Continuous microwave-assisted enzymatic hydrolysis system for oilseed protein: design and performance evaluation

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Background: Oilseeds are important source of plant proteins. Defatted oilseed meals are full of proteins and are a good source of proteins for the consumption of human and animals. However, due to some undesirable properties, such as its low solubility, the applications of oilseed protein are limited. Hydrolysis of oilseed meals is a efficient way for improving the additional value. Moreover, these hydrolysates also have certain useful antimicrobial, blood pressure-lowering, cholesterol-lowering, antioxidant, and immunomodulatory properties. Enzymatic hydrolysis with traditional water bath-assisted is generally used for protein hydrolysis. Nowadays, microwave-assisted approach is widely used in the food industry. In comparison to conventional heating, microwaves-assisted approach leads to faster heating rates and shorter processing times.

Objectives: The aim of this study was to design, test, and optimize a continuous microwave-assisted enzymatic digestion method for oilseed protein using temperature, residence time and microwave power as optimizing parameters.

Methods: Two commercially available, batch-type, house-hold microwave units were stacked on top of each other in series. To impart continuous operation, Teflon tubing was inserted vertically through the microwave chamber of the two units to serve as the conduit application tube. Soybean protein resolution was pretreated and hydrolyzed by using microwave-assisted. The effects of different microwave parameters, such as the time, temperature, and power level, on the degree of hydrolysis (DH) and polypeptide content were investigated by orthogonal experiment.

Results: Based on the results of the single factor experiment and orthogonal experiment, the conditions of alkaline protease in the batch reaction for soybean protein were optimized. The optimal conditions for microwave-assisted pretreatment were as follows: temperature 70°C, power 600 W, and time 4 min. Under conditions of initial substance concentration 6%, enzyme / substance 7%, temperature 50°C; power 500 W, and time 4 min. The optimum parameters for microwave-assisted continuous hydrolysis reaction of soybean protein were identified as15 min reaction time and 500W reaction power for 4% substance concentration using a 9% enzyme / substance ratio. By using the optimized protocol, DH of soybean protein was 55.4%, and polypeptide content reached 37.6mg/ml. Rapeseed protein, peanut protein and other oilseed protein were also processed by continuous, microwave-assisted hydrolysis reaction system. Functional properties of polypeptide were evaluated, such as oil adsorption ability, emulsifying capacity, foaming and foaming stability. Polypeptides showed better functional properties. Therefore, continuous, microwave-assisted hydrolysis reaction is a viable method for oilseed protein at relatively short residence times and high throughput.

Conclusion:
In this study, a microwave-assisted heating approach was applied to oilseed protein hydrolysis. The results indicated that the microwave-assisted approach could greatly improve the efficiency of protein hydrolysis. In the future, such a technique may be useful in the industrial production of peptides.

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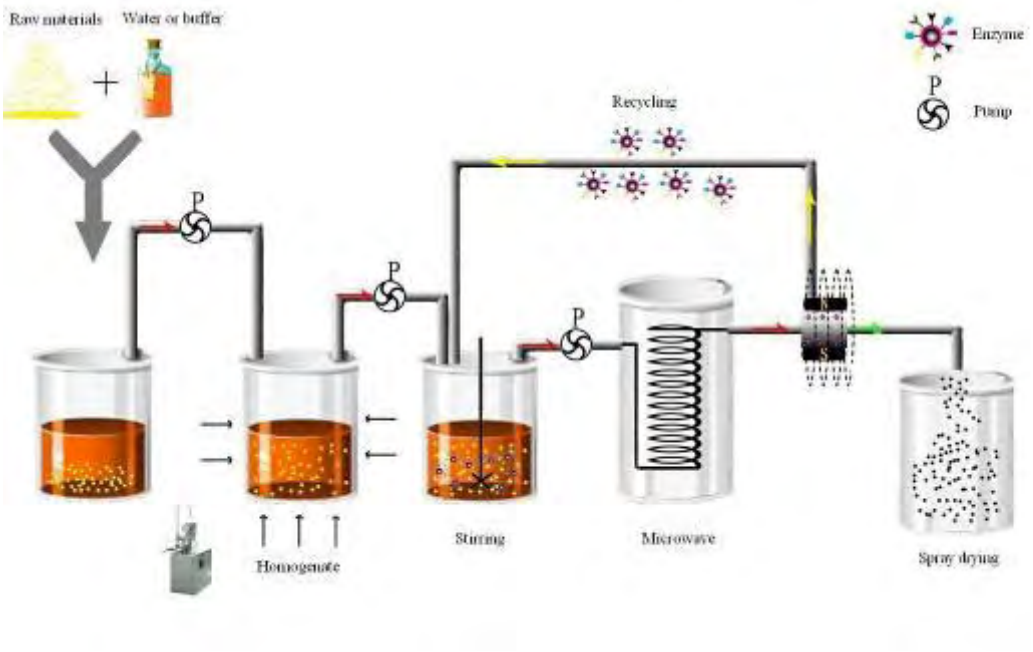

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