



मत्स्य प्रौद्योगिकी समाचार Fish Technology Newsletter

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News from the Research Front

Production of Food Grade Gelatin From Fishery Waste

Gelatin is a gelling protein, which has widely been applied in the food and pharmaceutical industries. Commercial gelatins are mostly derived from mammalian sources, mainly pig skin and cow hide but for many socio-cultural reasons alternative sources are increasingly demanded. The amount of gelatin used in the Worldwide food industry is increasing. However, frequent occurrences of Bovine Spongiform Encephalopathy (BSE) and foot/mouth diseases limited the utility of mammalian gelatin in processing of functional foods, cosmetics and pharmaceutical products. Therefore, the studies on the suitability of alternative sources such as fish skin and bone for the extraction of gelatin have gained momentum in recent years.

Utilization of fish processing waste for the production of high value products like gelatin is an active area of research and has high commercial relevance. Considering the quantum of fish processing waste generated in India every year (which is about 50% of the total fish production), it is appropriate to find suitable solutions for fishery waste management and turn this waste in to high value resource. The aquaculture production in the country is estimated to be over 2.5 million tonnes and freshwater fin fish contributed almost 97% of the total freshwater aquaculture. Among the freshwater species Indian major carps contribute 85% of the total landings of freshwater fish in the country. The 12th plan gives priority to value addition in the inland fishery sector in India through network of organized fish processing and marketing units which are being established in the sector. Viable options



Gelatin from carp skin



Gel dessert from carp skin gelatin

केन्द्रीय मात्स्यिकी प्रौद्योगिकी संस्थान

सिफ्ट जंक्शन, मत्स्यपुरी पी. ओ., कोचिन-682 029

Central Institute of Fisheries Technology

CIFT Junction, Matsyapuri P.O., Cochin - 682 029



are to be offered for the utilization and management of the significant quantity of fishery waste generated in these units. Fish skin forms a major portion of the fishery waste, particularly in the case of production of mince-based and fillet-based value added products.

Considering the need for developing appropriate technologies for the utilization of fishery waste, CIFT, Cochin had undertaken a research programme for extraction of gelatin from the skin of freshwater carps. The response surface methodology tool has been applied in the extraction process of gelatin to obtain the product with predictable quality attributes under optimized conditions. The physico-chemical and functional properties of carp skin gelatin has proven the suitability of this product in many applications hitherto restricted to mammalian gelatin.

The maximum gelatin yield was from Rohu (12.9%) followed by Common carp (12%) and Grass carp (10.5%) which is higher than the yield reported from any other freshwater and marine species indicating its viability for commercial extraction. A study on the functional properties of the carp skin gelatin showed that the gel had medium gel strength in the range of 181–230 B which is of commercial significance, considering the potential applications in food and edible film preparations. Gel strength of carp skin gelatin is comparable to that of gelatin obtained from tropical fish species. High viscosity gelatin (5.96–7.07 cP) was obtained from carps, which is suitable for film forming applications. Melting point of the gelatin obtained from carps (28.13–29.1 °C) was comparable to gelatin from mammalian sources. The setting temperature observed for the gels from carp skin is in the range of 17.9 °C – 20.5 °C. The setting and melting temperatures observed for carp skin gelatin are similar, if not better than many of the gelatin from animal sources and can possibly substitute the same in many applications without extensive modifications. This offers future scope for developing binary blends of these gelatin with animal gelatin that are completely compatible and commercially useful in many applications.

Gelatin from the carp skin was found to have a mild but easily perceivable odour, had a snowy white appearance and is light-textured. These are positive attributes, since it is easier to incorporate these gelatins into any food system without imparting any strong colour. Carp skin gelatin films had significantly low water vapour permeability and oxygen permeability than mammalian skin gelatin films which indicate the superior gas barrier property of carp skin gelatin films. This property has potential applications in developing biodegradable packaging material. Carp skin

gelatin was found to be suitable for the preparation of gel based edible products with good organoleptic properties.

Chemical analysis of carp skin gelatin indicated that the moisture content of the sample was below 10%, which is less than the limit prescribed for edible gelatin i.e. 15%. The ash content in gelatin samples were in the range of 1.10 - 1.18%, much less than the recommended maximum limit (2%) set for edible gelatin. Gelatin from the carp skin is safe with respect to heavy metals. The quantum of arsenic, lead, copper, zinc, cadmium and chromium in the samples were below the limits prescribed. Bacteriological analysis showed that the microbiological quality conforms to the standards of edible gelatin. The total plate counts were well below the allowable limit of 1000/g. Other bacterial groups viz., Coliforms, *E. coli*, *Salmonella*, Clostridial spores, Staphylococci, and *Pseudomonas* were not detected in the samples.

The texture attributes of the gelatin of Rohu, Common carp and Grass carp gives an indication that these are useful in food applications for the preparation of the products like fruit gums where gelatin helps in thermo-reversible gel formation, provide taste and colour neutrality, gives easy pouring ability due to low viscosity and excellent clarity. In addition, gelatin gives unique texture and excellent mouth feel, chewability and attractive appearance.

A comparative study of mammalian skin gelatin and carp skin gelatin showed that mammalian skin gelatin (Bovine and porcine) had significantly higher viscosity, melting and setting temperature and faster setting time when compared to carp skin gelatin. The odour scores were higher for mammalian gelatin, indicating that they had a distinguishable odour and hence can be considered as inferior to carp skin gelatin in organoleptic qualities. Gel strengths of Grass carp and bovine skin gelatin were comparable. Foam formation ability was similar for mammalian and Grass carp skin gelatins and mammalian skin gelatin exhibited significantly better foam stability than carp skin gelatin.

Optimization of the process of gelatin production from the skin of freshwater fish will help in better realization of price for primary producers and processors, who can actually convert the fishery waste into a significant source of income. This has the added advantage of a viable solution for environmental pollution by minimizing the solid waste generated in fish processing units and solutions for cleaner fish processing environment.

Dr. George Ninan, Dr. A.A. Zynudheen and Dr. C.N. Ravishankar

Fish Processing Division, CIFT, Cochin

