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A Review on the Application of Fish Waste-Derived Peptone in Microbial Growth Medium and Its Extraction Methods

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Abstract

Peptone is a partially hydrolysed protein molecule. Being hydrophilic in nature, it is extracted from protein sources and is the main ingredient in any nutrient agar medium. Conversions of fish waste into peptones will potentially bring the media cost down compared to using commercial peptone. Previous study states that the biosurfactant levels are superior in fish waste-based medium compared to the traditional media. Hence, fish-waste peptones can be used to promote microbial growth. The review aims to compare the amino acid content and peptone production from saltwater fish, freshwater fish and commercial peptone. As well as to determine the best peptone extraction method for the selected sources. The review was done systematically comprising formulation of questions and objectives, literature search, inclusion screening, quality assessment, data extraction and analysis. In comparison to Catfish (5.66 %) and River catfish (4.98 %), Swamp eel has higher peptone production (14.72 %) with amino acids content that can promote microbial growth. Asian swamp eel is common in Malaysia as it is consumed widely. For saltwater fishes, Mackerel is the best of the three examined due to its increased peptone production compared to Tiger groupers and Parrot fish. Overall, the swamp eel is the best source for peptones among the six species reviewed. Between the three methods compared, enzymatic hydrolysis (papain) shows to be the best method to extract peptone from swamp eels since peptones derived by acid hydrolysis have a poor concentration of amino acids. The research can be improved by giving more weights on cost of peptone as most research based on the yield and amino acid content. The review can help people in the aquaculture and biotechnology industry. This can increase fish farmers revenue and at the same can reduce the cost of buying commercial peptone for researchers.

Keyword: Fish-waste derived peptone; enzymatic hydrolysis; acid hydrolysis

INTRODUCTION

The research will look at the various ways for hydrolysing protein into a well-balanced nutrition agar media. Fish waste is high in protein, which is useful for clinical research since it promotes bacteria development. The focus of the research is on the comparison between freshwater and saltwater fish in terms of yield of peptone focused mainly on amino acid composition and protein content and to find

out best method for peptone extraction. Previous studies have always concentrated on figuring out how to extract peptone from fish waste and other materials in order to create low-cost peptone on the market. The leftover raw material from the fish has been used to produce low-value products such as silage or meal for animal feed. The economic potential of making better use of the remaining raw materials by turning them into higher-value products like peptones is considerable.

METHODOLOGY

The main objective is to compare and contrast the amino acid content of different fish species in terms of their amino acid content. A series of methods is used to gather information for this review Related questions were framed followed by identifying the concerns that require addressing. Using the clear and organized questions as the mainframe, relevant information was identified, utilizing scholar-based search platforms. Documentation of inclusions, exclusions and their reason took place prior to quality assessment of the study and summarization of evidence mentioned in the review. The final step was interpretation of findings which brings to the completed review.

RESULTS AND DISCUSSION

Peptones produced from fish-waste have a higher value than commercial peptones. While the commercial peptones have an almost complete amino acid profile, it lacks proline compared to all the six species reviewed against (Table 1). In addition to amino acid profile, peptone yield should also be considered when choosing for the better source.

Table 1: The amino acids compositions of freshwater and saltwater fish compared to the commercial peptone (Standard: Oxoid) *x*g/100g

Amino acids	Catfish [1]	Pangasius [1]	Swamp eel [3]	Oxoid [1]	Parrot fish [2]	Grouper [2]	Mackerel [4]
Alanine	4.72	5.79	7.10	7.00	8.12	9.70	9.32
Arginine	5.32	5.86	6.90	6.20	5.86	7.59	6.91
Aspartic acids	7.97	5.47	12.90	7.50	7.21	6.39	8.74
Glutamic acids	12.83	10.05	14.20	11.60	9.11	9.97	12.74
Glycine	18.17	19.05	8.00	5.60	21.34	18.67	16.73
Histidine	1.58	1.30	3.60	1.50	1.90	2.24	2.19
Isoleucine	4.77	4.91	8.80	2.40	3.49	4.07	3.21
Leucine	8.45	8.57	3.60	5.00	6.54	7.32	6.52
Lysine	5.69	5.46	7.90	5.80	2.68	3.73	6.88
Phenylalanine	4.87	4.73	2.50	2.30	6.73	6.96	3.05
Proline	9.37	10.29	3.30	-	8.70	7.64	8.73
Serine	3.94	4.77	4.90	2.90	6.30	4.20	5.54
Threonine	4.78	5.91	5.70	2.60	5.68	4.86	4.10
Tyrosine	1.04	1.01	3.60	1.80	1.39	1.40	0.77
Valine	6.54	6.84	3.90	3.60	4.95	5.26	4.59

SOURCE: [1], [2], [3] and [4]

Yield of peptone can be calculated by obtaining the percentage of protein yield from initial dry weight of sample and dry weight post extraction. Table 2 displays the peptone yield, protein content and method of extractions for the selected fish species. The acid hydrolysis technique from mackerel using hydrochloric acid gives a high yield of peptone extraction of around 30.69 % but the protein content is low [4]. Enzymatic hydrolysis is the better method, giving the highest protein content and high peptone yield (Swamp eel: 74.15% : 14.72) compared to other extractions.

Table 2: The yield of peptone, protein content and extraction methods of freshwater and saltwater fish

Types of fish	Yield of peptone	Protein content	Extraction method
Freshwater fish			
Catfish (*Clarias gariepinus*) [2]	5.66	89.41	Propionic and formic acids
Pangasius (*Pangasius Pangasius*) [2]	4.98	90.80	Propionic and formic acids
Swamp eel (*Monopterus albus*) [3]	14.72	74.15	papain
Saltwater fish			
Grouper (Epinephelus fuscoguttatus) [1]	3.45	86.43	Propionic & formic acids
Parrot fish (*Scarus javanicus)* [1]	5.70	86.67	Propionic & formic acids
Mackerel (*Scomber scombrus*) [4]	30.69	17.37	Hydrochloric acids

Source: [1], [2], [3] and [4]

CONCLUSION

The enzymatic hydrolysis method is the best method for peptone extraction. This means it selectively hydrolyses polypeptides and preserve all existing amino acids. The cultivation of freshwater fish should be increased to provide researchers to utilize peptone in their microbial growth media. This can increase the income of fish farmers at the same time and Asian swamp eel is best fish species to be utilized for peptone extraction.

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