THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212

Popular Article

August, 2023; 3(08), 2168-2171

Fish Protein Concentrate (FPC): Fueling Health and Sustainability

Ritika A. Tandel*, Jayesh R. Mer, Jitesh B. Solanki
Department of Fish Processing Technology, College of Fisheries Science, Kamdhenu University, Veraval, Gujarat – 362 265, India
https://doi.org/10.5281/zenodo.8304226

Abstract

The huge global demand for high-quality fish protein is increasing more quickly than it can be satisfied with existing supplies. To address this, fish protein concentrates (FPC) were created as one of the first attempts to recover protein from byproducts and underutilize fishery resources to use as a human meal. Fish protein concentrate (FPC) is a beneficial compound obtained from the remains of fish processing that provides a nutrient-rich solution to tackle worldwide food security issues. The protein content of FPC is remarkably high, ranging from 75% to 95%. This exceptional quality protein is obtained through solvent extraction from various fish species. As the population continues to increase and the need for protein-rich foods grows, FPC proves to be a sustainable and environmentally-friendly alternative that improves nutrition, reduces waste, and supports the fishing industry.

Keywords: Fish protein concentrate (FPC), fish processing, fish by-product, nutrition

Introduction

Fish processing is a rapidly growing industry, vital to the global economy. India is among the fastest-growing countries in total fish production, with an annual growth rate of 10.34% and fish consumption of 6.31 kg per capita. The growing exploitation of aquatic resources results in substantial biowaste, with over 60% coming from fish processing operations. The visceral mass of fish, which makes up around 20% of its live weight, is a rich source of protein, lipids, polyunsaturated fatty acids, soluble vitamins, phospholipids, and other nutrients and is also a significant source of agro-industrial products. These by-products are now recognized as significant sources of compounds of high added value, including hydroxyapatite, collagen, gelatin, lipids, enzymes, hydrolysates, and bioactive peptides, with significant potential for applications in human health. Fish discards from fish processing are now increasingly recognized to be a source of underutilized protein. Researchers have been working to maximize fish waste in recent years by creating fish protein concentrates (FPC), which have great potential for utilization in food, pharmaceuticals, nutrition and even in cosmetics. FPCs have a long history of use in various cultures, but scientific study of their production began only in the last 30 years.

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com

Published: **29.08.2023**

Types of FPC

Fish protein concentrate (FPC) is a low-cost, healthy, and stable product made from fish, with higher protein and nutrient concentration than raw fish. FPCs have different colors and flavors, some mild and tasteless, others strong and fishy. They can dissolve or stay insoluble and have varying nutritional benefits. Three categories are specified by the Food and Agriculture Organization of the United Nations:

1. Type A: an almost tasteless, odorless powder with a maximum total fat content of 0–75%.
2. Type B: powder with a maximum fat content of 3% and an aroma or flavor that is not specifically regulated but certainly fishy.
3. Type C: A typically manufactured fish meal that meets acceptable hygiene standards.

How does FPC differ from Fishmeal and Fish protein hydrolysate?

In comparison to fishmeal (FM), the remaining product (FPC) has less ash and is richer in protein (around 80%). FPC is similar to fish hydrolysate, with the exception that it doesn't contain any water or oil. Compared to FM, the FPC has smaller particles and a more uniform texture and colour. Due to the processing requirements involved in its manufacturing, FPC is more expensive than FM and is only made for human consumption and a small number of applications, especially in milk substitutes. Since FPC contains less oil, it has significantly less of a fishy flavour.

Process of manufacturing FPC

The manufacturing process of types A and B, while noting that type C is essentially just a hygienically prepared fish meal. It's worth noting that water and fat makeup roughly 80% of the whole fish, with the fat content in certain species sometimes accounting for up to 20% of the total weight. In the manufacturing of FPC, the majority of the water and some or all of the fat are removed. The techniques that have been created thus far rely mostly on the employment of chemical solvents to get rid of the water, fat, and fishy-tasting elements from either raw fish or fish meal. Alcohols, such as ethanol or propanol, as well as ethylene dichloride, are the solvents most successfully utilized to create FPC. Typically, the solvent is collected and utilized repeatedly. Fishery wastes or any sort of fish can be used to make FPC.

Potential of FPC

Proteins found in fish possess unique functional properties that make them ideal as carriers of lipids, creating stable lipid emulsions, forming solid gels, and retaining water (Lee *et al.*, 2016). The essential amino acids like arginine, histidine, tyrosine, isoleucine, cystine, lysine, leucine, threonine, methionine, and tryptophan, as well as nonessential amino acids such as glutamine, glutamic acid, glycine, proline, and taurine, make up the protein of the FPC (Wu, 2010).

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published: **29.08.2023**

They are active in participating in and controlling crucial metabolic pathways that benefit an organism's health, survival, lactation, growth, development, and reproduction. In addition, they offer remarkable potential for the prevention and treatment of a number of metabolic diseases such as infertility, infectious diseases, intrauterine growth restriction, intestinal and neurological dysfunction, obesity, hypertension, diabetes, and cardiovascular disorder as well as the treatment of infertility and infectious diseases (Wu, 2013). Fish protein concentrate is highly valued for its collagen content, which provides skin-tightening and whitening benefits, promotes skin cell renewal, strengthens bones, and slows down the aging process. As a result, it has gained widespread use in the cosmetic and personal care industries (Kumoro *et al.*, 2022).

Conclusion

Although fish is widely available and considered a highly nutritious, healthiest and most complete source of protein for humans, it is frequently unexpectedly rejected by specific groups of individuals due to its overpoweringly fishy smell. To maintain the nutrients and increase consumer appeal, converting fish meat to FPC may be a potential solution.

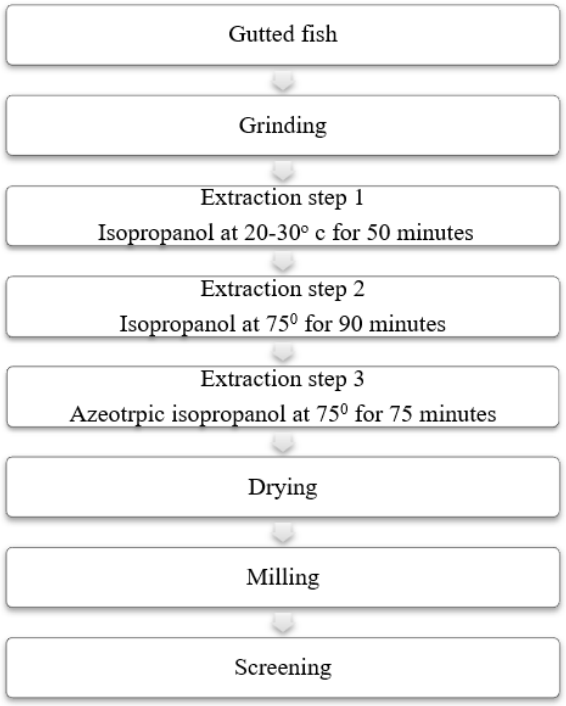

Figure 1. Process flow chart of FPC (source: Sikorski *et al.*, 1981)

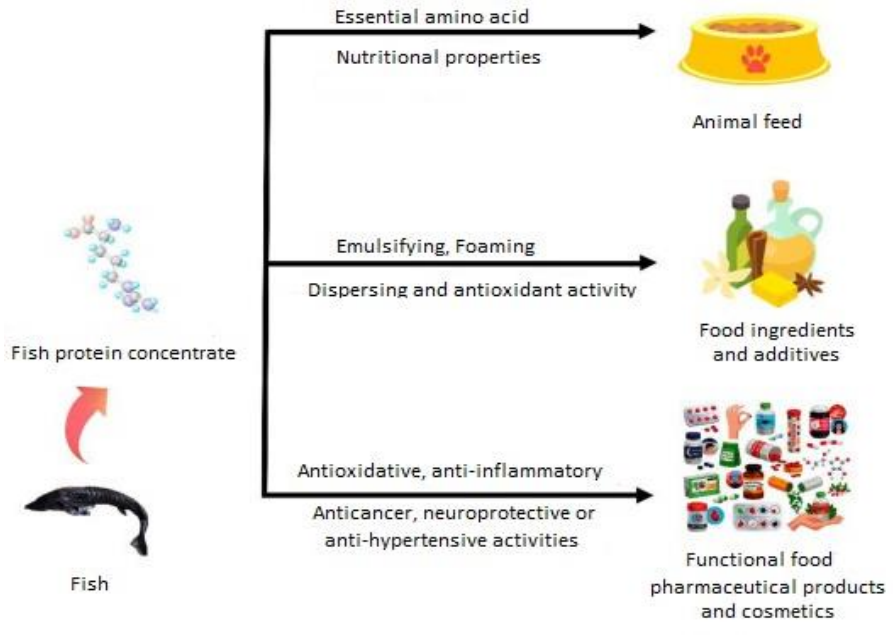

Figure 2. Potential application of FCP (Source: Gao *et al.*, 2021)

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published: **29.08.2023**

FPC has a strong future as a versatile food supplement because of its high-quality protein, minerals, and vitamins based on its nutrient content. FPC has also been used widely in applications for cosmetic and personal care products. Fish protein concentrate (FPC) emerges as a remarkable solution at the intersection of nutrition, sustainability, and resource optimization. In a world grappling with the challenges of food security, population growth, and environmental concerns, FPC offers the potential to convert underutilized fish by-products into a high-quality protein source.

References

Gao, R., Yu, Q., Shen, Y., Chu, Q., Chen, G., Fen, S. & Sun, Q. (2021). Production, bioactive properties, and potential applications of fish protein hydrolysates: Developments and challenges. *Trends in Food Science & Technology, 110,* 687-699.

Kumoro, A. C., Wardhani, D. H., Kusworo, T. D., Djaeni, M., Ping, T. C. & Azis, Y. M. R. F. (2022). Fish protein concentrate for human consumption: A review of its preparation by solvent extraction methods and potential for food applications. *Annals of Agricultural Sciences, 67*(1), 42-59.

Lee, H.J., Park, S.H., Yoon, I.S. (2016). Chemical composition of protein concentrate prepared from Yellowfin tuna *Thunnus albacares* roe by cook-dried process. *Fish Aquatic Sci. 19*(12), 1-8. https://doi.org/10.1186/s41240-016-0012-1

Sikorski, Z. E., Naczk, M. & Toledo, R. T. (1981). Modification of technological properties of fish protein concentrates. *Critical Reviews in Food Science & Nutrition, 14*(3), 201-230.

Wu, G. (2010). Functional amino acids in growth, reproduction, and health. *Advances in nutrition, 1*(1), 31-37.

Wu, G. (2013). Functional amino acids in nutrition and health. *Amino acids, 45,* 407-411.