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Analysis of the addition of natural preservative ingredients to the saving time of squid (*Loligo* sp.)

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Abstract
Squid is one of Indonesia's marine fisheries resources that is nutritious and in high demand by the public, hence the need for good quality squid. The obstacle experienced in fulfilling the demand for squid is the quality of squid. Various research have been conducted to determine preservatives that are effective enough to maintain the freshness of squid for a long time and extend the shelf life. This research was conducted using a literature study technique, comparing and selecting the most effective of several natural preservatives used. Some of the preservatives compared were lactate solution from cabbage fermentation, yogurt, chitosan solution, picung seeds, and cucumber. This study aims to determine the effective preservatives that have the longest shelf life for squid. The results of the literature study showed that yoghurt was the most effective preservative for extending the shelf life of squid until day 11 with total lactic acid bacteria colonies of 4.8x 105 cfu/gram and pH value of 6.8 in low temperature storage. The concentration used was 1.5%

Keywords: Squid, Natural Preservatives, Shelf Life, Lactic Acid Bacteria (LAB)

Introduction

One of the valuable assets of Indonesia is its fishery resources. Fishery resources have an important role in fulfilling community nutrition. One of the marine products commonly consumed by the community is squid (Edy Safrin *et al*. 2022). Squid is a marine product that contains high nutritional value and is good for the health of the body, has white meat that is favored by the community (Pricillia 2011) [22]. In Indonesia, squid is usually sold in fresh and salted dried form. The nature of squid that is easily degraded requires processing into foods that have a high protein value. One of the processed squid products includes salted dried squid, paper squid, canned squid and smoked squid (Hulalata *et al.* 2013) [15]. The high protein content in squid can accelerate the decay process, so salted squid products are often added with preservatives to extend the storage life of salted squid. The preservative commonly added to salted squid is formalin (Nurdiani & Sriwiditriani 2021) [19].

Squid Classification

Based on Sarwojo's research (2005), the classification of squid is as follows:
Domain : Eukarya
Kingdom: Animalia
Filum : Mollusca
Class : Cephalopods
Order : Teuthida
Sub order: Myopsina
Family : Loliginidae
Genus : Loligo
Species : *Loligo* sp.

Source**:** www.liputan6.com

Fig 1: Squid (*Loligo* sp.)

Description of natural preservatives

Natural preservatives are natural substances used to extend the shelf life of food products or other materials without the use of synthetic chemicals. Natural preservatives can help inhibit the growth of microorganisms such as bacteria, fungi, and mold that can cause damage or spoilage of food products.

Shelf-life description

Shelf life is defined as the time span that a product has from production to consumption before the product deteriorates and is not suitable for consumption (Asiah *et al*. 2018). The purpose of this article is to determine the effect of the addition of natural preservatives on the shelf life of squid and to determine the natural preservatives that most effectively extend the shelf life of squid.

Results and Discussion

Test Results of Addition of Natural Preservatives to the Shelf Life of Squid (*Loligo* sp.)

The following are the results and discussion based on several studies conducted:

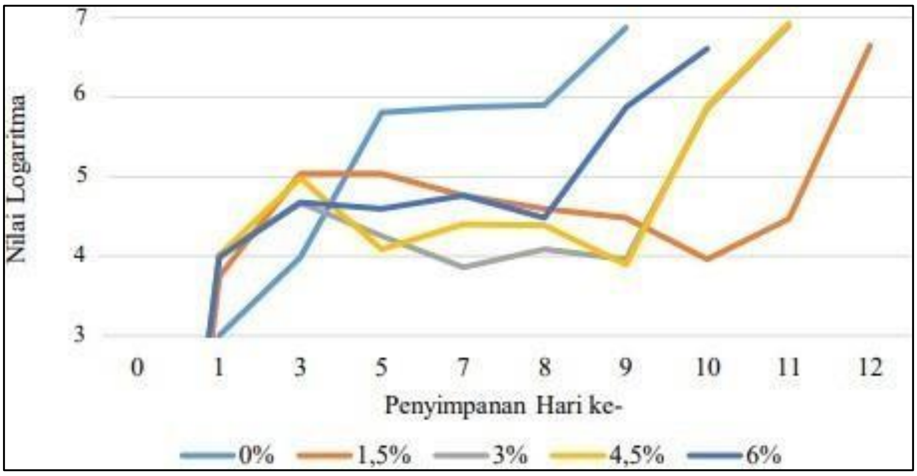
1. Using Lactic Solution from Fermentation of Cabbage Waste (Asmaul and Karyanto 2022) [5]

Lactic solution from cabbage waste fermentation is a solution produced through the fermentation process of cabbage waste using lactic acid bacteria. Lactic acid is an organic compound formed in the process of sugar fermentation by lactic acid bacteria. Lactic solutions are usually acidic, and these acids are often used in various industrial applications, including as preservatives, acidity regulators, and food additives (Patel *et al*. 2013) [21].

Based on the results of the study, the use of lactate solution fermented from cabbage waste in a certain amount has been shown to increase the shelf life of squid. From this study, it can be concluded that storage time and solution concentration have a significant impact on the shelf life of squid. The results also showed that the most optimal solution concentration to be used as a natural preservative with an observation period of 4 days was 75%. According to Siagian (2015), the fermentation solution in cabbage waste can be utilized as a natural preservative, which with a 3-hour soaking treatment can last for 6 days.

2. Using Yoghurt (Asandri *et al*. 2022) [3]

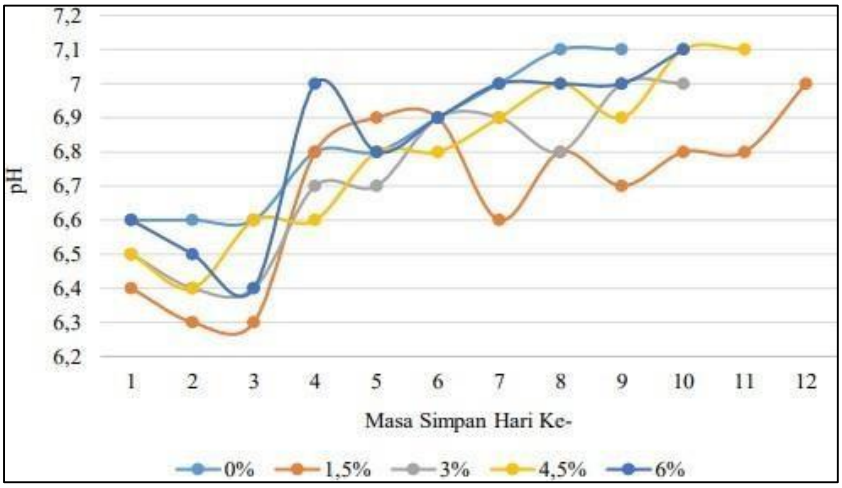
Yoghurt is fermented milk made from cow's milk, starter bacteria, flavoring and the addition of skim milk as a thickener (Vuyst 2000) [8]. Lactic Acid Bacteria can successfully inhibit the activity of spoilage bacteria because it is influenced by the type of bacteria, the concentration of bacteria used and the time required from contact with food. Lactic Acid Bacteria can successfully inhibit the activity of spoilage bacteria because it is influenced by the type of bacteria, the concentration of bacteria used, and the time required from contact with food. Lactic Acid Bacteria and their metabolites can be proven to play an important rolein improving the microbiological quality and shelf life of fermented food productsand can provide a good example of *biopreservation* (Heshmatipour 2015) [11].



Source**:** Asandri *et al*. 2022) [3]

Fig 2: Graph of the total number of bacterial colonies (cfu/g) in squid during storage at low temperature.

Squid with yoghurt immersion treatment with 1.5% yoghurt concentration had an advantage compared to the other 3 yoghurt treatments (Figure 2). This result occurred because the concentration of 1.5% increased LAB to the optimum population until the end of fermentation due to the availability of lactose component contained in the milk in the yoghurt so that the cells can still grow well because they can still utilize the existing nutrients (Astriani 2011) [7]. These results are different from soaking with other concentrations.



Source: Asandri *et al*. 2022 [3]

Fig 3: Graph of the pH value of squid during storage at low temperature

In all treatments, the pH decreased due to the soaking treatment of yogurt which had a lower value. compared to the control treatment. This is usually influenced by yogurt which has LAB activity, in the 1.5%, 3%, 4.5% and 6% treatments. This situation shows a close relationship between the addition of yogurt as a source of LAB and the pH value. Lactic acid bacteria themselves can break down lactose into lactic acid, the formation of lactic acid can cause an increase in acidity and a decrease in the pH value (Hidayat *et al.* 2013) [13].

Based on the results of research by Asandri *et al*. (2022) [3], that 1.5% yoghurt stater is the best concentration for the shelf life of squid at low temperatures. Squid marinated with 1.5% yoghurt concentration reached the acceptance limit until day 11 with a total colony of lactic acid bacteria of 4.8x105 cfu/g and a pH value of 6.8.

3. Using Chitosan Solution (Murtini and Kusmarwati 2006) [17]

Chitosan solution is a solution containing chitosan, which is a polymer compound obtained from chitin. Chitosan is a derivative product of chitin polymers produced from the extraction of shrimp and crab industrial processing waste. Chitin levels in shrimp range from 60-70% and if processed into chitosan produces 15-20%. Chitosan can be applied as a growth inhibitor for bacteria, fungi, as well as immobilizing enzymes and microbes. Chitosan solutions can also be used in various ways depending on the application. For example, in the food industry, chitosan solution can be used as a preservative to extend the shelf life of food products (Murtini and Kusmarwati 2006) [17].

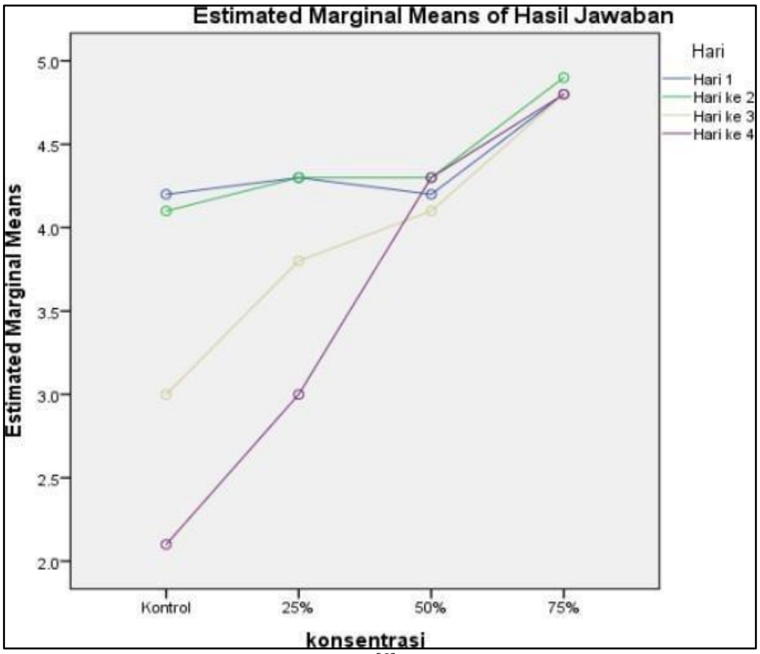
Based on the results of the research on soaking fresh squid in chitosan solution gives a real effect, based on the value of *Total Volatile Base* (TVB) and *Total Plate Count* (TPC), soaking treatment in 0.75% chitosan solution can extend the shelf life of squid for 16 hours, while other treatments, including the control, only have a shelf life of up to 8 hours. Chitosan solutions at 0.75 and 0.50% were able to reduce the number of bacteria, while the 0.38 and 0.30% chitosan treatments were not different from the control. This indicates that the chitosan concentration treatment at high levels of can have an inhibitory effect on bacterial growth. Chitosan can be applied, among others, as a growth inhibitor for bacteria, fungi including pathogens, as well as immobilizing enzymes and microbes. As an antibacterial agent, the growth of *E. coli* has been inhibited by concentrations of more than 0.02% chitosan in its culture medium. The growth of several plant pathogens is also inhibited in the presence of chitosan. In connection with these properties, the utilization of chitosan as an additive function for food processing has been developed such as chitosan *pickle* packers (Hirano 1988) [13].

4. Using Picung Seeds and Salt (Asmaul and Karyanto 2022) [6]

Source: Asmaul and Karyanto 2022 [5]

Fig 4: Research results: 1) Squid 1 (control); 2) Squid 2 (picung 25%); 3) Squid 3 (50% picung); 4) Squid 4 (picung 75%)

The seeds of picung/kluwek (*Pangium edule Reinw*) are widely used in the past as a preservative for fresh fish, especially in Banten, North Sulawesi, and West Java where it is difficult to find ice. Cyanide is one of the substances contained in the picung plant in its leaves, fruit and stem (Heyne 1987). In addition, the picung plant also contains antioxidant compounds (Andarwulan *et al.*, 1999; Nuraida *et al.*, 2000). Picung/kluwek seeds contain tannins, which are natural polyphenolic compounds. These phenolic compounds are useful in inhibiting the development of microbes, namely changes through permeability in the cell wall. Kristikasari (2000) suggested that the extract of from polar kluwek/picung seeds can slow down the development of bacteria thatcannot form spores.



Source: Asmaul and Karyanto 2022 [6]

Fig 5: Interaction diagram of observation time and concentration of picung seeds and salt

Based on the analysis diagram, the addition of 75% picung seed concentration and 15% salt to 1000 grams of squid can last for 4 days. It is indicated that there is no change in terms of aroma, texture, color and appearance. Picung or kluwak seeds can cause protein denaturation in shrimp with a concentration of 4% and a storage time of 3 days with the number of protein bands of 2 minor and 1 major, for fresh shrimp has 9 minor protein bands and 2 major protein bands, so that picung or kluwak seeds can inhibit spoilage bacteria in shrimp (Paramitasari 2020). Fresh fish with the addition of picung seeds is still acceptable to panelists and can be consumed with 6% picung seeds being able to withstand the development of TVB levels until the 6th day (Heruwati 2007) [10].

Based on the research of Asmaul and Karyanto (2022) [5] that the addition of picung seeds as much as 25% and the addition of 15% salt can maintain freshness on day 3, this can be described in terms of aroma on days 1 to 3 has not emitted a rotten smell, in terms of texture the fish meat is soft and slimy, in terms of color the squid still looks reddish spots, in terms of the appearance of the squid looks wrinkled. Addition of picung seeds of 50% picung seeds and 15% salt can be described as follows in terms of aroma from day 1 to 4, there is no foul s m e l l, i n t e r m s o f textureon day 4 the squid meat is firm and slimy, in terms of color there is no change in the color of the squid, in terms of appearance it looks good, not decaying and can be consumed. The addition of 75% picung seeds and 15% salt can be described as follows from day 1 to 4 in terms of aroma, there was no foul smell, the texture wasstill good and not slimy, there was no change in terms of color and the appearance was still good and not decaying and could be consumed. Some additions of picungseeds given to squid, 75% concentration can be used as an alternative natural preservative because in terms of aroma, color, texture, and appearance are still fairly good.

5. Using Cucumber (Oktari *et al*. 2023) [20]

One of the potential natural ingredients to be used to maintain squid quality is cucumber (*Cucumis sativus*). Cucumber contains several compounds that function as antibacterials, thus inhibiting the rate of squid deterioration. These compounds include flavonoids, saponins, and alkaloids. These active compounds can diffuse on agar media, so they can contact bacteria and inhibit bacterial growth (Sutyarso 2019). Flavonoids and phenolics are also active compounds that play a role in antioxidant activity (Agustin and Gunawan 2019) [1].

Based on research by Oktari *et al*. (2023) [20] that squid treated with grated cucumber has the same level of color brightness as ice cube treatment within a 24-hour immersion period. Giving grated cucumber does not affect the taste and texture of squid to the level of public preference. The provision of grated cucumber as much as 150 g with a 24-hour immersion period is acceptable to consumers and can compete with squid treated with ice cubes. Cucumber can be used to maintain the quality of squid during handling on ships and ports for up to 24 hours.

Conclusions

Based on the results of several studies that have been conducted, it can be concluded that the use of yogurt is more effective than other natural preservatives. This is because the

use of yogurt with a concentration of 1.5% can maintain the freshness of squid until the 11th day with a pH of 6.8. Paarup *et al.* (2002), showed that when the squid died, the pH of the squid decreased from the neutral pH range to 6.8 which then increased to 7.8. According to Yang *et al.* (2018), stated that the optimal pH for LAB growth is 4.5 to 7.4. As for the total bacterial colonies (cfu/g), the yoghurt concentration of 1.5% experienced an increase in the optimum population until the end of fermentation, which was around 4.8x105 cfu/g.
In the use of other preservatives such as lactate solution from fermented cabbage waste can only maintain the freshness of squid until the 4th day, chitosan solution only for 16 hours, picung seeds and salt only for 4 to 6 days, and the use of cucumber can maintain the freshness of squid for 24 hours. Therefore, the use of yoghurt to maintain the shelf life of squid for longer is the most effective than the use of other solutions such as lactate solution, chitosan solution, picung seeds, salt, and cucumber.

References

1. Agustin V, Gunawan S. Uji fitokimia dan aktivitas antioksidan ekstrak mentimun (*Cucumis sativus*). Tarumanagara Medical Journal. 2019;1(3):662-667.
2. Andarwulan N, Fardiaz S, Waimena GA, Shetty K. Antioxidant activity associated with lipid and phenolic mobilization during seed germination of *Pangium edule* Reinw. Journal of Agricultural and Food Chemistry. 1999;47(1):3158-3163.
3. Asandri AL, Liviawaty E, Buwono ID, Junianto. Analisis pengaruh yoghurt terhadap umur simpan cumi-cumi (*Loligo sp.*) yang disimpan pada suhu chilling. Jurnal Akuatika Indonesia. 2022;7(1):28-33.
4. Asian N, Cempaka L, David W. Pendugaan umur simpan produk pangan. Penerbitan Universitas Bakrie. Jakarta; 2018.
5. Asmaul R, Karyanto Y. Pemanfaatan biji picung dan garam sebagai pengawet cumi-cumi segar. *Seminar* Nasional Hasil Riset dan Pengabdian. Program Studi PVKK, Universitas PGRI Adi Buana Surabaya. Surabaya; 2022.
6. Asmaul R, Karyanto Y. Pemanfaatan larutan laktat hasil fermentasi limbah kubis untuk meningkatkan umur simpan pada cumi-cumi. Jurnal Teknologi Pangan dan Gizi. 2022;21(1):32-36.
7. Astriani. Uji aktivitas antimikroba ekstrak daun turi (*Sesbania grandiflora* L.) secara KLT-bioautografi. Fakultas Ilmu Kesehatan Universitas Islam Negeri Alauddin; 2022.
8. De Vuyst L. IMDO: Industrial Microbiology, Fermentation Technology and Downstream Processing. Department of Industrial Microbiology; 2000.
9. Edy S, Al zarliani WO, Aliani. Inovasi olahan baby cumi kering asin dan abon ikan sebagai wirausaha istri nelayan di desa terapung kecamatan Mawasangka Kabupaten Buton Tengah. Empowerment: Jurnal Pengabdian Masyarakat. 2022;1(9):2511.
10. Heruwati dkk. Pengawetan ikan segar menggunakan biji picung (*Pangium edule* Reinw). Jurnal Pascapanen dan Bioteknologi Kelautan dan Perikanan. 2007;2(1):9-18.
11. Heshmatipour Z. Antibacterial activity of lactic acid bacteria (LAB) isolated from native yoghurt against ESBL producing *E. coli* causing urinary tract infection (UTI). International Journal of Life Science Biotechnology and Pharma Research. 2015;4(2):117-121.
12. Heyne K. Tumbuhan Berguna Indonesia. Jilid I-IV. Terjemahan Balitbang Kehutanan, Jakarta; 1987. p. 668.
13. Hidayat IR, Kusrahayu, Mulyani S. Total bakteri asam laktat, nilai pH dan sifat organoleptik drink yoghurt dari susu sapi yang diperkaya dengan ekstrak buah mangga. Animal Agriculture Journal. 2013;2(1):160-167.
14. Hirano S. Production and application of chitin and chitosan in Japan. In: Skjack-Braek G, Sandford P, Anthonsen T, editors. Chitin and Chitosan. Elsevier Applied Science. London and New York; c1988. p. 39-40.
15. Hulalata A, Makapedua DM, Paparang RW. Studi pengolahan cumi-cumi (*Loligo sp.*) asin kering dihubungkan dengan kadar air dan tingkat kesukaan konsumen. *Media Teknologi Hasil Perikanan*. 2013;1(1):26-33.
16. Kristikasari E. Mempelajari sifat antimikroba biji picung (*Pangium edule* Reinw) segar dan terfermentasi terhadap bakteri patogen dan perusak makanan. Skripsi. Jurusan Teknologi Pangan dan Gizi, Fakultas Teknologi Pertanian, IPB; c2000. p. 57.
17. Murtini JT, Kusmarwati A. Pengaruh perendaman cumi-cumi segar dalam larutan kitosan terhadap daya awetnya selama penyimpanan pada suhu kamar. Jurnal Pascapanen dan Bioteknologi Kelautan dan Perikanan. 2006;1(2):157-161.
18. Nuraida L, Andarwulan N, Kristikasari E. Antimicrobial activity of fresh and fermented *Picung* (*Pangium edule* Reinw) seed against pathogenic and food spoilage bacteria. Journal of Food Technology and Industry. 2000;4(2):18-26.
19. Nurdiani CU, Sriwiditriani E. Analisis formalin pada cumi asin yang dijual di pasar tradisional wilayah Pandeglang dengan menggunakan metode spektrofotometri. Anakes: Jurnal Ilmiah Analis Kesehatan. 2021;7(2):217-225.
20. Oktari A, Bidayani E, Syaputra D, Kurniawan A. Respon organoleptik cumi-cumi (*Loligo sp.*) yang direndam dengan mentimun (*Cucumis sativus*) pada durasi dan konsentrasi berbeda. Journal of Aquatropica Asia. 2023;8(1):39-44.
21. Patel A, Prajapati JB, Holst O. Lactic acid production from lactose by *Lactobacillus bulgaricus*: Kinetic modeling and optimization. Bioprocess and Biosystems Engineering. 2013;36(6):911-920.
22. Pricillia V. Cumi-cumi (*Loligo sp.*), rendemen, morfometrik, analisis proksimat. Departemen Teknologi Hasil Perairan, Fakultas Perikanan dan Ilmu Kelautan, Institut Pertanian Bogor, Bogor; 2011.
23. Sarwojo. *Serba – Serbi Dunia Molusca*. PT. Dioma, Malang; 2005.
24. Siagan. Larutan hasil fermentasi limbah kubis sebagai pengawet alami ikan segar. *Majalah Ilmiah Politeknik Mandiri Bina Prestasi*. 2014;4(1):43-48.
25. Sutyarso PMR. Efektivitas antibakteri ekstrak etanol mentimun (*Cucumis sativus* L.) terhadap pertumbuhan Salmonella typhi. Majority. 2015;8:144-149.