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Utilization of Fish and Shrimp Processing Waste

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***Abstract*:**

As a highly perishable commodity, fish has a significant requirement for processing. Most of the processing waste will be traditionally been sold for use in fishmeal production, hauled into the ocean or dumped on land. Increasing production of inedible parts may cause environmental problems as a result of uncontrolled dumping.

Nowadays, fishery wastes are subjected to strict regulations due to limited land and increased concerns such as foul odor. A better understanding of the potential values of processing waste for a variety of applications have resulted in technological innovations for seafood wastes recycling. Currently, there has been a growing interest in natural ingredients which are readily available from seafood discards. However, lack of adequate utilization technology to fully convert such wastes into value-added products must be seriously addressed.

In this context, the present review is focused on basic option for the minimization of fish and shrimp processing waste to recycle, with reference to Visakhapatnam Fishing Harbor by the adoption of technological modification that reduces waste load and pressure on the ecosystem, which benefits the innate entrepreneurs too.

***Key words*:**

Seafood, Processing waste, By products, VFH, Feasible recycling method.

INTRODUCTION:

Seafood is divinely rich by virtue of its high nutritional value. Commercial processing of aquatic foods requires removal of bones, skin, head, and viscera, which account for approximately 60-70g/100g of the weight. Mostof the processing wastewill be traditionally been sold for use in fishmeal production (Ramasamy Ramasubburayani et. al., 2013;Wassef and Attalah 2003), hauled into the ocean or dumped on land. The discharge of processing waste is a serious environmental problem, as wastes are quickly colonized by spoilage organisms. The efficient utilization of these wastes can yield high economic value, as these wastes are good natural source of raw materials such as protein, chitin, minerals and carotenoids (Sachindra and Bhaskara, 2008;Trang Phuong 2012).

Protein extracted from the shrimp shell waste has been proved to be an excellent animal feed supplement (Ghaly et. al., 2013; Giyose et. al., 2010;Rupsankar Chakrabarti (2002). Chitin in the shell waste is associated intimately with proteins; therefore, deproteinization and demineralization of shrimp shell waste for the production of chitin and carotenoids was done using different strains of bacteria (Divya et. al., 2014; Parisa Sadighara et. al.,2014; Prameela et. al., 2010;Khorrami M.et. al., 2011, Maryam and Mahmood 2007,Olfa Ghorbel-Bellaajet. al., 2011;Sindhu and Sherief 2011; PratyaCharoenvuttithm et. al., 2006). Astaxanthin is a natural nutritional component, an antioxidant (Sindhu and Sherief, 2011; Sachindra and Bhaskara, 2008) and can be used as a food supplement. Calcium is extracted from the scales and bones of fish.

The nutritive and medical value of these bioactive components present in the processing waste depends upon their extraction method. So far, the by-products from fish and shrimp processing waste were extracted by using different ecofriendly and ecologically aggressive techniques by many scientists. Even though, many methods have been employed for the extraction of these byproducts, better utilization of this generated waste has not been done so far, which may be due to the controversy to figure out the duration, input and output.

By evolving appropriate processing waste utilization methods and marketing strategies there will be a better scope for development and to fetch high unit value of different resulting target products. To achieve this, evaluation of the waste utilization methods followed by earlier researchers is needed; to compare the technical investments with economic gains.Thus, techno economic feasible recycling methods may be developed to the goodwill of the entrepreneur and for the human health promotion.

In this context, the present review is focused on basic option for the minimization of fish and shrimp processing waste to recycle, with reference to Visakhapatnam Fishing Harbor (VFH) by the adoption of technological modification that reduces waste load and pressure on the ecosystem, which benefits innate entrepreneurs too.

DISCUSSION:

The sea coast of many countries throughout the world is affected strongly by the dumping of fish and shrimp processing waste into the ocean waters as well as the open land by producing unpleasant smell and increasing pressure on the natural environment resulting in negative interactions among various activities and also degradation of the coastal zone. Recycling of this non-rendered animal waste is a global need for which many countries throughout the world have developed industries for recycling the fish and shrimp leftovers as they become valuable bioactive compounds. In this connection, tremendous research is going on in many countries by using conventional and non-conventional methods in a confusion to find out methodology for better utilization of this processing waste and for profit maximization.

All around the world, fish is produced from capture fisheries and aquaculture (FOC, 2013 a,b). The world's marine capture fisheries contribute more than 50% of the total world fish production. The fish processing industry is a major exporter of seafood in many countries. About 70% of fish is processed before final sale, resulting in 20-80% of waste depending on the level of processing and type of fish (AMEC, 2003). Majority of processing waste is being disposed off in the ocean. In addition, a significant amountof the total catch from fish farming is also discarded each year.

Shrimp, being in great demand (Sudharani, 2014) constitutes the major marine resource in terms of value with 16% of internationally traded fishery products (Food and Agriculture Organization, 2009). The solid shrimp processing waste namely head and shell accounts approximately 40-50% of whole body weight and contain protein (35-40%), chitin (10-15%), minerals (10-15%) and carotenoids (Sachindra and Bhaskara, 2008).

At Visakhapatnam fishing harbor (VFH), field survey was conducted on seafood landings and utilization (Sudharani, 2015; Yedukondala Rao et. al., 2013). Due to enhanced demand for the production of fish meal and fertilizer (Alemu and Abera 2013), landings at VFH showed a steady increase from 2% to 21% (Dineshbabu et.al., 2013).

More than 70% of marine capture fisheries have been utilized for processing (Sachindra and Bhaskara (2008). As a result, every year a considerable amount of total catch is discarded as processing leftovers and that include trimmings, fins, frames, heads, skin and viscera. At VFH, different quantities of waste are being generated at various stages between capture and consumption. Tuna is an important group of large pelagics and Visakhapatnam alone contributes to half of the total tuna catch for the state. They are locally called 'suralu'; support a regular fishery and brought from different landing centers to VFH for export. Huge quantities of tuna waste and shrimp waste are being dried in the drying yard of VFH and Bhimili (30km from VFH); the final dried product is sold for the preparation of fish meal. Sometimes a significant amount of waste is also sent to landfill as it is not wanted. An alternative and beneficial use of this waste seems to be more preferable but as the costs to get finished products in the market are more viable, most of the processing waste may be disposed off simply. On average 5,150 t of shrimp waste is generated annually (Das et. al., 2013) through VFH.

Fish processing is one of the major industries, where the waste is used for the production of various value added products such as proteins, oil, amino acids, minerals, enzymes, bioactive peptides, collagen and gelatin (Ghaly et. al., 2013). The characteristics of chitosan and carotenoprotein produced from byproducts of Vietnam shrimp processing industry have been evaluated and proved (Trang and Phuong, 2012) that high quality chitosan and lipid-mineral-rich carotenoprotein can be obtained from shrimp by-products.

An effective method demonstrated by Divya et. al., (2014), uses a combination of three procedures for the extraction of high purity chitosan through crude chitin from the shell waste of *Penaeus monodon* also used alkali and acid for deproteinization and demineralization. pH-shift process is an alternative to protein hydrolysis for recovering protein from shrimp cephalothorax of white leg shrimp, *Penaeus vannamei* (Julio et. al., 2013).

Across the seafood industry in south-eastern Australia alone, it is estimated that >20,000 t of fish product waste is produced annually. Some of this fish waste is rendered, but most of it is dumped to landfill at a cost up to $150/t. This practice is coming under increased scrutiny due to environmental issues.The average amount of waste for all fish is about 30% (Carawan ***et** al.*, 1979). Preparation and filleting fish generate 30-40% of solid wastes (Anon., 1992).

Two Indian Scientists (Sindhu and Sherief, 2011) have experimented on shell waste of the Arabian red shrimp, *Aristeus alcocki* to get high yield of carotenoids by using different organic solvents under wet and dry conditions, with and without deproteinization. Chitin is produced by partial fermentation of shrimp bio waste using microorganisms (Prameela et. al., 2010) from shrimp biowaste collected from East Godavari and Visakhapatnam districts of Andhra Pradesh, India; as use of alkalies (4% NaOH) for deproteinization and acids (4%HCl) for demineralization, makes the process expensive and ecologically aggressive. But, if more cheaper and safe process has been determined through the present evaluation, it makes the better use of the processing waste. HCl can be replaced by organic acids while extracting chitin from shell waste of black tiger shrimp (Pratya et.al., 2006), which was also followed by some other researchers while demineralizing the sea food processing waste, as HCl is a harsh chemical. In enzymatic process of extracting carotenoprotein (Rupsankar Chakrabarti, 2002) from shell waste of brown shrimp, *Metapenaeusmonoceros*maximum yield was obtained through trypsin rather than pepsin and paparin, but the cost of trypsin is more than pepsin and twenty times than paparin.

The potential use of proteases has been evaluated (Giyose et. al., 2010) for the extraction of pure chitin from a South African sea food processing industry using standard methods and concluded that proteases produced by *Erwinia chrysanthemi* could be used to transform waste into products of commercial value. For sustainable aquaculture in Nigeria, a catfish farm was evaluated (Sotolu, 2009) for its diet of fish waste meal and imported fishmeal and suggested that the fish farmer should be adopted by fish waste meal to the aquafarm to a major extent.

However, there is a need of evaluating all the techniques used so far to get economic benefits where the present subject has both national and international status.

CONCLUSION:

It is better to think of the items; viscera, fins, trims, flaps, shell etc. of fish and shrimp processing as the by-products or co-products have significant potential for use as raw material to make other products. The processing waste is nutritionally rich and contains a high proportion of enzymes which results in rapid spoilage. The natural volatility of the waste can be utilized to ensile it, which may result in the yield of more useful by products. A complete effort of the present subject may develop the best techno-economic feasible method or methods for effective utilization of fish and shrimp processing waste.

Moreover, the recovery of biochemical compounds from seafood processing waste material could be used for human health promotion along with economic returns. Recycling of the processing waste, instead of mere dumping, will reduce the organic load on the environment. A better economic use of the fish and shrimp processing waste by applying better techno-economically feasible methods and marketing strategies would minimize the pollution problem and maximize the profits of the processor. It will give a better scope for development and fetches high unit value of different resulting target products. The comparison of the technical investments with economic gains would help the potential entrepreneurs in the respective work field.

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