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Maillard Induced Pea Protein-Polysaccharide Conjugates: A Functionally Enhanced Ingredient for the Food and Beverage Industry

ABSTRACT

Pea proteins are increasingly recognized as a cost-effective, sustainable source of legume proteins with a well-balanced amino acid profile. The primary goal of this research was to enhance the functional properties of pea proteins by combining enzymatic hydrolysis with Maillard conjugation. Pea protein-enriched flour was hydrolyzed using trypsin and papain to achieve low to medium degrees of hydrolysis (2% – 15%). These hydrolysates were then conjugated with residual starch within the PPEF through heat conjugation (Maillard reaction). Molecular weight analysis indicated a shift towards higher molecular weights. The resulting conjugates showed improved functional properties compared to the raw samples with enhanced stability at acidic pH. Following conjugates having higher degrees of hydrolysis (above 15%) were examined with additional carbohydrate hydrolysis using α -amylase. The trypsin-hydrolyzed conjugates outperformed papain-hydrolyzed ones across a range of pH levels, demonstrating superior foaming, emulsifying, water- holding, and oil-holding properties. Contrary to previous findings in the literature, the research showed that extensive hydrolysis, when combined with Maillard conjugation, did not impair functionality but enhanced it. In the further study, protein- and starch-rich flour preparations were independently hydrolyzed using trypsin and α -amylase, respectively, and then were conjugated. Functional evaluations showed high solubility and improved foaming and emulsifying properties, particularly at acidic pH, with notable enhancements across all pH levels. Overall, this research demonstrated the potential of conjugation to enhance the functional properties of pea proteins which can be used to improve the texture and stability of foams and emulsions or to improve sensory attributes in alternate meat products. The process not only adds value to starch fractions typically used for animal feed but also promotes eco-friendly, cost-effective solutions for food and beverage applications.

Keywords: Legume proteins, green label, food ingredients, lysine-hydroxygroup conjugation, enzymatic hydrolysis.

BIOGRAPHY

Dr. Takuji Tanaka is professor in Department of Food and Bioproduct Sciences, University of Saskatchewan. His research fields are mainly in enzymology, including structure-function relationships of enzyme using X-ray crystallography to utilization of enzymes in value-added applications. His research program further extends to the utilization of fermentation, especially modification of proteins through fermentation and combinations of fermentation and insect culture to generate novel sources of food and feed materials.