**Development of protein-polysaccharide complex-based emulsions and emulsion-gels for food applications.**

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Oil-in-water (O/W) emulsions are widely utilised in food products such as salad dressings, mayonnaise, and sauces, where high emulsion stability under acidic conditions is required. Additionally, O/W emulsions can be used in gel form for potential applications as substitutes for animal fats, requiring high shape retention and oil release suppression. While egg yolk is one of the most commonly used food emulsifiers due to its high acid resistance and excellent emulsifying performance, its use imposes challenges related to flavor change and allergen concerns, making it unsuitable for individuals with egg allergies. Consequently, the food industry has seen an elevated demand for alternative emulsifiers that are natural, egg-allergen-free, and environmentally sustainable.

In response to these industrial and consumer needs, the present study aimed to develop and characterise stable O/W emulsions and their corresponding emulsion gels using natural biopolymers. The investigation focused on molecular complexes formed between xanthan gum (XG) and either whey protein isolate (WPI) or soy protein isolate (SPI), providing insights into the role of protein-polysaccharide complexes in enhancing the functional properties of the emulsions and emulsion gels.

Highly stable O/W emulsions were prepared by leveraging electrostatic interactions between WPI and XG. Through optimising preparation methods and conditions, required emulsifying performance of the protein-polysaccharide complex was achieved1. At pH 4.0, the WPI-XG complex formed nanoscale assemblies (〜100 nm), with the ζ-potential of the complex (−37.3 mV) being significantly lower than that of WPI alone (+6.94 mV). Cryo-SEM imaging revealed fibrillar XG structures extending from the WPI globules. The emulsions stabilised with the WPI-XG complex exhibited enhanced storage stability over 28 days at 25℃. These findings highlight the potential of the complex as a natural, protein-conserving emulsifier for acidified food products.

O/W emulsion gels using SPI-XG complexes were further investigated for applications in plant-based processed meat products, addressing lipid leakage and texture improvement2. Building upon prior findings1, stable O/W emulsions were prepared with SPI-XG complex at pH 4.0. By incorporating selected gelling agents, emulsion gels with enhanced properties were formulated. Rheological tests identified methylcellulose as a key ingredient contributing to heat resistance. Application tests on plant-based meat patties demonstrated that the emulsion gels effectively reduced weight loss during cooking/reheating, improved juiciness and enhanced texture compared to conventional liquid oils. These results underscore the potential of SPI-XG based emulsion gels in developing plant-based, clean-label processed food products.

These findings support the potential of protein-polysaccharide complexes, particularly under acidic conditions, in designing functional emulsion systems. Such systems can enhance flavor and texture perceptions while promoting environmental sustainability, thereby contributing to the development of highly functional and consumer-preferred food products within the industry.

*References:*

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