

## Supplementary Materials:

### 1. The single-factor experiment:

The single-factor experiment of the mass ratio: SA and SPI were dissolved in phosphate buffer solution (0.05 mol/L, pH 8) at the mass ratios of 0.4:1, 0.6:1, 0.8:1, 1:1, and 1:1.2, respectively, and then place all samples in the HHP equipment, the processing pressures: 100 MPa, 200 MPa, and 300 MPa, respectively at 60°C, processing time= 24 h. The degree of grafting (DG) and emulsifying activity of the products were measured, and the 2% (W/V) SPI was used as a comparison.

The single-factor experiment of the HHP processing time: SA and SPI were dissolved in phosphate buffer solution (0.05 mol/L, pH 8) at the mass ratios of 0.6:1, and then place the sample in the HHP equipment, the processing pressures: 100 MPa, 200 MPa, and 300 MPa, respectively at 60°C. The high pressure processing times was 12 h, 18 h, 24 h, 30 h, 36 h, 42 h, respectively. The degree of grafting (DG) and emulsifying activity of the products were measured, and the 2% (W/V) SPI was used as a comparison.

The single-factor experiment of the buffer pH: SA and SPI were dissolved in phosphate buffer solution (0.05 mol/L, pH 7, pH 7.5, pH 8, pH 8.5, pH 9) at the mass ratios of 0.6:1, and then place the sample in the HHP equipment, the processing pressures: 100 MPa, 200 MPa, and 300 MPa, respectively at 60°C. The high pressure processing times was 24 h. The degree of grafting (DG) and emulsifying activity of the products were measured, and the 2% (W/V) SPI was used as a comparison. The optimal processing conditions, selected based on single-factor experiments, were as follows: mass ratio of SPI to SA = 1:0.6, buffer pH = 8.0, HHP processing time = 24 h, and pressure = 200 MPa.

### 2. The far-UV CD spectrum:

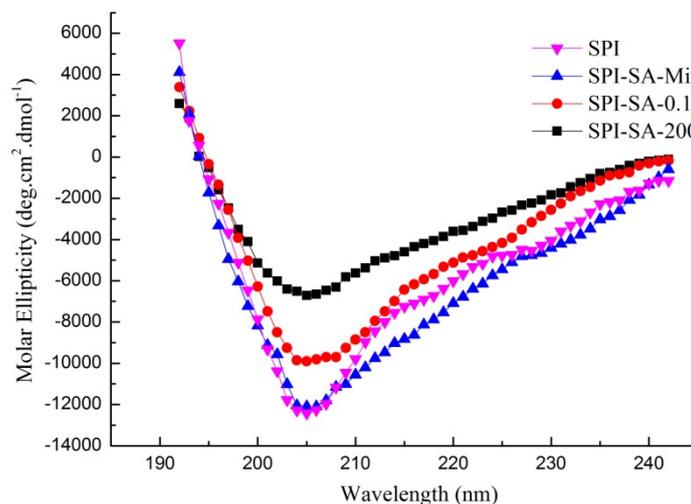


Figure S1. Far UV CD spectrum of SPI, SPI-SA mixture, SPI-SA-0.1, and SP-SA-200.