable films, nanocellulose, food application.

**INTRODUCTION**

Common materials used for food packaging are plastics, paper and metal. However, the utilization of plastic overshadows metal and paper due to their low cost production and outstanding material properties. To date, almost one-third of the world’s non-degradable plastic production is used in packaging application. This large volume of food packaging is meant to be quickly discarded, and the waste volume has not been greatly reduced by the recycling programs, because of high recycling costs and difficulties related to polymer separation [1]. Several biodegradable films to be used in food packaging, not to completely replace synthetic plastics, but rather to improve their efficiency, thus reducing the amount of synthetic polymers required for each application. Food packaging is essential to avoid deterioration of food products during handling and storage, besides provide nutritional information and expired date of the products.

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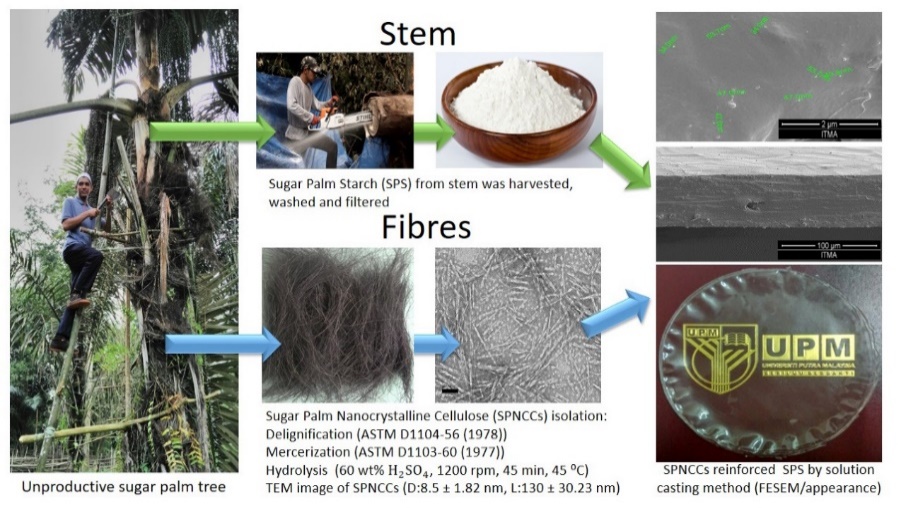
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Fig. 1: Biodegradable film from sugar palm tree [1]

TABLE 1: Water permeability properties of biodegradable films reinforced with nanocellulose for food packaging application

|  |  |  |  |
| --- | --- | --- | --- |
| **Authors** | **Polymer** | **Source of nanocellulose** | **Description** |
| Ilyas et al., [1] | Sugar palm starch | Sugar palm fibre | * Increasing the SPNCCs concentration from 0.1% to 1.0% caused a slight reduction in the WVP of composite films. |

\*Commercial crystalline microcellulose (MCC), cellulose nanofibre (CNF), microfibrillated film (MFC), cellulose nanocrystals (CNC), water vapour permeability (WVP), polyvinyl alcohol (PVA)

**MATERIALS AND METHODS**

*Materials*

Sugar palm fibres gathered in Bahau (Negeri Sembilan, Malaysia) were used in this study. The chemical reagents used were sodium chlorite, acetic acid, sodium hydroxide and sulphuric acid (purchased from Sigma–Aldrich).

*Methods*

The fibres were grinded and sieved.

**RESULTS AND DISCUSSION**

*Subsection 1*

The chemical compositions of the sugar palm fibres were affected by the chemical extraction process, NaClO2 followed by NaOH.

*Subsection 2*

The mechanical performances of the films were monitored in term of tensile strength, Young’s modulus and elongation at break.

**CONCLUSIONS**

Water vapor barrier properties of biodegradable films were improved by addition of cellulose nanofibers.

**ACKNOWLEDGEMENTS**

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**REFERENCES**

[1] R. A. Ilyas, S. M. Sapuan, M. R. Ishak, and E. S. Zainudin, “Development and characterization of sugar palm nanocrystalline cellulose reinforced sugar palm starch bionanocomposites,” *Carbohydr. Polym.*, vol. 202, pp. 186–202, Dec. 2018, doi: 10.1016/j.carbpol.2018.09.002.

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