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INNOVATIVE THREE-DIMENSIONAL FRUIT DESSERTS WITH AEROGELS AND BY PRODUCTS: A Path Toward Personalized Nutrition

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Abstract

Three-dimensional (3D) food printing is an emerging technology that enables the production of personalized, ready-to-eat food with tailored shape, texture, and nutritional composition. A critical challenge in this process is the development of food inks that ensure smooth extrusion while maintaining structural stability after printing. While hydrocolloids are commonly used to achieve these properties, edible aerogels are gaining increasing attention as innovative functional materials for 3D food printing. Aerogels are highly porous, lightweight solids produced by replacing the liquid phase of a gel with gas while preserving its three-dimensional network, resulting in materials with exceptionally high surface area and porosity. Within the framework of the HRID project, fruit-based with by-products food inks incorporating pea protein aerogels are being developed to enhance printability, stability, and functional performance. Due to their porous structure, pea protein aerogels effectively bind free water, reduce water activity, and prevent syneresis, thereby improving shelf life and microbial stability. In addition, their high porosity enhances flavor perception, allowing sugar reduction without compromising sensory quality. Pea protein aerogels are hypoallergenic and gluten-free, making them suitable for consumers with dietary restrictions, including hospital patients and individuals with food allergies. The integration of aerogels into fruit-based 3D food printing offers a promising approach for creating novel structures with controlled porosity,

tailored texture, and improved retention of bioactive compounds, opening new opportunities for functional, sustainable, and personalized fruit-based foods.

Keywords: *3D food printing, edible aerogels, fruit desserts, personalized fruit-based foods*

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