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The Effect of Salt Concentration and Natural Preservative Atung on the Organoleptic of the Tongkol Salted Fish *(Euthynnus affinis)*

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ABSTRACT

The purpose of this research was to determine the organoleptic quality of Tongkol salted fish *(Euthynnus affinis)* with a combination of salt soaking and natural preservative atung (*Parinarium glaberimum*, Hassk). The salt concentrations used were 6% (A1) and 8% (A2), while the concentrations of atung used were 2% (B1), 3% (B2), and 4%. (B3). Organoleptic observations include appearance, smell, taste, and texture. The research results showed that the best organoleptic quality of Tongkol salted fish *(Euthynnus affinis)* was in treatment A1B1 with a salt concentration of 6% and a 2% brine, achieving an appearance score of 8.7 with specifications of clean, very bright specific type, a smell score of 8.6 with a strong specific type, a taste score of 8.4 with a salty specific type, and a texture score of 8.8 with specifications of solid and dry. The research results have met the quality and safety standards for dried salted fish.

INTRODUCTION

The tongkol fish is one of the most economically valuable fish species, widely consumed due to its rich chemical composition, which includes 25% protein, 1.50% fat, 25% ash, 0.03% carbohydrates, and 69.40% water **(Sanger, 2010)**. Despite its high protein content (18–30%), fish also have a relatively high water content (70–80%), making them prone to rapid quality degradation due to the activity of spoilage bacteria **(Moeljanto, 1992)**. This is supported by **Leiwakabessy *et al.* (2024)**, who noted that fish provide an ideal environment for the growth of decomposing microbes due to their high water content and nutrient richness.

To avoid spoilage in a short period, handling and processing are necessary to preserve fish. Salted fish is one of the traditional processed products that can serve as an alternative for long-term storage. Salted fish, known for its distinctive taste and aroma, is the highlight of this product. As a traditionally processed item, the tools and materials used in its production remain limited and adhere to age-old recipes **(Moniharapon *et al.*,**

2022). Nevertheless, the prospects for salted fish processing continue to develop and the quality produced is better **(Panjaitan, 2015)**. Generally, the salt used in the process of making salted fish is 20-30% of the weight of the fish after cleaning **(Widyaningsih & Murtini, 2006)**.

Based on Regulation of the Minister of Health of the Republic of Indonesia Number 33 of 2012, the use of substances such as formaldehyde or formalin in food is prohibited because they can be harmful to human health, either acutely or chronically. Acute exposure to formalin can cause irritation to the respiratory and digestive tracts, as well as vomiting and dizziness. Meanwhile, chronic exposure to formalin can damage the liver, kidneys, heart, spleen, and pancreas, and accelerate aging **(Tarumingi *et al.*, 2021)**. It is known that until now, salted fish that test positive for formalin are still found in several Indonesian markets, as reported by **Rovita and Wulandari (2022)**, **Lewerissa *et al.* (2023)** and **Riani *et al.* (2024)**.

Atung (*Parinarium glaberimum*, Hassk) is one of the natural preservatives that has been proven to contain bioactive components capable of killing several types of pathogenic and food-destroying bacteria **(Moniharapon *et al.*, 2019)**. Atung has been widely applied as a preservative in fishery products such as smoked fish **(Hiariey & Lekahena, 2015)**, salted fish **(Tuharea *et al.*, 2019)**, fresh squid **(Kaimudin, 2022),** and fresh fish **(Moniharapon *et al.*, 2023)**.

The widespread use of formalin and excessively high salt levels makes salted fish very salty, even to the point of tasting bitter, so panelists tend to prefer salted fish with low salt content **(Tumbaleka *et al.*, 2013)**. Therefore, this research was conducted to determine the organoleptic quality of salted Tongkol fish *(Euthynnus affinis)* processed using low salt content and combined with the use of atung (*Parinarium glaberimum,* Hassk) as a natural preservative.

MATERIALS AND METHODS

1. **Materials**

   The materials used in this research are Tongkol fish *(Euthynnus affinis)*, atung *(Parinarium glaberimum,* Hassk*)*, water, and salt.

2. **Atung preparation (Moniharapon, 1993)**

   The process of making atung solution *(Parinarium glaberimum,* Hassk*)* began with splitting the atung fruit, removing its seeds, and grating them. The grated material was then dried manually. The dried grated atung seeds were crushed and sifted until atung powder was produced. For one night, the atung powder was macerated. 30 grams of atung powder were dissolved in 1000ml of water (B/V) to produce a 2% atung solution, and with further treatment, to produce 3 and 4% atung solutions.

3. Making salted fish (Modification of Moniharapon & Pattipeilohy, 2018)

The Tongkol fish goes through the stages of washing, cleaning, and cutting. The fish was split from the front of the mouth through the belly to the tail, forming a butterfly cut. It was then drained and weighed. Next, the fish was soaked for 30 minutes in a 6 and 8% salt solutions, followed by soaking in a 2, 3, and 4% atung solutions. After soaking, the Tongkol fish was sun-dried. Then, an organoleptic test was conducted.

4. Treatments

This research used 2 treatment factors: (A) salt concentration and (B) atung concentration, as follows :

1. Salt 6%, atung 2%........... (A1B1)
2. Salt 6%, atung 3%........... (A1B2)
3. Salt 6%, atung 4%........... (A1B3)
4. Salt 8%, atung 2%........... (A2B1)
5. Salt 8%, atung 3%........... (A2B2)
6. Salt 8%, atung 4%........... (A2B3)

5. Observation and analysis

Organoleptic observations included appearance, smell, taste, and texture using the hedonic analysis method with numerical values (SNI 8273:2016). Organoleptic observations were analyzed using a Completely Randomized Design (CRD) with 4 replications followed by the Friedman Test and then the Multiple Comparison Test **(Wayne, 1989)**.

RESULTS AND DISCUSSION

The results of the organoleptic test analysis included appearance, smell, taste, and texture. The sensory evaluation of the butterfly-cut Tongkol fish consisted of 15 panelists. A panelist is a person who conducts sensory evaluations of a product **(Ayustaningwarno, 2014)**.

Table 1. Recapitulation of the Friedman Test and multiple comparisons of dried salted Tongkol

Treatments	Appearance		Smell		Taste		Texture	
	Ranking no/differences	Mean	Rankingn o/differences	Mean	Rankingn o/differences	Mean	Rankingn o/differences	Mean
A1B1	**23.0**[a]	8.3±0.125	**22.5**[a]	8.6±0.175	**23.0**[a]	8.4±0.15	**24.0**[a]	8.8±0.125
A1B2	**16.0ab**	8.3±0.20	**16.5ab**	8.3±0.05	**17.5ab**	8.2±0.15	**16.5ab**	8.5±0.20
A1B3	**16.5ab**	8.4±0.125	**10.5 b**	8.2±0.150	**11.5 bc**	8.0±0.15	**15.0 b**	8.4±0.125
A2B1	**15.0ab**	8.3±0.30	**6.0 c**	7.9±0.175	**13.0 bc**	8.1±0.125	**10.0 b**	8.2±0.30
A2B2	**9.5 bc**	8.0±0.175	**11.0 b**	8.2±0.075	**6.5 c**	7.8±0.275	**9.5 b**	8.2±0.175
A2B3	**4.0 c**	7.6±0.20	**17.5ab**	8.3±0.125	**12.5 bc**	8.0±0.15	**9.0 b**	8.2±0.20

Note : The exponent is the ranking value of each exam column. Numbers followed by the same letter are not significantly different.

1. **Appearance**

The results of the multiple comparison test showed that the treatment with a 6% salt concentration (A1) and 2% atung (B1) received the highest scores with a total rank and average of 23.0 and 8.7, respectively, charasterized by clean and very bright specifications. This was followed by treatment A1B3, which did not significantly differ from treatments A1B2 and A2B1, but showed significant differences compared to treatments A2B2 and A2B3, whereas treatment A2B3 (8% salt, 4% sugar) obtained the lowest score with a rank of 4.0 and an average of 7.6, as shown in Fig. (1).

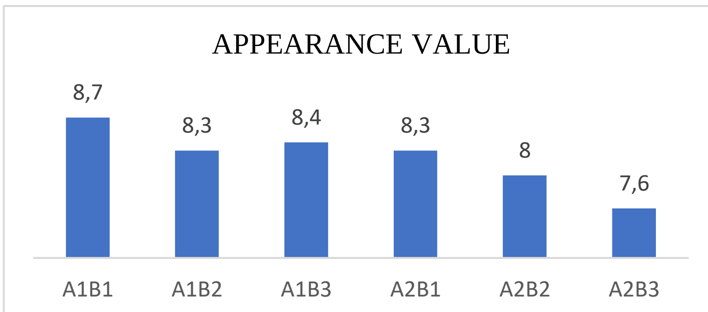

Fig. 1. Histogram of the appearance values of dried salted tongkol

Appearance and color are important factors in determining whether a product is favored by consumers, as they serve as the initial attraction to catch their attention **(Winarno, 2002)**. Based on the histogram, the average panelists preferred the treatment A1B1 (6% salt, 2% atung). This differs from the findings of **Pattipeilohy *et al.* (2023)**, which reported the highest appearance score in treatments with a combination of 10% salt and 5% atung for both fresh tuna and dried salted tongkol **(Pattipeilohy *et al.*, 2022)**. This is supported by **Moniharapon *et al.* (2022)**, who reported that varying concentrations of salt and atung resulted in different appearance outcomes.

A factor influencing these results is the size and weight of the fish. In this study, smaller fish were used, with butterfly fillets averaging 64 grams per piece, compared to the 130 grams per piece in the research by **Pattipeilohy *et al*. (2022)**. According to the salting method outlined by **BPOM RI (2017)** in the book *Food Production for the Home Industry of Salted Fish*, the salt concentration varies based on fish size: large fish use 20-30% of the fish's weight, medium fish use 15-20%, and small fish use 5%. This variation in salt concentration significantly affects the appearance, smell, taste, and texture of salted fish. **Rahmani *et al.* (2007)** states that higher salt concentrations can cause dried fish to appear whiter due to the presence of more salt grains.

In addition to the lower salt concentration, panelists also preferred the lower atung concentration. Soaking the fish in a 3 or 4% atung solution for 30 minutes resulted in darker, brownish salted fish compared to the 2% atung solution. Furthermore, the heat from the drying process also influences the fish's color, a phenomenon known as the browning reaction **(Tumbaleka *et al.*, 2013)**.

2. Smell

From the results of the multiple comparison test, it was found that the use of 6% salt concentration and 2% atung (A1B1) obtained the highest values with a ranking total and average of 22.5 and 8.6, with a specific strong type smell. This value gradually decreased to the lowest in the A2B1 treatment (8% salt, 2% atung), which was 6.0 and 7.9. (specific type is weak). This shows that the panelists preferred the salted fish with a salt concentration of 6% (A1) compared to the salt concentration of 8% (A2), which was influenced by the soaking of atung (B), hence the use of a lower salt concentration still gave a specific smell to the butterfly-cut Tongkol fish. The research results differ from those of previous studies reporting that the combination of 10 and 5% salt obtained the highest smell values, namely 8.7 for dried salted tuna and 7.7 for dried salted Tongkol **(Pattipeilohy *et al.*, 2022; Pattipeilohy, 2023)**. This proves that the combination of salt treatment and atung, whether at high or low concentrations, significantly affects the smell value of dried salted fish.

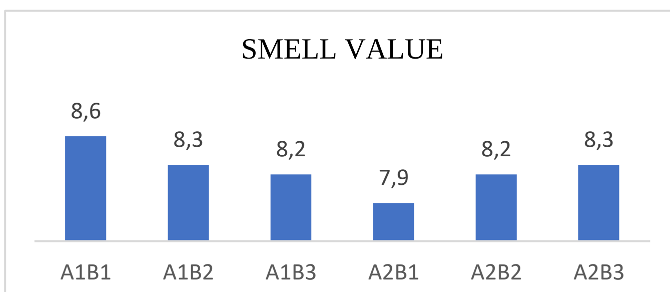

Fig. 2. Histogram of the smell values of dried salted Tongkol

According to **Reo (2013)**, the concentration of the salt solution and the drying time affect the smell of salted fish, where a higher concentration of salt with a longer drying process results in a more specific smell due to the reduced moisture content in the fish flesh, causing the fishy smell to evaporate and the smell caused by the salt to become more pronounced.

The prolonged soaking of fish in an atung solution for 30 minutes, which serves as a preservative, also imparts a distinctive smell to butterfly-cut salted fish. This is because atung is capable of preventing the degradation of nutrient composition, which causes oxidation that can lead to a rancid smell in the product

(Olatunde & Benjakul, 2018). **Pattipeilohy *et al.* (2022)** postulates that the smell of dried salted tongkol is influenced by bioactive compounds present in the atung, namely azelaic acid, which plays a role during the soaking and drying process of the fish. Atung is known to be able to kill spoilage bacteria and prevent rancidity, so the resulting smell is a distinctive smell that is favored by the panelists.

3. Taste

Fig. (3) shows that the taste value of dried salted Tongkol decreases from treatment A1B1 (6% salt, 2% sugar), with a ranking total and average of 23.0 and 8.4 with specific type salt specifications, but the values consecutively decrease until reaching the lowest values of 6.5 and 7.8 in treatment A2B2.

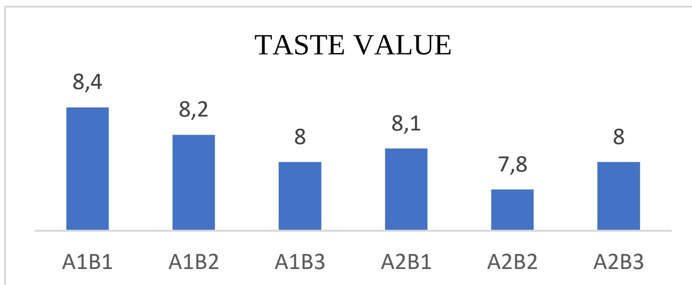

Fig. 3. Histogram of the taste values of dried salted Tongkol

Pattipeilohy *et al.* (2023) reported that the treatment with a 10% salt solution and a 5% atung concentration yielded the highest appearance score of 8.7 for dried salted tuna, with a total ranking of 23.5 and an average of 7.9 for dried salted Tongkol **(Pattipeilohy *et al.*, 2022)**. The differences in salt and atung concentrations clearly affect the taste of salted fish. However, based on the research results, panelists preferred the butterfly-cut Tongkol salted fish with a 6% salt concentration (A1) over the 8% salt concentration (A2). This indicates that the use of atung, whether at high or low concentrations, can enhance the taste of butterfly-cut Tongkol salted fish, as it serves as a humectant. **Usmany and Liline (2018)** state that the longer the salting process and the higher the salt concentration, the lower the panelists' acceptance of the taste of dried salted flying fish. A higher salt concentration contributes to an increased saltiness in dried salted fish.

4. Texture

From the results of the multiple comparison test, it was shown that the treatment of salt and atung concentration affects the texture of dried salted Tongkol, resulting in the highest value in treatment A1B1 (6% salt, 2% atung) with a ranking total and average of 24.0 and 8.8, with specifications of solid and dry. Followed by treatment A1B2 (6% salt, 3% atung) with a ranking total and average of 16.5 and 8.5, then treatment A1B3 (6% salt, 4% atung) and obtaining a value of 8.2 for the treatment with 8% salt concentration (A2). Based on the research results, all treatments obtained high values and met the organoleptic quality standards for dried salted fish. The texture of butterfly-cut Tongkol salted fish, which is dense and dry, is influenced by the initial condition of the raw material with a dense and compact texture. Therefore, during soaking and drying, atung acts as an antimicrobial that prevents the breakdown of muscle tissue after the rigor mortis phase, and salt functions to bind water so that during drying, the water content decreases due to evaporation.

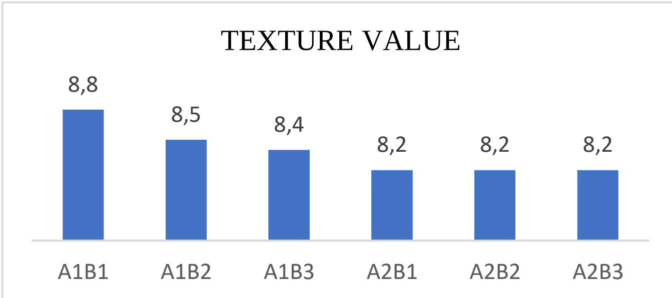

Fig. 4. Histogram of the texture values of dried salted tongkol

According to **Yuarni and Jamaluddin (2015)** texture is one of the most important quality factors to provide the best impression on dried salted fish products, such as chewy, hard, soft, tender, or tough, as well as sticky, smooth, or coarse and sandy. The drying time also affects the texture of dried salted fish. Butterfly-cut Tongkol fish is dried for 3 days under sunlight, resulting in a firm and dry texture. The firm and dry texture also affects the moisture content of the dried salted fish, with a maximum requirement of 40%.

CONCLUSION

The treatment of salt concentration and drying on Tongkol salted fish has different effects, and all treatments meet the quality and safety standards for dried salted fish. (SNI 8273:2016). The best organoleptic quality of butterfly-cut salted Tongkol fish *(Euthynnus affinis)* is in treatment A1B1 with a salt concentration of 6 and 2% atung, with a clean appearance, very bright specific type (8.3 value), strong specific type smell (8.6 value), specific type salty taste (8.4 value), and a solid and dry texture (8.8 value).

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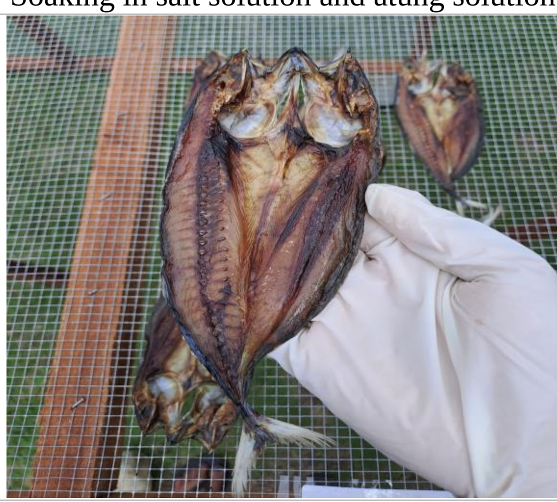
Appendix 1. Documentation of Butterfly-Cut Salted Tongkol

Tongkol fish *(Euthynnus affinis)*

Atung solution

Soaking in salt solution and atung solution

Fish drying process



Butterfly-cut salted Tongkol