TRANSITION FROM FISH PROCESSING WASTE TO VALUE ADDED PRODUCTS: A SYSTEMATIC LITERATURE REVIEW

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Abstract

Fish processing industries develop an enormous level of fish wastes which always raises a serious sustainability issue and there is definitely a need for inculcating value-added seafood products both in our domestic industry and export platter in order to capture a new horizon of market. Apart from that it is a phase of difficulty in waste disposal which leads to serious environmental issues which projects the necessity of conducting such a review. Perhaps it is very relevant to conduct a review on the conversion of this fish processing waste to high value-added seafood products. Systematic literature review has been conducted and as a part of the planning of search process, proper inclusion and exclusion criteria along with complementary inclusion and exclusion has adopted. The results are rigor returns with a list of impact journals in the study area and a detail of articles that are related to each category of research questions. Data were extracted and synthesized with those have open access from eminent journals through Scopus, dimensions, ERIC, Google scholar etc

Keywords:- Sustainability, Value added fish products, fish waste, by-products, and environmental pollution.

The fish processing business has grown significantly and is now a major player in the global economy. Growing amounts of biowaste are produced as a result of the growing discovery of marine resources, and this waste is discarded. Many efforts have been undertaken to deal with the trash from fisheries more efficiently in light of the disposal issues that follow as well as the environmental issues(Ideia et al., 2019). More than 60 per cent of fish waste, including heads, viscera, and skin, is produced by the fish processing industry.

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These waste materials include low-market-value items like fish meal and fish silage, and they have a significant impact on the environmental pollution and disposal problem(Desai et al., 2022) The world marine capture fisheries contribute more than 50 per cent of the total world fish production. About 70 per cent of fish is processed before final sale, resulting in 20-80 per cent of fish waste depending on the level of processing and type of fish. Furthermore, a substantial portion of the annual catch from fish farming is wasted.(Ae et al., 2013) The issue of fish waste has drawn a lot of attention from food producers, processors, retailers, and consumers in India since fish waste is produced in large quantities by the retail markets, fishing harbor by catch, and fish processing companies. A quarter of the world's yearly amount of fish caught is wasted as a result of the ongoing expansion of fish resources.(Mohanty & Swain, 2021)

In India, the matter of fish waste has concerned considerable attention to the food producers, processors, retailers, and consumers because the waste from fish generated during a huge amount from the fish processing industries, retail markets and also from the by-catch at the fishing harbour. The continuous increase in global fish resources leads to 25 per cent of wastage among total fish catch annually. During 2006-07, an estimate of the, 02,750 tons of waste was generated from fish processing (both processing and preprocessing taken together) industries of India alone. Non-utilization or underutilization of those waste products not only cause negative externalities to society but also cause environmental pollution and ecological onus. To secure from pollution and to scale back waste, it's now become important to possess a comprehensive understanding about the recycle and/or conversion of those fish wastes into useful products of higher nutritive value and betterment of human society. Thus, the effective utilization of fish processing waste materials from the fish processing sectors has been reviewed here-in India, the problem of fish waste has concerned considerable attention to the food producers, processors, retailers, and consumers because the waste from fish generated during a huge amount from the fish processing industries, retail markets and also from the by-catch at the fishing harbour. Non-utilization or underutilization of these waste products not only cause negative externalities to society but also lead to environmental pollution and ecological onus. To secure from pollution and to scale back waste, it's now become important to possess a comprehensive understanding about the recycle and/or conversion of those fish wastes into useful products of higher nutritive value and betterment of human society. Thus, the effective utilization of fish processing waste materials from the fish processing sectors has been reviewed here (Mohanty et al., 2018)

Objectives of the Study

1. To study about the research profiles of selected literature.
2. To identify various themes related to accumulated researches.
3. To identify the research gap in the existing literature.

Statement of the Problem

Considering the increasing focus on sustainability and resource efficiency, the shift from waste products from fish processing to value-added products presents a viable option.Through the process of transforming waste materials into valuable products like nutraceuticals, bioactive compounds, animal feed, fertilizers, bioenergy, and materials for cosmetics and pharmaceuticals, the seafood industry can drastically lower its environmental impact and improve its financial sustainability. Despite the obvious advantages, there is still a limited adoption of circular economy practices in the fish processing industry due to obstacles relating to technology, regulations, and the market. Moreover, there is a dearth of thorough and organized knowledge regarding the current procedures, tools, and results related to this shift. Due to this knowledge gap, a detailed analysis of recent studies is required in order to pinpoint practical approaches, obstacles, and chances for expanding these practices. Consequently, the purpose of this study is to conduct a thorough literature review on the shift from waste products from fish processing to value-added products.

Significance of the Study

This study is important because it could revolutionize the seafood industry by encouraging the environmentally friendly conversion of waste from fish processing into useful products. The study identifies strategies that can lessen their impact on the environment, create new economic opportunities, and improve resource efficiency by methodically reviewing the literature. It offers researchers, policymakers, and industry stakeholder's important insights and a way forward for more sustainable practices that are consistent with the circular economy's tenets. In addition to addressing urgent environmental issues, this research advances technology and the seafood industry's financial stability.

Methodology of the Study

The structure of this systematic review followed applicable guidelines set in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement. In addition, the search for data, synthesis and conceptualization of data from relevant studies was based on (Petticrew & Roberts, 2008) complemented with qualitative content analysis process. The SLR technique was chosen for the current study because it enables a thorough and understandable presentation of the body of existing literature in the topic (Tranfield et al., 2003) This method has been utilized in numerous recent research to review earlier literature (Kushwah et al., 2019). Data extraction and research profiling are the two unique processes in the SLR methodology evaluation process (Behera et al., 2019) (Seth et al., 2020).

Data Extraction

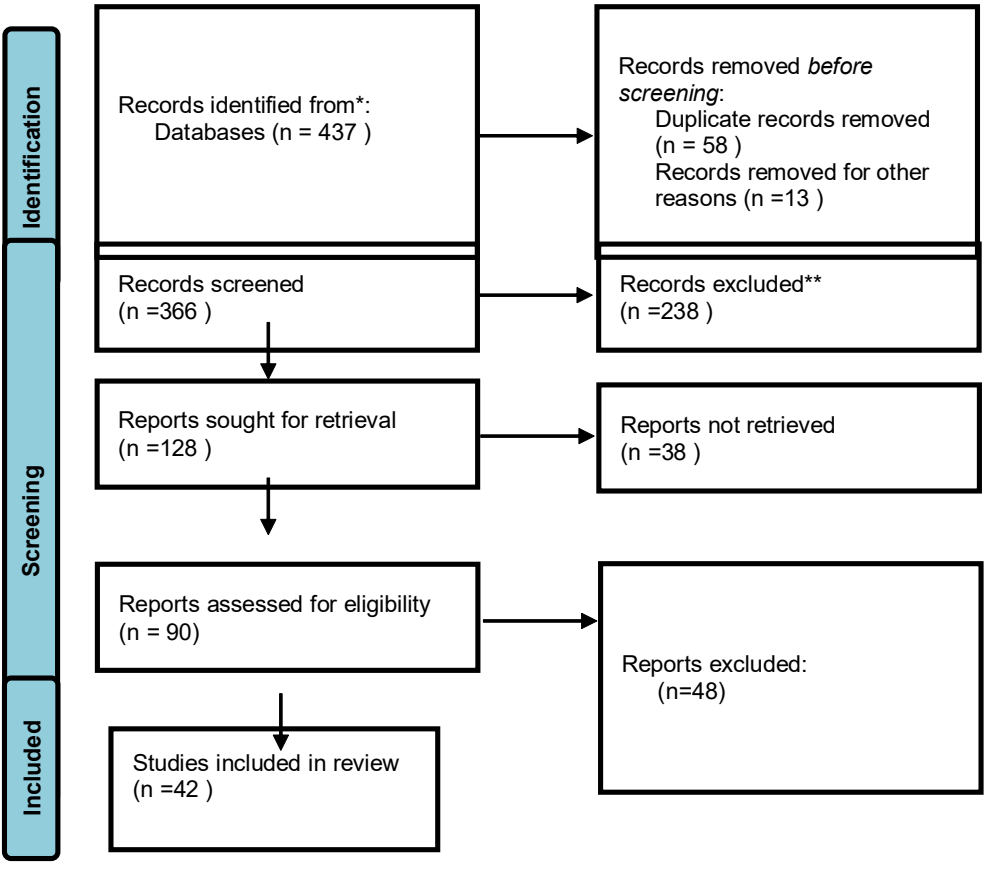
The review used most relevant and reliable database, Scopus for finding the relevant literatures. First of all; we traced related studies based on our objective of study with proper inclusion and exclusion criteria.

Scope of the Study

This study's scope includes a thorough analysis of the body of research on the

Figure 1

Prisma Framework



conversion of waste from fish processing into products with added value. It discusses different conversion techniques, technological advancements, and how they are applied in various seafood industry sectors. The research delves into the environmental, economic, and regulatory facets of these practices, pinpointing significant obstacles and prospects for their wider implementation. In order to give stakeholders in the seafood industry, policymakers, and researchers interested in promoting sustainable practices in the sector a comprehensive grasp of the current state of knowledge, the study takes a global approach.

Study Selection

Here, we restricted the analysis to journal articles in English and excluded intentional reports book chapters, conference proceedings etc. Scopus, Springer databases were used to find out the related literature. Initial search keywords used were "FISH WASTE" which gives a result of 1124 literatures. Inclusion criteria include subject area of

social science and Business, Management and Accounting which limits the studies to 63 (35 and 29 respectively). Inclusion criteria include article document type and final publication stage which limits the related studies from 48 to 47. Finally, the literature find stick on to open access articles which ends up the number in 21. In the extraction stage 4 studies wanted to be excluded which are not directly related to the topic. Before arriving at the final number those articles are to be screened through titles and abstract.

Discussions

The review discusses the significant issue of fish waste generated during the processing of fish, highlighting both the environmental challenges and the potential for utilizing this waste in sustainable ways. Here are the key findings and results.

The review notes that a substantial amount of fish waste is produced globally, with estimates suggesting that 9.1 million tons are discarded annually. In India alone, over 4.32 million tons of fish waste is generated each year. Traditional disposal methods for fish waste, such as land filling and incineration, are not only costly but also environmentally damaging, contributing to green house gas emissions and pollution. Inappropriate waste management practices can lead to public health risks and environmental degradation. The review emphasis on the potential of fish by-products, which are rich in proteins and other valuable nutrients.

These by-products can be transformed into high value products, such as novel food and animal feeds, thereby enhancing the sustainability of the aquaculture sector. Recent advancements in marine biotechnology have enabled the bio-refinement of fish waste using eco-friendly methods. This includes the conversion of low value fish by-products into more valuable substances, which can be commercially viable and environmentally beneficial. The review suggests that effective waste management practices, including the recovery of marketable by-products from fish waste, can lead to better resource utilization and profit maximization for the seafood industry. Strategies such as hydrolyzing fish waste for use in animal feed or fertilizers are highlighted as beneficial approaches. The findings underscore the need for identifying environmentally sound alternatives for recycling fish waste, which can mitigate the negative impact of waste disposal and contribute to sustainable development.

In summary, the review presents a compelling case for the sustainable management of fish waste, highlighting its potential as a resource for creating valuable products while addressing environmental concerns associated with its disposal.

Research Implications

There were five major gaps noted, including challenges with generalizability, research design, self-reports and voluntary surveys, sample sizes and representativeness, and data collection issues. The studies chosen spanned a wide range of geographical areas, fish waste treatment facilities, and so on. This has contributed to the literature in a specific way, but the diversity of situations has also raised concerns regarding the

generalizability of study findings to other contexts (e.g., Betz et al., 2015; Stockli € et al., 2018). Many of the selected studies utilized a qualitative research design to examine fish waste conversion (Mozumder et al., 2022). The qualitative design has inherent flaws that might have a negative impact on study outcomes. These obstacles include the framing of research questions, ethical considerations, contextual issues, and non-numerical data analysis, which raises concerns about the results' rigour. Similarly, some studies employed experiment based designs that were conducted in hypothetical scenarios rather than in real-world settings, thereby imposing a limitation on the findings (Nalinga & Legonda, 2016)(Madhu et al., 2014).

Many of the selected studies relied on small sample sizes to collect data (Kannan et al., 2017). The utilization of smaller sample sizes in comparison to the size of the target population raises concerns about the sample's representativeness and, as a result, the reliability of the findings. Certain examined studies took a narrow focus on the issues related to fish waste. There are ethical and economic reasons for bio-waste management, and adequate legislation appears to be a necessary need for properly and profitably utilizing the fish waste. Proper fish waste treatment reduces their impact on environment and society at a large and thereby increasing the chances of sustainability measures to a great extend.

Limitations of the Study

There are three issues with the current study: First a thorough grasp of the field and subject was used to construct the search procedure as well as the many inclusion and exclusion criteria. It is plausible that the keywords employed may not have been comprehensive, hence increasing the likelihood of certain pertinent research being omitted. Second only article papers written in English were included in the selection of studies. This might have resulted in the omission of prominent research from other languages and sources (conferences, reports and reviews) as well as papers published in other languages. The review totally lacks comparative studies on the basis of fish waste treatments and processing across various economies.

Findings

It has been discovered that the studies that were chosen do not contain any literature that addresses the most cost-effective and comprehensive way to utilize fish waste. Fish waste can be processed using a variety of pretreatment and processing methods to provide a range of value-added fish products. Furthermore, there is more need for additional evaluations based on fish wastes from artisanal traditional fishing methods, such as low-value, underutilized, highly nutritious fish and their subsequent processing and use. The examined studies took a narrow focus on the issues related to fish waste treatment. By capturing food waste at many stages, such as growing, processing, production, and consumption, scholars may provide more rigorous results and build more effective fish waste reduction and utilization strategies. There is a need for better quantification of fish waste as the first step towards waste reduction and sustainability. The review condenses information on

popular fish processing methods. High-quality value-added products in lower cost with advantageous nutritional value can be produced by combining the knowledge and the techniques offered in an inventive and well-planned manner and also are able to solve the main sustainability issue regarding this. Customers, exporters and producers will find value in this. This review paper has the same rigour as that of primary research with many practical implications in the field of fertilizer production, fish feeds and cattle feed production, high value addition in sea food products etc.

Suggestions

Examine the methods for optimising current technologies to increase their affordability and scalability. To increase the yield and efficiency of valuable compounds from fish processing waste, look into cutting-edge and novel extraction techniques like ultrasonic, microwave, and supercritical fluid extraction. Examine the possibilities of using microbial fermentation to produce valuable products and bioactive compounds from fish waste. Examine how to better break down and recover valuable compounds from fish waste by using particular enzymes. From fish processing waste, find and create new value-added products with an emphasis on novel uses in bioplastics, nutraceuticals, and pharmaceuticals. To make sure these goods satisfy legal and industry requirements, conduct studies on their efficacy, safety, and quality. Conduct thorough economic analyses, including cost-benefit analyses with conventional waste disposal techniques, to evaluate the financial feasibility of turning fish waste into products with added value.

Examine the market potential and consumer acceptability of goods made from waste of fish processing, taking into account consumer preferences and market trends. Assess the environmental effects of turning fish processing waste into value-added products, including greenhouse gas emissions, energy use, and water footprint, conducts thorough life cycle assessments. Create and implement sustainability metrics to evaluate these practices' long-term environmental benefits. Examine how supportive laws and regulations might be created to promote the seafood industry's adoption of circular economy principles. Examine how government subsidies and incentives can help to facilitate the switch from waste to products with value added. Examine whether effective fish waste processing models can be scaled up and replicated in various settings.

Conclusion

The majority of the selected research relied heavily on a qualitative and experiment-based approach to data collection from fish waste treatment facilities. Despite the fact that the findings were fascinating and valuable, the majority of the investigations did not employ any theory or theoretical framework. As a result, they lacked the theoretical underpinnings that would have made them far more useful for guiding future research. Only a few of the research from the pool were theoretical in nature. Furthermore, legislative efforts should be aimed towards establishing waste quantification benchmarks in order to

standardize the collection of fish waste data. This would also make future academics' comparative investigations across diverse companies and economies easier. A large body of literature has also emphasized the importance of adequately quantifying fish waste as the first step towards waste reduction and treatment.

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