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Effects of electric fields and electromagnetic wave on food protein structure and functionality: A review

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Abstract

Background: Protein is an essential component of human diet and can be applied to many aspects in food systems due to its abundant nutritional value and functional properties. There are many physical methods that have been used to modify the inherent of protein to expand its application areas in the food industry. Among them, electric and electromagnetic fields technologies have attracted increasing attention on their abilities to modify food protein structure and functionality, due to the advantages of energy efficiency, food safety and minimal loss of nutrients.

Scope and approach: The current review presents the effects of electric and electromagnetic fields including pulsed electric field, microwave, radio frequency and irradiation on the changes in food protein structure (primary, secondary, tertiary and quaternary) and functionality (solubility, emulsifying, foaming, apparent viscosity, gelling properties). The affecting factors such as protein concentration and pH, and the strength and duration of electric and electromagnetic fields on the mechanisms and effectiveness of changes in protein structure and functional properties are introduced, and the advantages and limitations of these technologies for protein modification are also discussed.

Key findings and conclusions: Applications of electric and electromagnetic fields can induce the conformational changes of protein via the creation of free radicals or larger or smaller molecules, damaging the primary, secondary, tertiary and quaternary structure of protein, and thus influence the functional properties. Therefore electric and electromagnetic fields are useful methods to modify food protein structure and functionality for the food industry.

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