'Greener' packaging with oil palm biomass

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PLASTIC is used extensively for food packaging due to its durability, flexibility and lightweight properties. Although convenient, many of the items are created for single use.

Poor handling of plastic packaging, where they are not recycled and discarded haphazardly, will cause a negative impact to the environment that affects wildlife and humans alike.

In addressing the issue, Universiti Putra Malaysia (UPM) recently signed a memorandum of agreement with Nextgreen Pulp and Paper Sdn Bhd to licence its oil palm biomass nanocellulose technology to produce greener paper packaging alternatives.

The 30-month licence involves a fee of RM550,000, paid by Nextgreen to UPM.

Nanocellulose from oil palm biomass has been developed by UPM researchers led by Associate Professor Dr Hidayah Arifin from the Faculty of Biotechnology and Biomolecular Sciences, in collaboration with Kyushu Institute of Technology in Japan.

Nanocellulose is a natural material obtained from any cellulose matter, such as plant biomass, pulp and cotton, said Hidayah.

"The reason why I embarked on this research is because I have been working with bio-based polymers, cellulose and composite materials for some time. They are mainly derived from oil palm biomass."

Her research had won the gold medal for the "Most Commercial-Ready Product" at the 2017 Bioeconomy Innovation Award.

Hidayah added that nanotechnology is an emerging technology. She realised its role and potential, so she and her team decided to focus their research on nanocellulose.

"Mechanically, nanocellulose is strong with high specific surface area. It is also renewable and biodegradable. It is a versatile material that can be tailor-made to suit its application.

"Since Malaysia has many oil palm plantations with an abundance of biomass, why not capitalise on this readily-available resource. With about 25 million tonnes of oil palm waste produced by our country every year, this project will add value to the industry while reducing its disposal issue."

She said normal paper is less durable and can easily be broken down when it comes into contact with water.

"Paper food packaging that we often see today is actually coated with polyethylene, which provides a very strong moisture barrier. This type of packaging is extremely durable but not biodegradable.

"Our partnership with Nextgreen focuses on using nanocellulose as a reinforcement material to enhance the strength of paper packaging."

She said only three per cent of nanocellulose is needed to increase the paper's tensile and bending strength by about 55 and 200 per cent, respectively.

"It is also useful for load-bearing applications, such as lightweight biocomposites for interior components of cars and aeroplanes.

"Apart from those, nanocellulose is also used as material for water filtration and facemasks.

"Due to its nanodimension feature, nanocellulose has a large surface area for hydrogen bonding. This results in the formation of a gel-like structure, even at very low concentration of water, making it suitable as a thickening agent in food products."

UPM vice-chancellor Professor Datuk Dr Aini Ideris (second from left) and Nextgreen Pulp and Paper Sdn Bhd managing director Datuk Lim Thiam Huat (second from right) exchanging the memorandum of agreement on licencing for the company to use UPM's oil palm biomass nanocellulose technology to produce green paper packaging. With them are Kyushu Institute of Technology president Dr Yuji Oie (left) and Nextgreen executive director Kelly Lim Kah Yen (right).

Associate Professor Dr Hidayah Arifin showing a bottle of nanocellulose that can be used to enhance the strength of paper packaging.

Hidayah said to produce nanocellulose, her team extracts the cellulose from oil palm biomass. The cellulose is converted into nanocellulose using a milling method.

"Currently, we have obtained nanocellulose with an average diameter size of between 20 and 80 nanometres," she said, adding that nanocellulose technology in Malaysia is still in the research and development stage.

"It is difficult to compare our product with other nanocellulose produced in Malaysia. However, we see this opportunity as an advantage since our product is almost ready to be commercialised."

Hidayah said she believed that her research had met the 3P concept — Profit, People and Planet — in developing a new product.

"In Malaysia, nanocellulose has started to receive interest from many parties. It is interesting to see that it has been recently listed as an 'emerging product' in the 11th Malaysia Plan.

"In terms of profit, the manufacturing of new products from oil palm biomass is expected to generate a new income stream for mill and plantation owners as they could venture into a new business, or sell their biomass to the nanocellulose industry.

"Nanocellulose has the potential to contribute to the bioeconomy of Malaysia since the market is wide. Moreover, the technology can create more job opportunities for locals when it is commercialised."

Hidayah said the product can be considered environmental-friendly as it is made of natural and renewable material.

"Our technology does not involve the use of hazardous or harsh chemicals."

Hidayah said the applications of nanocellulose technology would be of interest to the polymer and biocomposite plastic industry, healthcare and pharmaceutical sector, and food and beverage sector.

She added that her team has filed for a patent and copyright for their research technique and product.