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Optimization of Extraction of Carotenoids from Shrimp Waste

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Abstract: This study describes pigments extraction from shrimp wastes under different methods. Carotenoids were extracted and measured from shrimp waste by acid, alkaline, enzyme and solvent extraction. These results demonstrated that good yields can be obtained alkaline treatment. Subject to economic advantages, sodium hydroxide can replace the other methods.

Key words: Shrimp Waste · Carotenoids · Extraction Methods

INRODUCTION

About 50% of shrimp total body weight is waste. These wastes are environmental contaminants. Therefore, utilization of these wastes can prevent environmental contamination. Carotenoids have been documented for health promoting function. Astaxanthin, the main carotenoid found in shrimp, its antioxidant activity was reported to be higher than that of carotene, carotene and lutein and is higher than tocopherol against certain reactive oxygen species [1]. The extraction of shrimp wastes can be used as a source of coloring and flavoring agent in marine products [2]. Moreover, this carotenoid could also be used the food industries. Because of the concern about safety of synthetic antioxidants in foods, searching natural antioxidant for replacing has been attracted by food industries. The extracted carotenoids would also be a cheaper alternative than synthetic carotenoids [3].

There are different techniques for extraction carotenoids such as fermentation, using enzyme and organic solvent. The most popular methods for pigment extraction are using organic solvents. But, this method is toxic and expensive. The aim of this study was to compare the bioactivity of carotenoids of shrimp wastes by four extraction techniques; acid, alkaline, enzyme and solvent with using inhibition of lipid peroxidation method.

MATERIALS AND METHODS

The Test Materials: The shrimp wastes, *Penaeus semisulcatus*, were collected from the processing plants. Then, the wastes were air dried in the shade and powdered.

Extraction of Carotenoids by Trypsin: 0.5 g of sample was placed in test tube and dissolved in deionized water. Separation of carotenoids was done by trypsin. 5% of trypsin was added to waste. pH was adjusted to 8 for enzyme activity and heated at 37°C for 120 min. Then, the hydrolysate was centrifuged and the supernatant was used for experiments.

Extraction of Carotenoids by Acid Treatment: 0.5 g samples were solved in hydrochloric acid (1N) for 48 h. The solution was centrifuged and the supernatant was used for experiments.

Extraction of Carotenoids by Alkaline Treatment: 0.5 g samples were solved in sodium hydroxide (1N) for 48 h. The solution was centrifuged and the supernatant was used for experiments.

Extraction of Carotenoids by Solvents: 0.5 g samples were solved in hexane for 48 h. The solution was centrifuged and the supernatant was used for experiments.

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Table 1: Level of total carotenoid

Extraction Method	Pigments Content* (ppm)
pigments extracted by trypsin	0.02±0.005
pigments extracted by solvents	0.04±0.01
pigments extracted by acid treatment	0.16±0.01
pigments extracted by alkaline treatment	0.32±0.02*

*The values of antioxidant activity were significant difference in carotenoids extracted alkaline treatment with other groups (P<0.05)

Determination of Total Carotenoids: Total carotenoids were determined by β carotene standard curve and by spectrophotometric method at 470 nm [4].

RESULS AND DISCUSSION

This study was used to survey less toxic, economical and applicable method for pigment extraction of shrimp waste. The results of experiments are shown in Tables (1). The concentration of carotenoid pigment in the extracts was calculated using the standard curve obtained by commercial β carotene.

$y = 3240.7x + 0.1129$, $R^2 = 0.9974$

The more content of pigments exited in extracts of alkaline treatment. The level of carotenoid pigment in this group was 0.32±0.02. The amount of pigments was significantly more than other groups (P<0.05). Therefore, alkaline extraction of shrimp waste could be a potential source for pigments. The amount of pigment was followed by acid treatment (Table 1).

The recovery of carotenoids extraction from the waste would improve the economics of the shrimp processing plant. To use organic solvents are not safe extraction methods. This method is not guaranteed, environmentally safe for extraction of pigments. Therefore, there is a need to develop a suitable extraction method [5]. In our previous study, sodium hydroxide extraction was more than ethanol and acetic acid extraction[6]. This study also showed that alkaline extraction was more effective as compared with other methods and the extraction of pigment from the shrimp waste could be efficiently and economically achieved by this method.

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