The Effectiveness of Mangrove Fruit Extract (*Sonneratia alba*) submersion as a Bacterial Growth Resistor in Giant Sneakhead (*Channa micropeltes*) Fish

Efektivitas Perendaman Ekstrak Buah Bakau (*Sonneratia alba*) sebagai Penghambat Pertumbuhan Bakteri terhadap Mutu Ikan Toman (*Channa micropeltes*)

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Abstract

This research was conducted to study the effect of mangrove fruit (*Sonneratia alba*) extract submersion as a bacterial growth resistor in giant sneakhead (*Channa micropeltes*) fish in the process of preserving the fish. The design used in this study was with 3 treatments. Treatment A without the addition of mangrove extracts, treatment B with submersion of 2 (mangrove fruit):1(water) mangrove extracts, and treatment C with submersion of 3:1 mangrove extracts. The parameters which being observed included the Total Plate Number (ALT) test and the pH test. The results of the study showed that the lowest total bacterial colonies were found in the treatment with the 3:1 submersion of mangrove extracts, which was 8,153x 10^3. The use of mangrove fruit extract in this study was able to extend the shelf life of fresh fish for one week, with temperatures less than 5°C.

Keywords : bacterial growth, cool box, extract mangrove fruit, submersion

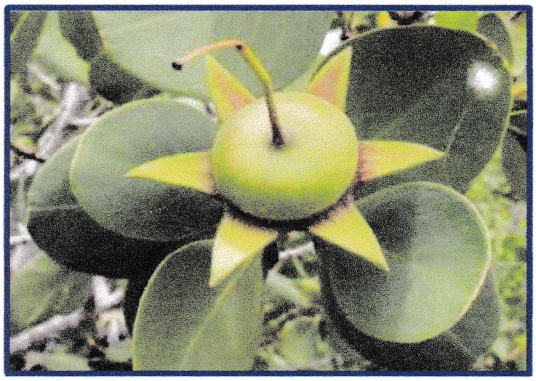
Abstrak

Penelitian ini dilakukan untuk mengetahui pengaruh perendaman ekstrak buah bakau (*Sonneratia alba*) sebagai penghambat pertumbuhan bakteri pada ikan toman (*Channa micropeltes*) dalam mengawetkan ikan toman. Rancangan yang digunakan dalam penelitian ini adalah Rancangan Acak Lengkap dengan 3 perlakuan yaitu perlakuan A tanpa penambahan ekstrak buah bakau, perlakuan B dengan perendaman (ekstrak buah bakau: air) perbandingan 2:1. Perlakuan C dengan perendaman (ekstrak buah bakau : air) perbandingan 3:1. Parameter yang diamati meliputi uji Angka Lempeng Total (ALT) dan uji pH. Hasil penelitian menunjukkan bahwa total koloni bakteri yang paling rendah terdapat pada perlakuan dengan perendaman (ekstrak buah bakau : air) perbandingan 3:1 yaitu 8,153x 10^3. Penggunaan buah ekstrak buah bakau pada penelitian ini mampu memperpanjang daya simpan ikan segar selama satu minggu, dengan suhu kurang dari 5°C.

Kata kunci : ekstrak buah bakau, kotak pendingin, perendaman, pertumbuhan bakteri.

Introduction

Handling fish is the most important thing to maintain fish quality. Post-harvest handling of fisheries is an important matter because fish decompose quickly compared to other food ingredients. The process of deterioration in the quality of fish is caused by several factors, including: the process of physical damage, biological processes, enzymatic processes, and chemical processes. Fish must have a high level of quality to meet the increasing market demand, but fish is a perishable food (high perishable food). The quality of fishery product result identical to the freshness (Nurimala *et al.*, 2009).



Picture of *Sonneratia alba*

The problem that often arises in the fisheries sector is in maintaining the quality. The things that adversely affect the fish quality are temperature increases, poor handling, delays in handling time and pollution while on land, transportation and distribution. To get quality and long lasting stored fish, the important things that must be considered in handling fish are to be careful, clean, stored it in a room with cold temperatures, and be quick to handle the fish. A dead fish would decay very quickly after being caught unless it handled properly. High temperature will accelerate and shorten *rigor motis* and deliver it to the process of autolysis and decay by bacteria that go very fast (Murniati & Sunarman, 2000). At a room temperature, fish will be the *rigor mortis* phase faster and last shorter. If the *rigor* phase cannot be maintained for longer, the decay by enzyme and bacterial activity will take place even more quickly. The enzyme and bacterial activity causes rapid changes and make the fish be in the post *rigor* phase. This phase shows that the quality of fish is already low and not suitable for consumption (FAO, 1995 *in* Munandar *et al.*, 2009).

The most common fish handling technique to maintain fish freshness is the use of low temperatures. Also, under low temperature conditions the growth of spoilage bacteria and biochemical processes that take place in the body of the fish leads to deterioration in quality become slower (Gelman *et al.*, 2001).

The use of low temperature in freshly dead fish could not increase the

freshness but could only maintain the freshness, so it will not quickly experience the process of deterioration in quality. According to Hadiwiyoto in Suprayitno (2017) the most effective and common effort to maintain the freshness of the fish that just died is the use of low temperatures as soon as possible such as using bulk of ice to cool it so temperatures reaching 0 °C with good handling.

Mangroves are trees or plant communities that live between the sea and land which affected by sea tides. All types of mangroves produce fruits, and *Sonneratia Alba* is one type of mangrove tree. it contains compounds that could prevent the growth of bacteria such as: xylitol, polyol, sucrose, tannin, sterol, triterpenoid, minerals and nucleotides, and 24 types of phytochemical compounds consisting of 8 steroids, 9 triterpenes, 3 flavonoids, and 4 carboxyl benzene derivatives (Varghese, *et al.*, 2010 in Hamzah, 2013).

Therefore the aim of the research is to study the effect of mangrove fruit extract submersion as a bacterial growth resistor in giant sneakhead fish to preserved the giant sneakhead fish.

Methodology

The Making of Extract Mangrove Fruit Solution.

1. The mangrove fruit were washed clean, and weighted (2500 gram for two treatments), then mixed with sterile aquades with the different ratios for each treatment, 2 (mangrove fruit):1(water) in B treatment, 3:1 in C treatment. After that, mashed it with blender, then filter it.
2. The extract mangrove fruit solution that has been filtered then being used to soak the fresh giant sneakhead fish. Every total weight of the fish of every treatment was 1.5 kg each. Then from the submersion the cold chain system were applied, the soaking was carried out for 12 hours before being storage in the cooler at a temperature of less than 5°C, in a large container so that all fish surfaces get a same treatment and all of the fish bodies were submerged in the extract solution.

2.1.Procedure of Storing the Giant Sneakhead Fish in Cool Box.

1. The giant sneakhead fish that has been submerged then stored for a week in a cool box, with the addition of ice with ration between the ice and the fish were 2 (mangrove fruit):1(water). To keep the temperature stable so it would not be more than 5 °C, stored the fish in one week in a cool box made of styrofoam.

2. During the storage, ice had to change every 8 hours so that the temperature stays less than 5°C.
3. Then the quality of fish was being measured everyday which was consisted of Degree of Acidity (pH) and Total Plate Count (ALT).

2.2.Time and Location

This research was conducted in Laboratory Processing of Fisheries Product, Fisheries Department of Palangka Raya University.

2.3. Procedure of Data Collecting

The data were gathered from the the result of ALT and pH test, using ATC 190012 Generic pH Meter.

Result and Discussion

Total Plate Count (ALT) Test

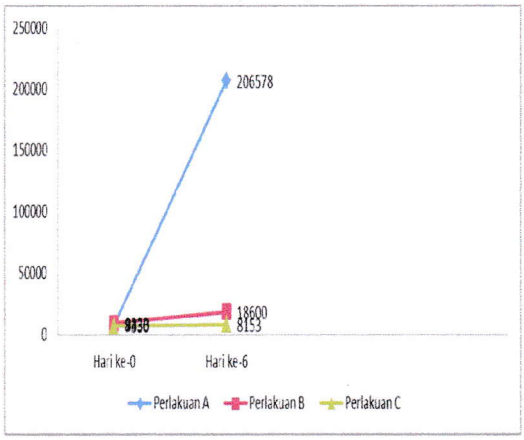


Figure 1. Growth of Bacterial Colony in Giant Sneakhead Fish Sneakhead Fish during Storage Process

The number of bacterial increased with the duration of the storage (**Figure. 1**). This happened due to the optimal environment for the bacterial growth causes the bacteria to grow optimally. In treatment A (without extract mangrove submersion), the total bacterial colony was 8,500 CFU/ml then after storage the total of bacterial colony experienced growth to 206,466.66 CFU/ml. At the range of 5°C some types of bacteria growth was stunted and even some died. The bacteria that were stunted at low temperature storage were usually from the type of thermophilic and mesophils bacteria. The proliferation of bacteria in fish is strongly influenced by temperature. The greater the difference between the temperature in the fish habitat with the storage temperature used, the bacterial growth will be stunted (Gelman *et al.*, 2001).

In treatment B (with extract mangrove submersion) were also experience the growth of bacterial colony number. On the first day, the fresh fish had 9,300 CFU/ml total bacterial colonies, along with the length of storage on the last day the total number of bacterial colonies was 18,900 CF /ml. In treatment C, the total fresh fish bacterial colonies were 7,750 CFU/ml, then the total bacterial colonies experienced growth during storage to 8,150 CFU/ml.

Giant sneakhead fish which given extract of mangrove fruit submersion treat

was able to slowdown the bacteria growth compared with control treatment.

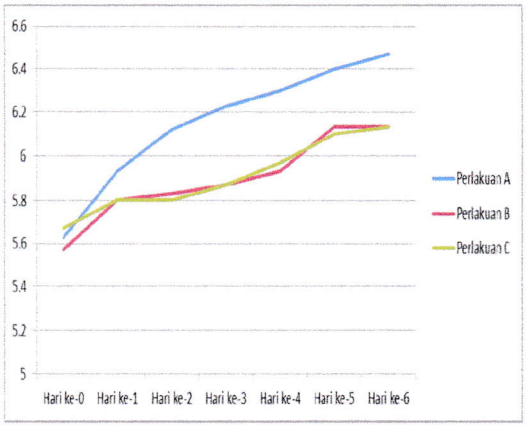


Figure 2. Mean of pH Values during Storage Process

Giant sneakhead fish in treatment C result show that it was slowing down the bacteria growth the most than the other treatments. The difference in bacterial growth rate is due to differences of total content of anti-bacterial compounds which contained in mangrove extracts. It's contains compounds that could prevent the growth of bacteria such as : xylitol, polyol, sucrose, tannin, sterol, triterpenoid, minerals and nucleotides, and 24 types of phytochemical compounds consisting of 8 steroids, 9 triterpenes, 3 flavonoids, and 4 carboxyl benzene derivatives. According to Varghese *et al.*, (2010) in Hamzah (2013) state that phytochemical compounds have anti-bacterial benefits that could act as an inhibitor of growth and a bacteria killer by various mechanisms. The mechanism action as an anti-bacterial is suspected to inhibit cell wall synthesis which will cause cells to die. On the damaged cell walls, secondary metabolites also enter deeper and damaging the bacterial membrane (Lamothe *et al*, 2009, in Nimah, 2012).

The mechanism of terpenoids as antibacterial which play a role with fluorine (transmembrane protein) membrane on the outer membrane of the bacterial cell wall, will forms a strong polymeric bond that has the potential to damage the porins. The damage of the porin, which is the entrance and exit of the compound, will reduce the permeability of the bacterial cell wall which will result in bacterial cells will lack of nutrients, bacterial growth will inhibited or dead (Cowan, 1999 in Sri Wahdaningsih, *et al.* 2016). The mechanism of action of flavonoids as an anti-bacterial is to form complex compounds with extracellular and dissolved proteins so that they could damage the bacterial cell membrane and will followed by the release of intracellular compounds (Najow *et al*, 2013).

pH Test

pH is degree of acidity used to express the acidity or basicity of a solution. pH is identified as activity algorithm of dissolved hydrogen ion (H^+). Fresh fish pH

value is in the range below neutral to neutral pH. Ilyas, 1983 in Nurqaderianie *et al*, (2016) explained the pH value of a alive fish is 7.0 and after the fish dead, the pH value decreasing to 5.8 – 6.2. pH value is one of the indicators which used to determine the freshness of fish. In the process of fish decays, the change in pH value of fish meat is very big because it influences the process of autolysis and bacterial attack

The results showed that for one week of storage, all the sample of giant sneakhead fish experienced a decrease in pH value (**Figure. 2**).

The fastest pH increase was occurred in treatment A which was the one without mangrove extracts submersion, the initial pH was still very fresh at 5.63 until it rose to the last day of 6.47. It indicated the freshness of the fish has decreasing. Fish that are not fresh (around 5.8 – 6.2. pH) have a high meat pH (alkaline) compared to fish that are still fresh. That was due to the emergence of basic compounds such as ammonia, trimethylamine, and other volatile compounds. The dominant microorganisms that cause damage in the form of bacteria due to the pH of the meat of the fish detect neutral so that it becomes a suitable medium for bacterial growth (Afifah, 2009). In treatment B or with 2:1 submersion extract did not experience a rapid increase, namely with a pH value of 5.57 on the first day and increased until the last day of storage with a value of 6.13. Likewise, treatment C (3: 1) also did not experience a rapid increase, with a pH value of 5.67 on the first day and increased with a pH of 6.13 on the last day. However, the pH values in treatments A, B, and C are still in the normal range.

The increasing of pH value indicates the activity of spoilage bacterial growth by the action of a number of enzymes in fish tissue which produce ammonia. The adding of anti-bacterial natural ingredients from mangrove extracts according to Vikram *et al.* 1999 in Naiborhu (2002) it could inhibit bacterial growth, which flavonoid compounds in mangroves could change various physiological processes of bacteria to inhibit their growth, one of them is by inhibiting the formation of biofilms on *V. harveyi* which are used for self-protection.

The use of low temperature affects the fluctuation of the pH value in tilapia fish. Storage of tilapia fish at low temperatures causes the activity of enzymes contained in meat to be inhibited so that the quality of the fish will decrease a little slower. The lower the temperature

used, the more inhibited the enzyme activity. Putrefactive bacteria live in environment with 0-30 °C temperature. If the temperature reduced to 0 °C or lowest, the activity of putrefactive bacteria will be prevented or stop. Mean while the activity of the enzyme which caused autolysis has stopped before that. Low temperature could be used to preserved fresh fish or fish that already past the preserved process. Such as salted fish, smoked fish and others. In the process of glycolysis, enzymes play an important role until the formation of lactic acid (Afrianto and Liviawaty, 2011).

Conclusion

Soaking mangrove extract significantly affected the growth of bacterial colonies in giant snekahead fish. Based on the analysis of the ALT test, the lowest total bacterial colonies were found in the treatment with 3:1 ratio submersion of mangrove extracts. The use of mangrove fruit extract in this research was able to extend the shelf life of fresh fish for one week at a temperature of less than 5°C in the cooler.

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