

## Effect of Salts on the Antimicrobial Activity of Food Protein-Polysaccharide Conjugates

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## Summary

Maillard-type protein-polysaccharide conjugate has been proposed to be useful as a safe functional biopolymer, since it was demonstrated that a neoglycoprotein can be prepared by binding of the free amino groups in the protein to the reducing-end carbonyl group in the polysaccharide through a controlled heating system without any chemical reagents. In this paper, enhanced antimicrobial activities of food protein-polysaccharide conjugates by the addition of salts, are discussed.

Lysozyme and phosvitin were covalently linked with galactomannan (average molecular weight of 15,000) or xyloglucan (average molecular weight of 1,400) through a controlled dry-heating at 60°C in 65% or 79% relative humidity. The surface functionality of lysozyme was remarkably improved by the covalently binding of polysaccharide chains, as well as phosvitin. A significant improvement in the emulsifying properties of lysozyme and phosvitin was observed in the galactomannan conjugates. The emulsifying activity and emulsion stability were stable in a high salt condition. An interesting finding was that the improved amphiphilicity provided the egg proteins with a novel antimicrobial activity against a typical Gram-negative *Escherichia coli* and a typical Gram-positive *Staphylococcus aureus*. Especially, galactomannan conjugates showed much more strong bactericidal effects on the both Gram-negative and Gram-positive bacteria, compared to xyloglucan conjugates. At the NaCl coexisting system, the antimicrobial activity of lysozyme-galactomannan conjugate increased with increasing the salt concentration, while that of the native protein was drastically reduced in the 100 mg/L NaCl system. The similar trend was observed in the phosvitin-galactomannan system. On the other hand, the promising phenomenon was demonstrated in the coexisting system with MgCl<sub>2</sub> and CaCl<sub>2</sub> for both lysozyme-galactomannan and phosvitin-galactomannan conjugates. The synergistic effect of salts on the antimicrobial actions of the conjugates was CaCl<sub>2</sub> > MgCl<sub>2</sub> > NaCl.

The conjugates of hen egg proteins with galactomannan can be used as a natural antibiotics with excellent surface functionality, because those were prepared by naturally occurring Maillard reaction.