Eco-friendly, chitosan-based food packaging material doubles shelf life of food products

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Researchers from the National University of Singapore (NUS) have successfully developed an environmentally-friendly food packaging material that is free from chemical additives, by fortifying natural chitosan-based composite film with grapefruit seed extract (GFSE). This novel food packaging material can slow down fungal growth, doubling the shelf life of perishable food, such as bread.

Chitosan, a natural and biodegradable polymer derived from the shells of shrimp and other crustaceans, has immense potential for applications in food technology, owing to its biocompatibility, non-toxicity, short time biodegradability and excellent film forming ability. Chitosan also has inherent antimicrobial and antifungal properties. GFSE, on the other hand, is antioxidant and possesses strong antiseptic, germicidal, anti-bacterial, fungicidal and anti-viral properties.

Associate Professor Thian Eng San and PhD student Ms Tan Yi Min from the Department of Mechanical Engineering at NUS Faculty of Engineering spent three years perfecting the formulation to create a novel composite film that not only prevents the growth of fungi and bacteria, but has mechanical strength and flexibility that are comparable to synthetic polyethylene film commonly used for food packaging. The composite film also effectively blocks ultraviolet light, hence slowing down the degradation of food products as a result of oxidation and photochemical deterioration reactions.

Laboratory experiments showed that the shelf life of bread samples

packaged with chitosan-based GFSE composite films was two times longer than those packaged using synthetic packaging films.

"Increasing attention has been placed on the development of food packaging material with antimicrobial and antifungal properties, in order to improve food safety, extend shelf life and to minimise the use of chemical preservatives. Consumers are also demanding that packaging materials be formulated from natural materials that are environmentally friendly and biodegradable while improving food preservation. This novel food packaging material that we have developed has the potential to be a useful material in food technology," said Assoc Prof Thian.

Elaborating on the benefits of the chitosan-based GFSE composite film, Ms Tan said, "Extending the shelf life of food products also means reducing food waste, and as a result, reducing the rate of global food loss. This will bring about both environmental and economic benefits."

The research received support from the A*STAR Singapore Institute of Manufacturing and Technology (SIMTech) and the Food Innovation & Resource Centre (FIRC) of Singapore.

Assoc Prof Thian and Ms Tan will be conducting further studies to improve on this technology. They will look into the degradability of chitosan-based GFSE films, as well as carry out an accelerated shelf life study to examine the extent of microbial growth and quality changes during storage of various food products. There are also plans to explore opportunities to commercialise the novel composite film as a packaging material.

Provided by National University of Singapore