

Heat-Induced gelation properties of isoelectric and ultrafiltered sweet potato protein isolate and their gel microstructure

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Abstract

Heat-induced gelation properties of sweet potato proteins (SPP) and their gel network structure were studied. The protein considered were ultrafiltered/diafiltered sweet potato (UDSP) and isoelectrically precipitated sweet potato (IPSP) proteins. The minimum gelation concentration of IPSP and UDSP proteins in phosphate buffer (pH 7) after heat treatment at 95 °C were 2% and 4% respectively. Gelling temperature (T_{gel}) of 10% UDSP and IPSP protein dispersions were 79.4 °C and 76 °C respectively. Both UDSP and IPSP gels were slightly frequency dependent with storage modulus (G') and angular frequency (ω) relationship of $G' \sim \omega^{0.11}$ and $G' \sim \omega^{0.13}$ for UDSP and IPSP gels respectively. The solubility of these protein gels in different aqueous solvent with/without denaturizing agent revealed that hydrophobic, hydrogen bonding and disulphide (–S–S–) covalent interactions were involved in their gel molecular network. However, –S–S– interactions were significantly ($p < 0.05$) higher in both UDSP and IPSP protein gels than the hydrophobic and hydrogen bonding. IPSP gel had significantly higher mechanical properties than UDSP gels. Scanning electron microscopy revealed that IPSP gels had repeating fine-stranded network structure, while UDSP gel had dense, spherical particulate network appearance.

Highlights

► Sweet potato protein gel formation and network structure were studied. ► Sweet potato protein dispersions exhibited pseudoplastic behavior. ► Least gelation concentration of sweet potato protein ranged from 20 to 40 g/l. ► The onset of gelation of sweet potato proteins were in the range 76–79 °C. ► Sweet potato protein gel networks were predominantly covalent.

Keywords

- Sweet potato protein;
- Gelation;
- Rheology;
- Mechanical properties;
- Microstructure