



## Smart and sustainable food packaging based on corn proteins

March 7, 2022

A new material that is based on biopolymers, non-toxic solvents and antimicrobials of natural origin, developed by researchers at the Universities of Singapore and Harvard, has the potential to improve the safety and quality of food packaging and reduce the impact on the environment of plastic ones. A third of the food produced never reaches the table, getting lost along the supply chain due to spoilage and logistical inefficiencies. Every day, tons of spoiled food are thrown away in supermarkets, especially fruit and vegetables that last a few days.

To extend the shelf life of fresh produce, a group of researchers from Nanyang Technological University (NTU) in Singapore and the US -based Harvard University - Chan School of Public Health Initiative for Sustainable Nanotechnology has developed a new biodegradable food packaging material , non-toxic and antimicrobial, which would extend the shelf life of fruits and vegetables.

Furthermore, the packaging industry is the largest and growing consumer of synthetic plastic derived from fossil fuels, and plastic food packaging accounts for the majority of the plastic waste that pollutes the environment.

The research results were released in the study " Enzyme- and Relative Humidity-Responsive Antimicrobial Fibers for Active Food Packaging ", published in the academic journal ACS Applied Materials & Interfaces , and subjected to revision

In laboratory experiments, when exposed to increased humidity or enzymes from harmful bacteria, the fibers in the package released natural antimicrobial compounds, also killing common dangerous bacteria that contaminate food, such as E. Coli and Listeria , and some fungi, in response to the presence of additional moisture or bacteria, ensuring that the package can withstand multiple exposures and last for months.

Because bacteria-fighting compounds grow on the surface of the package and on the food product itself, as well as fruits and vegetables, they can be used for a wide variety of products, such as convenience foods and meats.

In one experiment , strawberries wrapped in the package remained fresh for 7 days before developing mold , while those stored in traditional plastic fruit boxes remained fresh for only 4 days.

" This solution could be a better option for packaging in the food industry, as it has demonstrated superior antimicrobial qualities in fighting a myriad of food-related bacteria and fungi that could be harmful to humans ," said Professor Mary Chan . Director of NTU's Center of Antimicrobial Bioengineering, who co-directed the project - Packaging can be applied to various products such as fish, meat, vegetables and fruit. The intelligent release of antimicrobials only in the presence of bacteria or high humidity, provides protection only when needed, thus minimizing the use of chemicals and preserving the natural composition of packaged foods "

The experimented food packaging is produced by electrospinning ( electrodynamic production process used both industrially and at the laboratory research level for the production of fibers with extremely small diameters, typically below a micron, down to a few nanometers) from a corn protein called zein , starch and other naturally derived biopolymers , infused with a cocktail of natural antimicrobial compounds, including thyme oil and citric acid

" Food safety and waste have become one of the major societal challenges of our time with an immense impact on public health and the economy that undermines food safety - said in turn the other co-director Philip Demokritou , Professor of Environmental Health at Harvard TH Chan School - One of the most efficient ways to improve food safety and reduce spoilage and waste, and eliminate damage to the environment and health is to reduce the use of non-biodegradable plastic to a global, and promote sustainable food systems "

The research team from NTU and Harvard Chan School hopes to expand their technology with an industrial partner, with the goal of commercialization within the next few years. It is also currently working on developing other technologies to develop biopolymer-based smart food packaging materials to improve food safety and quality.

Cover: A batch of strawberries wrapped in biopolymer film developed by NTU and Harvard TH Chan School; lasted about 3 days longer before forming mold, compared to those stored in a normal plastic package (Source: Aytac et al, 2021)