Edible surfactants promote the preparation of silkworm sericin food 3D printing by emulsion gel method

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Introduction

Food 3D printing technology is an emerging field that utilizes edible bio-inks as printing materials. The rheological, hydration, and printability properties of these inks are crucial for the printing process. Despite many food materials currently being incompatible with 3D printing, leading to low printing precision and resolution, sericin, a low-cost byproduct with tunable mechanical properties and high printing accuracy, has been extensively studied in biomedicine. Sericin, rich in the 18 amino acids essential for human health, has been used as a raw material in food products, garnering significant market interest and demonstrating its vast potential as a food 3D printing material.

Methods

In this article, sericin, soybean oil, and surfactants such as gelatin were used to successfully prepare sericin-based emulsion gels. Food 3D printing technology was applied to process and produce the final products.

Results & Discussion

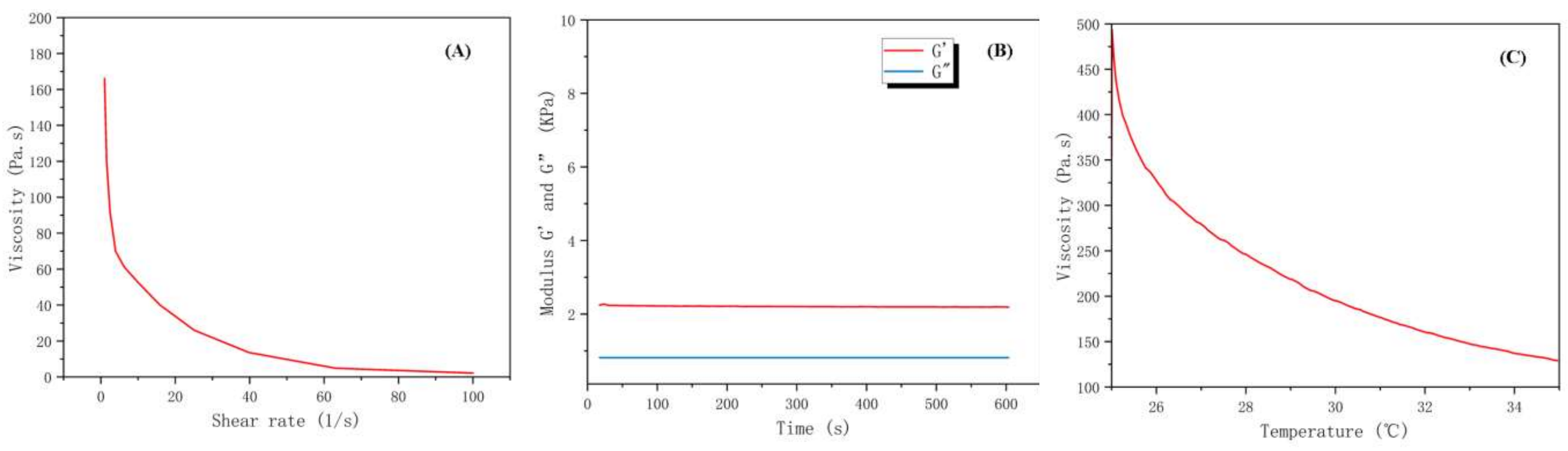

Figure 1. (A2) At 25°C, with a constant shear strain of 1% and an angular frequency of 10 rad/s, the viscosity and shear rate curve of the sample was obtained; (B2) At 25°C, with a shear rate of 1 s $^{-1}$, the modulus curve of the sample was determined; (C2) When the temperature ranged from 25 to 35°C, with a temperature ramp of 2°C/min and a shear rate of 1 s^{-1}, the viscosity and temperature curve of the sample was acquired.

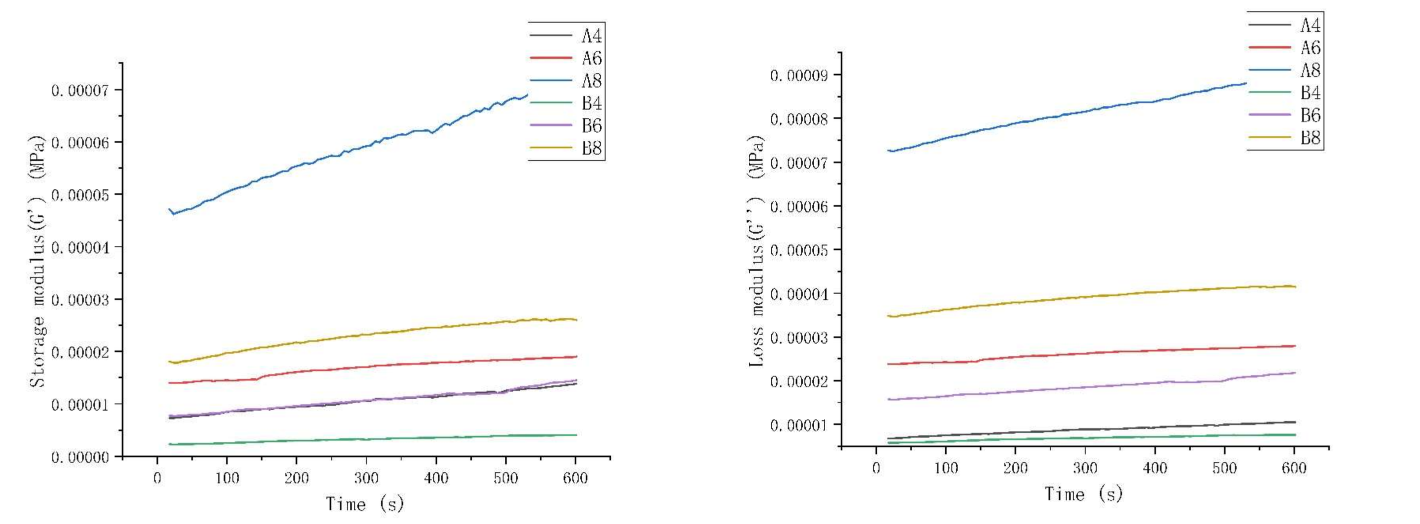

Figure.2 At 25°C, with a shear rate of 1 s $^{-1}$,(A) The sample's storage modulus;(B) The sample's loss modulus.

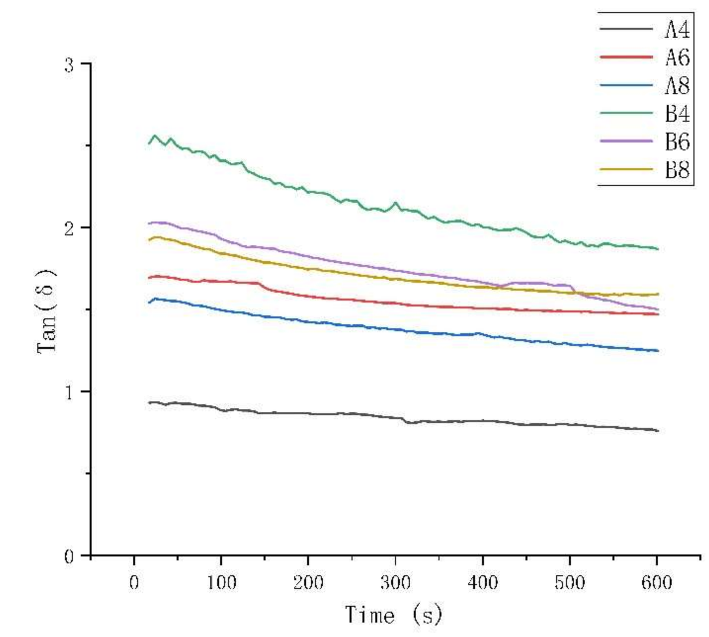

Figure.3 At 25°C, with a shear rate of 1 s $^{-1}$, the sample's tangent of the loss angle.

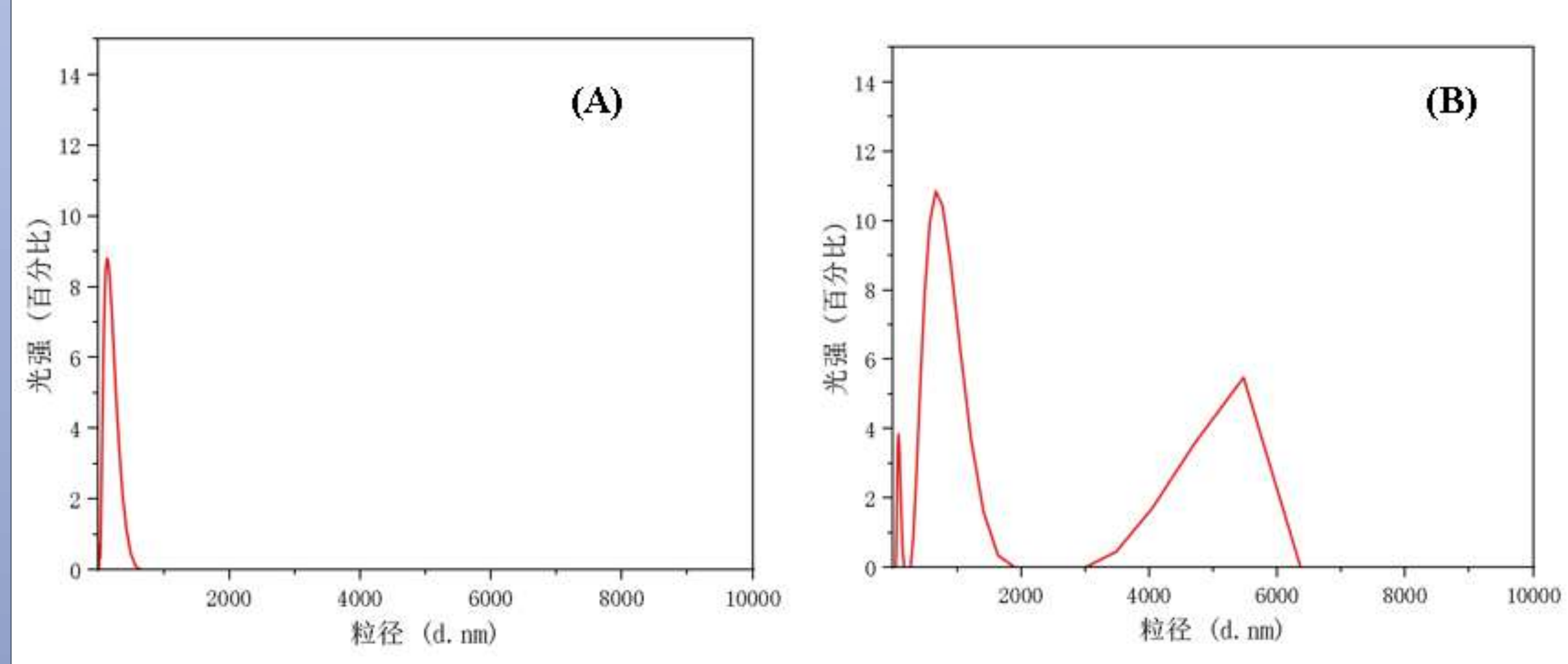

Figure.4 Using water as the dispersant, with a refractive index set at 1.44 and an absorption rate of 0.001, the thermal equilibrium time at 25°C is 180 seconds; (A) the primary emulsion with added gelatin; (B) the primary emulsion without added gelatin.

Conclusion

In summary, an emulsion gel with favorable particle size and mechanical properties was prepared using gelatin as a surfactant. During the primary emulsion phase, it exhibited good particle size uniformity, microstructural orderliness, and shear stability. Upon gelling, it demonstrated a certain degree of supportiveness.

Acknowledgement

Key Research and Development Program (Modern Agriculture) of Jiangsu Province (BE2019358)
Jiangsu Agricultural Science and Technology Innovation Fund (CX(20)2029)
Postgraduate Research & Practice Innovation Program of Jiangsu Province (KYCX22_3762)

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