Supporting Information to the manuscript

# Preparation and Properties of Salecan-Soy Protein Isolate Composite Hydrogel Induced by Thermal Treatment and Transglutaminase

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Table S1. Summary of the raw materials and characteristics of Protein- Polysaccharide composite hydrogel.

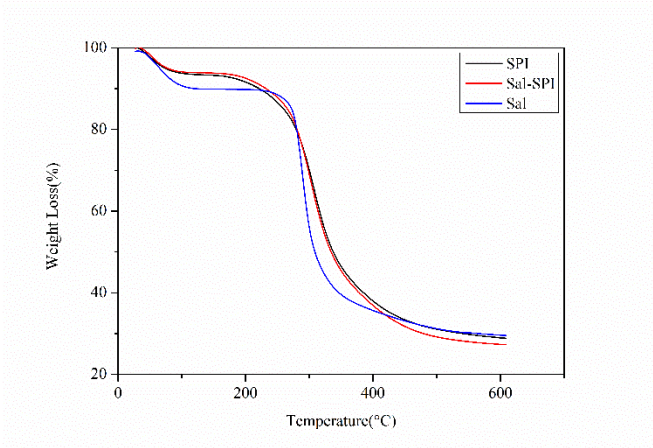
| Materials | Gelling methods | Properties and Functions | Reference |
|---|---|---|---|
| Gelatin/Carrageenan | Glutaraldehyde crosslinking | Good gel strength, potential barrier for microbes | [1] |
| Chitosan/Gelatin | EDC crosslinking | Biodegradability, fast gelation, reducing cecum-abdomen adhesion formation | [2] |
| Silk fibroin/ Tyramine-modified hyaluronic acid | Laccase-catalyzed | High structural stability, improved mechanical properties | [3] |
| Diosgenin-nanocellulose/ Gelatin | Genipin crosslinking | good swelling capacity, high gel yield, excellent antibacterial effect | [4] |
| *Flammulina velutipes* polysaccharide/ soy protein | Thermal treatment | uniform and dense microstructure, low viscosity, higher water-binding ability, good 3D printing quality | [5] |

## 2. Results and Discussions

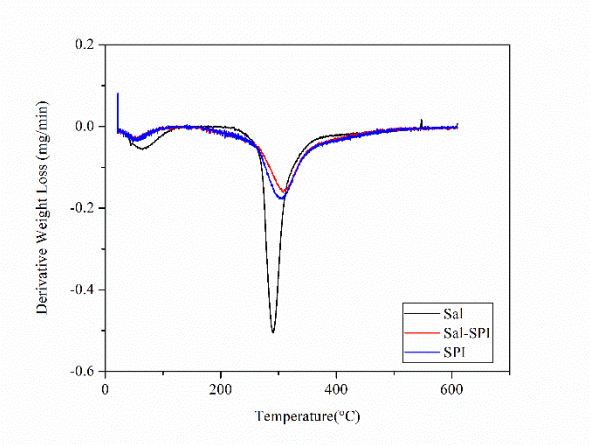
*2.9. Thermal stability of Sal-SPI composite hydrogel*

The relationship curves of the weight loss of Sal, SPI, and Sal-SPI composite hydrogels as a function of temperature are shown in Figure S1(a) and Figure S1(b). All samples show a slight weight loss near 100℃, which may be due to water evaporating from the surface of the samples. Sal loses roughly 60.4% of its weight in the range of 288~600 °C, which corresponds to the break of the depolymerized side chain of the C=O and C=C bonds of the sugar ring and the dehydration degradation of the main chain[6]. For SPI, there are two stages of decomposition: at 204~383 °C, the weight loss is 50.1%, which can be attributed to the breakage of the side chain groups including $NH_2$ and COOH, as well as the destruction of the hydrogel network; at 384~583 °C, the weight loss is 12.4% which

could be due to the breakage of the protein backbone. The thermogravimetric analysis curve of Sal-SPI composite hydrogel showed a similar tendency to that of a single SPI hydrogel. As shown in Figure S1(b), the maximum mass loss rate temperature (Tmax) of Sal-SPI composite hydrogel is 312 °C greater than that of a single SPI hydrogel (302 °C). This result demonstrates that the thermal stability of Sal-SPI composite hydrogel improved after the introduction of Sal. With the help of hydrogen bonds, electrostatic interactions, and other intermolecular interaction forces, SPI and Sal chains could form a denser network structure, increasing the thermal stability of the composite hydrogel.




(a)




(b)

**Figure S1.** (a) Thermogravimetric Analysis (TGA)of Sal, SPI, and Sal-SPI composite

hydrogel; (b) DTGA of Sal, SPI, and Sal-SPI composite hydrogel.

**3. Materials and Methods**

*3.7. Thermogravimetric analysis (TGA)*

The lyophilized Sal single hydrogel, SPI single hydrogel, and Sal-SPI composite samples (about 3 mg) were weighed and placed in a thermogravimetric analyzer (METTLER, Switzerland) for detection. The testing temperature were ranging from 25 to 600℃, the nitrogen purge speed was 100 mL/min, and the heating rate was 10℃/min [7].

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