

Chitin and Chitosan as Potential Nutraceuticals: An Overview

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Abstract—Dietary components play a vital role in maintaining good health which is the top priorities for many people. Nutraceuticals are bioactive materials isolated or purified from foods to be utilized in the medicinal form. Marine derivatives are the major contributors of the bioactivities such as Proteins, peptides, and carbohydrates. There are so many processing plants in India, generating a huge quantity of crustacean shell wastes, these wastes are no longer classified as waste since we can recycle them. Chitin and chitosan obtained from crustacean shell wastes have long been of interest as biomaterials in a variety of application in edible film industry, additives, for improving nutritional quality, Recovery of solid materials from food processing waste, in purification of water etc. This review attempts to compile all principal information available regarding the importance of nutraceuticals, growing demand of nutraceuticals, use of chitin and Chitosan as Nutraceuticals and Nutraceuticals product based on chitin and Chitosan available in the market.

Key word: Marine derivatives, Nutraceuticals, Chitin and chitosan etc.

1. INTRODUCTION

In modern Era of twenty one century the life style has significantly changes with the tremendous increase in world population. Increased leisure and rise in purchasing power resulted in reduction in physical activity. These change in life style had specific impact on food consumption patterns of general public. A shift towards consumption of chunk food with high levels of sugar and saturated fats, showed detrimental effects on health with course of time. This leads to sudden rise in chronic disease such as coronary heart diseases, hypertension, obesity, cancer, diabetes, and osteoporosis.

At the same time, many opportunities for the development of novel dietary products have been created. With all new fields of study come new term knew as "Nutraceuticals"[1] a term combining the words "nutrition" (a nourishing food or food component) and "pharmaceutical" (a medical drug), is a food or food product that provides health and medical benefits, including the prevention and treatment of disease. Such products may range from isolated nutrients, dietary supplements and specific diets to genetically engineered foods, herbal products and processed foods such as cereals, soups and beverages [2].

In marine fish processing industry, the main concern is food and nutritional value of the products. However, in addition to this main production stream, there is a potential to identify and develop new industries related to marine fisheries. As a result, identification of biological properties and development of nutraceuticals from these bioresources have yielded a considerable number of drug candidates in recent years. However, most of these compounds are still at the developmental stages. Fish protein hydrolysates and fish bone-derived functional materials have attracted the main focus among functional bioactive materials identified from marine fisheries by-products.

There are so many processing plants in India, generating a huge quantity of crustacean shell wastes, these wastes are no longer classified as waste since we can recycle them. Chitin is the major structural component of the exoskeleton of invertebrates and the cell walls of fungi [3-7]. Since the biodegradation of chitin is very slow in crustacean shell waste, accumulation of large quantities of discards from processing of crustaceans has become a major concern in the seafood processing industry [8]. Chitin and its deacetylated form, chitosan, have been of interest in the past few decades due to their potential broad range of industrial applications [6,9]. There is wide applications of these product which include preservation of foods from microbial deterioration [10,11], formation of biodegradable, recovery of waste material from food processing discards, purification of water and clarification and deacidification of fruit juices etc.

This review attempts to compile all principal information available regarding the importance of nutraceuticals, growing demand of nutraceuticals, use of chitin and Chitosan as Nutraceuticals and Nutraceuticals product based on chitin and Chitosan available in the market.

2. DEMAND OF NUTRACUTICLES

Globally the nutraceutical market was estimated to be US\$ 140.1 billion in 2010. Of this USA and Europe formed the

largest markets accounting to 36 percent and 25 percent respectively. Exhibit 1 portrays global nutraceutical market.

In 2010, the Indian nutra industry was estimated at US \$ 2 Billion, roughly 1.5 percent of the global nutraceutical industry. The existence and consumer belief the alternate medicines share in India could provide a platform for the nutraceutical industry to capitalize on. Currently, an Indian nascent market is trying to incorporate traditional herbal ingredients (usually ayurvedic) into the nutraceutical portfolio. In India, functional foods and beverages are expected to see increased consumption over the next five years resulting in this segment garnering greater product share (67%) in the market as opposed to dietary supplements (33%). The total Indian nutraceuticals market in 2015 is expected to be approximately US \$ 5 billion.

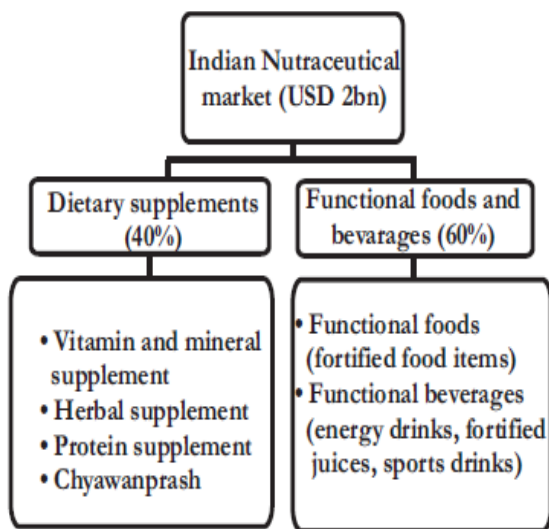


Fig. 1: Segments of Indian Nutraceutical market

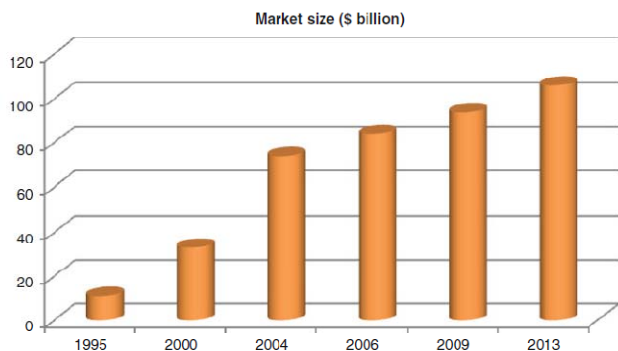


Fig. 2: Global market size of functional foods

3. CHITIN AND CHITOSAN AS NUTRACEUTICALS

Chitin is the second most abundant natural biopolymer after cellulose. The chemical structure of chitin is similar to that of

cellulose with 2-acetamido-2-deoxy-b-d-glucose (NAG) monomers attached via linkages. Chitosan is the deacetylated (to varying degrees) form of chitin, which, unlike chitin, is soluble in acidic solutions. Application of chitinous products in foods and pharmaceuticals as well as processing aids has received considerable attention in recent years as exotic synthetic compounds are losing their appeal.

Chitin is recovered from processing discards of shrimp, crab, lobster, and crayfish following deproteinization and demineralization. The chitin so obtained may then be deacetylated to afford chitosan. Depending on the duration of the deacylation process, the chitosan produced may assume different viscosities and molecular weights. The chitosans produced are soluble in weak acid solutions, thus chitosan ascorbate, chitosan acetate, chitosan lactate, and chitosan malate, etc., may be obtained and these are all soluble in water. Chitosan has a variety of health benefits and may be employed in a number of nutraceutical and health-related applications. Chitosan derivatives may also be produced in order to obtain more effective products for certain applications.

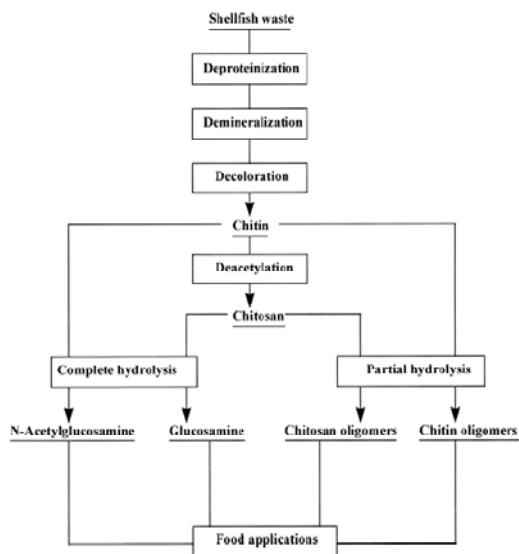


Fig. 3: Simplified flowsheet for preparation of chitin, chitosan, their oligomers and monomers from shellfish waste

Table 1: Marine Sources of Chitin and Percentage (Dry Weight Basis) Found in shell discards

Chitin source	Chitin in shell wastes (%)
Clam/oyster	3-6
Crab:	
Collinectes sapidus	13.5
Chionoecetes opilio	26.6
Shrimp:	
Pandalus borealis	17.0
Crangon crangon	17.8

<i>Penaeus monodon</i>	40.4
Crawn fish:	
<i>Procamborus clarkia</i>	29.8
Prawn	33.0
Squid pen	20-40
Krill:	
<i>Euphausia superba</i>	41..0

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Some Chitin based products available in market



4. CONCLUSION

Even though chitin nutraceutical in, chitosan and their derivatives have been considered as potential source for nutraceutical industry. In that sense, research and development should have great potential in finding novel uses in product development, microbiology, edible film industry, water purification, purification of waste discharge from food processing waste and nutritional aspects related to chitin, chitosan and their derivatives.

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