Material-independent nanocoating antimicrobial spray extends the shelf life of produce

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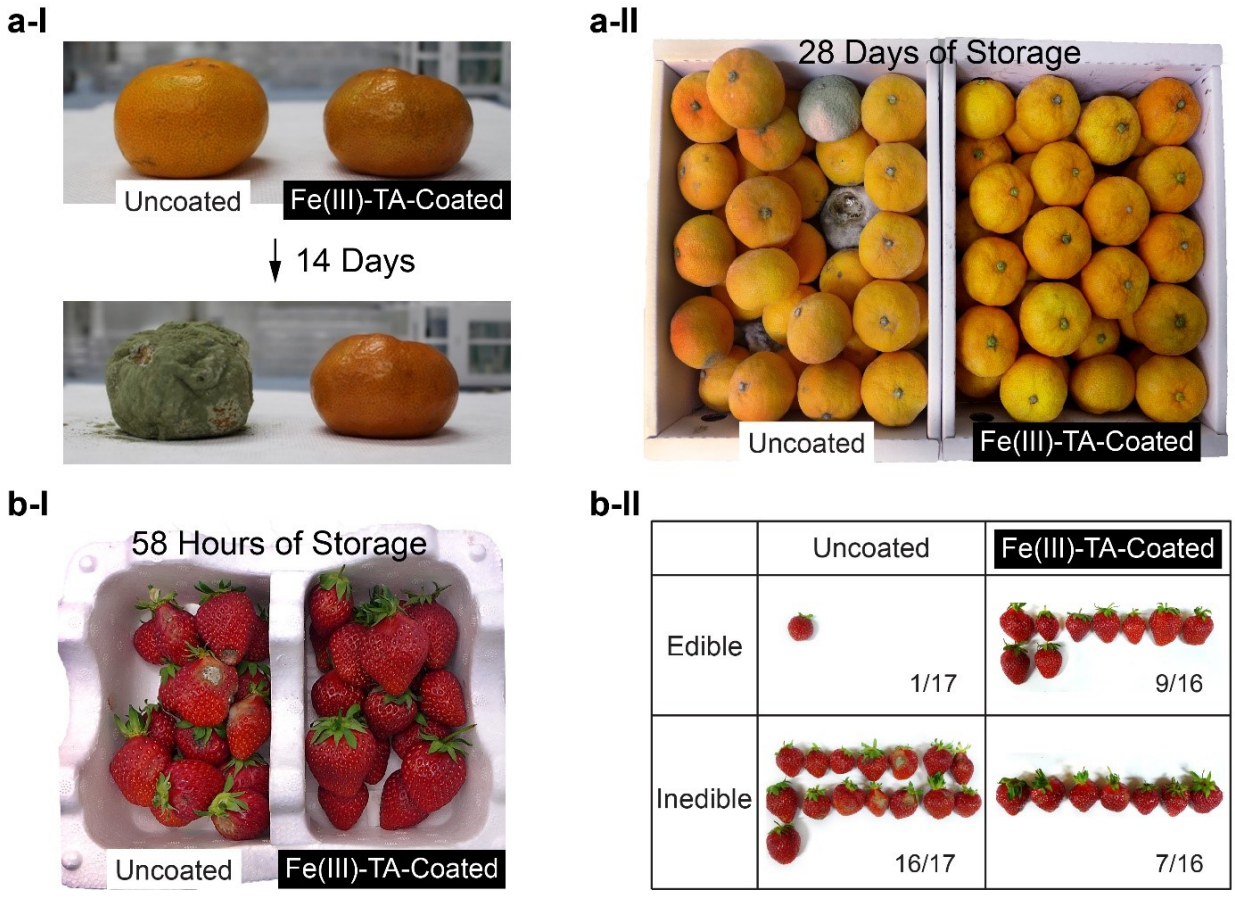

a-I, II : Uncoated and coated tangerines incubated for 14 and 28 days in daily-life settings b -I: Uncoated and coated strawberries incubated for 58 hours in daily-life settings b -II: Statistical investigation of the resulting edibility. Credit: KAIST

The edible coating on produce has drawn a great deal of attention in the food and agricultural industry. It could not only prolong postharvest shelf life of produce against external changes in the environment but also provide additional nutrients to be useful for human health. However, most versions of the coating have had intrinsic limitations in their practical application. First, highly specific interactions between coating materials and target surfaces are required for a stable and durable coating. Even further, the coating of bulk substrates, such as fruits, is time consuming or is not achievable in the conventional solution-based coating. In this respect, material-independent and rapid coating strategies are highly demanded.

The research team led by Professor Insung Choi of the Department of Chemistry developed a sprayable nanocoating technique using plant-derived polyphenol that can be applied to any surface. This new nanocoating process can be completed in seconds to form nanometer-thick films, allowing for the coating of commodity goods, such as shoe insoles and fruits, in a controlled fashion. For example, spray-coated mandarin oranges and strawberries show significantly-prolonged postharvest shelf life, suggesting the practical potential in edible coatings of perishable produce.

The technology has been patented and is currently being commercialized for widespread use as a means of preserving produce. The research results have recently been published in *Scientific Reports* on Aug 1.

Polyphenols, a metabolite of photosynthesis, possess several hydroxyl groups and are found in a large number of plants showing excellent antioxidant properties. They have been widely used as a nontoxic food additive and are known to exhibit antibacterial, as well as potential anti-carcinogenic capabilities. Polyphenols can also be used with iron ions, which are naturally found in the body, to form an adhesive complex, which has been used in leather tanning, ink, etc.

The research team combined these chemical properties of polyphenol-iron complexes with spray techniques to develop their nanocoating technology. Compared to conventional immersion coating methods, which dip substrates in specialized coating solutions, this spray technique can coat the select areas more quickly. The spray also prevents cross contamination, which is a big concern for immersion methods. The research team has showcased the spray's ability to coat a variety of different materials, including metals, plastics, glass, as well as textile fabrics. The polyphenol complex has been used to form antifogging films on corrective lenses, as well as antifungal treatments for shoe soles, demonstrating the versatility of their technique.

Furthermore, the spray has been used to coat produce with a naturally antibacterial, edible film. The coatings significantly improved the shelf life of tangerines and strawberries, preserving freshness beyond 28 days and 58 hours, respectively. (Uncoated fruit decomposed and became moldy under the same conditions).

Professor Choi said, "Nanocoating technologies are still in their infancy, but they have untapped potential for exciting applications. As we have shown, nanocoatings can be easily adapted for several different uses, and the creative combination of existing nanomaterials and coating methods can synergize to unlock this potential."

More information: Ji Park et al, Antimicrobial spray nanocoating of supramolecular Fe(III)-tannic acid metal-organic coordination complex: applications to shoe insoles and fruits, *Scientific Reports* (2017). DOI: 10.1038/s41598-017-07257-x

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