Optimization of pH, Temperature, and Protein for Resistant Starch and Textural Properties of Corn Starch–Pea Protein Gels

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The textural behaviour of starch–protein gels is critical for designing functional foods with enhanced resistant starch (RS) potential. This study explored the influence of heating temperature (75–100 °C), pea protein isolate concentration (5–20 %), and pH (3–9) on the gelation properties of a corn starch–pea protein system. A Minitab-generated Box-Behnken experimental design produced 30 gel samples, and texture profile analysis (TPA) was used to measure hardness, cohesiveness, springiness, gumminess, chewiness, resilience, and adhesiveness. The results showed that pH was the most influential factor in enhancing RS formation, with acidic conditions (pH 3) leading to approximately 24.55% RS content in the gels. Conversely, increasing protein concentration tend to reduce RS levels, suggesting a possible inhibitory effect on starch retrogradation mechanisms. Temperature had a moderate effect on RS formation. Furthermore, higher processing temperatures (87.5–100 °C) significantly improved springiness, cohesiveness, and gumminess, indicating the formation of more structured and elastic gels. Protein concentration also influenced gumminess and springiness at elevated temperatures, while pH had a milder impact on textural attributes. Optimisation results tailored to maximise RS content with specific textural properties for specific food applications, such as set yoghurt revealed a temperature of 100 °C, 5% protein, and a pH of 3, with a desirability score of 0.61. These findings highlight the critical role of formulation parameters in promoting RS formation and modulating texture, providing valuable guidance for the design of functional starch-based food systems. Future studies should apply the modified starch in food systems to assess the functionality and RS levels in model foods.

Keywords: Corn starch; Pea protein isolate; Rheology; Gel structure; Functionality