Green tea-based adhesive films show promise as a novel treatment for oral mucositis

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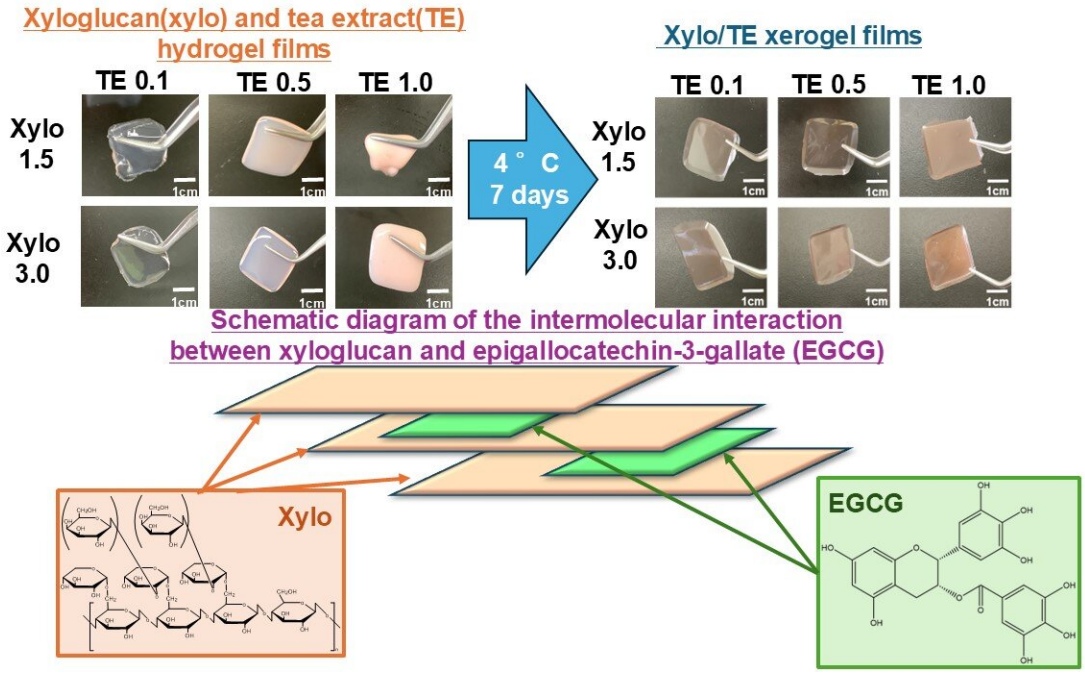

The researchers prepared the film by combining xyloglucan, a polymer from tamarind seeds, with green tea extract, then drying the mixture at 4°C for seven days. The resulting film offers adhesion and properties comparable to commercial oral mucoadhesive films. Credit: Reproduced from Hirose et al. with permission from the American Chemical Society Image source link: pubs.acs.org/doi/10.1021/acsomega.4c06410

Green tea shines as a natural powerhouse of antioxidants, with catechins

leading the charge among its polyphenols, which protect cells from oxidative stress. These powerful compounds neutralize harmful free radicals generated during cancer treatment. The anti-inflammatory properties of green tea can alleviate oral mucositis, a painful inflammation of the mouth lining often caused by chemotherapy and radiation.

Building on these benefits, researchers at the Tokyo University of Science (TUS), Japan, have explored the potential of tea catechins in developing a novel treatment for oral mucositis that minimizes patient discomfort.

Their findings were published in *ACS Omega*.

The research team, led by Professor Takehisa Hanawa, included Assistant Professor Kaoru Hirose, Ms. Rieko Nitto, and Mr. Shotaro Yokota from TUS, in collaboration with Dr. Yayoi Kawano (former lecturer at TUS, now Professor at Nagoya City University, Japan), as well as Mr. Akira Tabuchi, Dr. Yumeo Suzuki, and Dr. Kazuhiko Yamatoya from MP Gokyo Food & Chemical Co., Ltd., Japan.

In line with TUS's commitment to advancing research that supports the UN Sustainable Development Goals (SDGs), the team sought to develop an innovative and accessible treatment for oral mucositis, aligning with SDG 3 (good health and well-being) and SDG 9 (industry, innovation, and infrastructure).

"Our goal was to create a formulation for oral mucositis that patients could use easily and comfortably, helping to prevent the decline in quality of life and difficulties with eating caused by cancer treatments," explains Prof. Hanawa.

Oral mucositis, a common and painful side effect of cancer treatments,

affecting 30–40% of the patients, results from damage to rapidly dividing mucosal cells. This condition causes significant discomfort and interference with vital activities, such as eating and sleeping.

To address this, the researchers designed a thin mucoadhesive film enriched with tea catechins, which can be applied directly to affected areas for prolonged relief.

This film is a thin, flexible material that adheres to the inside of the mouth to deliver active ingredients, like medications, directly to the affected area. It offers a more convenient, inexpensive, and user-friendly alternative to mucoadhesive tablets, which often have limited usability.

The films were prepared by combining xyloglucan (Xylo), a water-soluble polymer extracted from tamarind seeds, with green tea extract (TE) which contains over 75% catechins, including more than 40% epigallocatechin gallate (EGCG).

Xylo is a natural gelling agent, commonly used as a food thickener. It forms a structure similar to the mucin network in the mouth, giving the film its mucoadhesive properties.

Given the easy availability, usage as a food additive, and low cost of TE, which contains EGCG as well as various catechins, it was selected as a gelling agent for Xylo in this study. The researchers examined how Xylo and TE gelled together and explored the physical and chemical properties of the gels and films they produced.

The researchers developed two types of films: hydrogels, prepared by drying Xylo/TE solutions at 4°C for 24 hours; and xerogels, which were dried for seven days, resulting in firmer, drier films.

The hydrogel, however, transitioned into a liquid-like state at skin

surface temperatures (35–37°C) and became weak, breaking with just a small amount of pressure. In contrast, the xerogel films demonstrated better mucoadhesive properties, withstanding up to ten times more force and performing similarly to commercially available oral mucoadhesive films.

To test the adhesive strength of the xerogel, the researchers simulated oral conditions using mucin disks coated with artificial saliva. The film was pressed onto the disk with a plunger, and the force required to detach it was measured. The films adhered well, with detachment forces matching or exceeding those of over-the-counter products.

The team also examined the release of EGCG by soaking the films in water, discovering that higher concentrations of Xylo facilitated greater EGCG release over time, highlighting their potential as mucoadhesive films.

"Xylo/TE xerogel films demonstrated high strength, hydrogel-like properties due to rapid water absorption, and adhesion forces comparable to commercial films," says Prof. Hanawa.

The team is now focused on enhancing the film's design and evaluating its safety and efficacy through cell-based experiments, advancing toward a promising solution for oral mucositis.

More information: Kaoru Hirose et al, Preparing and Characterizing of Xyloglucan Films Containing Tea Extract for Oral Mucositis, *ACS Omega* (2024). DOI: 10.1021/acsomega.4c06410

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