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Impact of Tryptic Limited Hydrolysis on Bambara Protein-Gum Arabic Soluble Complexes Formation

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Abstract : The formation of soluble complexes is usually within a narrow pH range characterized by weak interactions. Moreover, the rigid conformation of globular proteins restricts the number of charged groups capable of interacting with polysaccharides, thereby limiting food applications. Hence, this study investigated the impact of tryptic-limited hydrolysis on the formation of Bambara protein-gum arabic soluble complexes formation. The electrostatic interactions were monitored through turbidimetry analysis. The Bambara protein hydrolysates at a specified degree of hydrolysis, and DHs (2, 5, and 7.5) were characterized using size exclusion chromatography, zeta potential, surface hydrophobicity, and intrinsic fluorescence. The stability of the complexes was investigated using differential scanning calorimetry and rheometry. The limited tryptic hydrolysis significantly widened the pH range of the formation of soluble complexes, with DH 5 having a wider range (pH 7.0 - 4.3) compared to DH 2 and DH 7.5, while there was no notable difference in the optimum complexation pH of the insoluble complexes. Larger peptides (140, 118 kDa) were detected in DH 2 relative to 144, 70, and 61 kDa in DH 5, which were larger than 140, 118, 48, and 32 kDa in DH 7. 5. An increase in net negative charge (- 30 Mv for DH 7.5) and a slight shift in the net neutrality (from pH 4.9 to 4.3) of the hydrolysates were observed which consequently impacted the electrostatic interaction with gum arabic. There was exposure of the hydrophobic amino acids up to 4-fold in comparison with the isolate and a red shift in maximum fluorescence wavelength in DH dependent manner following the hydrolysis. The denaturation temperature of the soluble complex from the hydrolysates shifted to higher values, having DH 5 with the maximum temperature (94.24 °C). A highly interconnected gel-like soluble complex network was formed having DH 5 with a better structure relative to DH 2 and 7.5. The study showed the use of limited tryptic hydrolysis at DH 5 as an effective approach to modify Bambara protein and provided a more stable and wider pH range of formation for soluble complex, thereby enhancing the food application.

Keywords : Bambara groundnut, gum arabic, interaction, soluble complex
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