How to cite this article?

Chudasama *et al*., 2020. Best Use of Shrimp Processing Waste. Biotica Research Today 2(9): 883-885.

Biotica Research Today

Vol 2:9 2020

883 / 885

Best Use of Shrimp Processing Waste

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Open Access

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Keywords

By-product, Chitin, Chitosan, Shrimp

Article History

Received in 07th September 2020

Received in revised form 09th September 2020

Accepted in final form 10th September 2020

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Abstract

Processing of large bulk of shrimp and other aquatic organisms produces a corresponding large bulk of by-products and wastes. Much of these wastes are made into various value-added products. The recent applications of bioactive compounds from shrimp waste briefly describe in terms of different bioactivities, food and feed applications, and other industrial approach. Active compounds in shrimp waste open the doors of energy, solid wastes, and waste water treatment etc. Hence, the future trends of shrimp waste utilization are the movement towards eco-friendly energy conversion, bioremediation and food feeding area.

Introduction

The amount of by-product from shrimp processing varies from 40% to 80% of raw material, depending on the shrimp species and the types of processed products. Shrimp produces 52% as by-products, out of its total body weight in general (Heu *et al.,* 2003). Shrimp processing industries generate tremendous amount of waste, which can be extracted to obtain active compounds including chitin, carotenoids and protein hydrolysates, etc. These active compounds act as antioxidant, antimicrobial, anti-hypertensive, anti-inflammatory and anti-proliferative agents. Moreover, due to their functional and nutritional properties, these compounds could be used as natural safe additives or functional food/ feed ingredients. Active compounds in shrimp waste open the doors of energy, solid wastes, and waste water bioremediation.

Traditionally some of the by-product is processed into sticky shrimp extract ("*petis*"), fermented shrimp paste ("*terasi*"), and shrimp crackers. The potential utilization of shrimp comb is for shrimp paste production. Protein hydrolysates can be obtained from the hydrolysis of shrimp comb byusing strong acid (6N hydrochloric acid). Artificial flavoring from shrimp heads by extracting them with water (1:2, w/v) at 121 °C for 2 h to obtain shrimp filtrate. It is then added with sodium proteinate and 40% maltodextrin as filler, followed by spray drying. Pyrazine compounds are assumed to contribute to the formation of the flavor. Some major utility of shrimp processing waste are describing below.

Shrimp Meal

Shrimp waste meal has been identified as an animal protein source that has great potential. The increase in shrimp farming and production has led to the concomitant production of shrimp waste meal. Larger amounts of shrimps are sold or exported as peeled or unpeeled tail. Shrimp heads alone represent 35–45 % of the total shrimp production. Shrimp waste meal is basically the dried waste of the shrimp industry, consisting of the heads, appendages, and exoskeletons, and is particularly rich in lysine. Shrimp waste meal can be used as a substitution for fish meal in broiler feed formulation processes. The proximate compositions of shrimp meal processed using shrimp heads or skin are 35.90% protein, 4.96% fat, 9.40% moisture, 29.7% ash, and 20.04% other substances.

Figure 1: Shrimp Meal

Chitin and Chitosan

Chitin is the second most important natural polymer in the world. The main sources exploited are two marine crustaceans, shrimp and crabs. Chitin, poly [β-(1→4)-N-acetyl-d-glucosamine], is a natural polysaccharide of major importance, first identified in 1884. This biopolymer is synthesized by an enormous number of living organisms, and considering the amount of chitin produced annually over the world, it is the most abundant polymer after cellulose. Chitin occurs in nature as ordered crystalline micro fibrils forming structural components in the exoskeleton of arthropods or in the cell walls of fungi and yeast (Alishahi and Aïder, 2012). Traditionally, the separation of chitin includes deproteinization, demineralization, and decolorization. Deproteinization or removal of protein is usually done by alkali treatment (NaOH), whereas demineralization or the removal of calcium carbonate and calcium phosphate is done by acid treatments (HCl, HNO_3, H_2SO_4, CH_3COOH, and HCOOH) under high temperatures.

The deacetylated polymer of acetyl glucosamine obtained through alkaline deacetylation of chitin is known as chitosan. Chitosan is a liner, polycationic polymer of D-glucosamine and N-acetyl glucosamine. The two monosaccharides are linked by β-(1→4) glyosidic bonds and the relative amounts of these two monosaccharides varies remarkably, resulting in a varied degree of deacetylation, ranging from 75% to 95%. As the world's leading chitosan manufacturer, each year, Japan manufactures more than 100 billion tons of chitosan and contributes to more than 90% of the world's chitosan production.

Figure 2: Fresh Shrimp (As Raw material)

Figure 3: Waste generated after processing

Applications of Chitin and Chitosan

Chitin and its deacetylated derivative, chitosan, are non-toxic, antibacterial, biodegradable, and biocompatible biopolymers. Due to these properties, they are widely used for biomedical applications, such as tissue engineering scaffolds, drug delivery, wound dressings, separation membranes and antibacterial coatings, stent coatings, and sensors. Wound dressing is one of the most promising medical applications for chitin and chitosan. The adhesive nature of chitin and chitosan, together with their antifungal and bactericidal character, and their permeability to oxygen, is a very important property associated with the treatment of wounds and burns. Different derivatives of chitin and chitosan have been prepared for this purpose in the form of hydrogels, fibers, membranes, scaffolds, and sponges (Jayakumar *et al.,* 2011). The possible utilization of chitin rich waste would fetch two major benefits in the countries where seafood is processed on an industrial scale. Apart from decreasing pollution, the chitooligosaccharides produced during the process contribute enormously to the field of biotechnology. However, the production of chitin and its hydrolyzed derivatives, such as acetyl-glucosamine and chitooligosaccharides from waste of the shell fish industry, has been limited due to the high cost of chitinase and expensive pretreatment processes of the shrimp.

Figure 4: Shrimp Chitin and Chitosan

Carotenoid Pigments

Carotenoid Pigments play an important role in physiological function and also give characteristic pink-orange color to shrimp. Carotenoid is a fat-soluble pigment and can be extracted from head, hepato-pancreas, and shell of shrimps. Astaxanthin is the major carotenoid (75-95 % of total pigment) found in crustacean shells.

Protein Hydrolysate

Proteins are the essential biomolecules for the physiological functions of living organisms. Shrimp waste discard contained high quality of protein, which is composed of 45% total proteins in shrimp.

When shrimp waste is hydrolyzed with proteolytic enzymes, more than 70% protein can be recovered as a hydrolysate. Besides the protein, shrimp waste is a rich source of essential and non-essential amino acids. Protein hydrolysate from shrimp waste has been reported to possess several functional and biological properties.

Conclusion

In order to create green industries that are friendlier to the environment, by-products especially from shrimp processing industries waste should be processed into value-added goods. The shrimp processing industry produces 50–60 % waste of the catch volume. These wastes contain a large quantity of bioactive compounds including chitin, protein, lipid, carotenoid and minerals. Bioactive compounds from shrimp processing waste exhibit various bioactivities, and can be used as food and feed as well as ingredient in functional food preparation. In the process of the utilization of by-products, consideration needs to be given to the availability of required technology, human resources, and financial support.

Acknowledgment

The authors would like to thanks College of Fisheries Science, Junagadh Agricultural University, Veraval for providing the necessary support for this work.

References

Alishahi, A., Aïder, M., 2012. Applications of chitosan in the seafood industry and aquaculture: a review. *Food Bioprocess Technology,* 5(3), 817–830.

Heu, M.S., Kim, J.S., Shahidi, F., 2003. Components and nutritional quality of shrimp processing byproducts. *Food* Chemistry, 82(2), 235–242.

Jayakumar, R., Prabaharan, M., Sudheesh, K.P.T., Nair, S.V., Tamura, H., 2011. Biomaterials basedon chitin and chitosan in wound dressing applications. *Biotechnology Advance,* 29(3), 322–337.