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Original paper

OPTIMIZING PRODUCTION OF LEMURU FISH (*Sardinella Longiceps*) WITH HIGH FATTY - ACID OMEGA- 3 USING LIQUID SMOKED GINGER FLAVOR PROCESS

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ABSTRACT

Lemuru Fish (Sardinella longiceps) have high enough of protein contents (17,8-20%). However, lemuru fish also contains important fatty-acid, especially omega-3. Because of the contains of fatty acid was high (1-24%) and the texture is not compact, the fish become easily be broken and become spoiled. That was because of the activity of microbes or the autolysis on the post morterm. Because of that, the right and intensive handling is needed , it can be done with immediate process or with long-lasting storage. In this research, the pickling method that used was smoking with liquid smoke.

The purpose of this research is to find the optimum operation condition for liquid smoke process of fish lemuru to produce lemuru fish that its fatty-acid Omega-3 did not decomposed and the fish has unique taste.

The methods of this research was completely random design with concentration of liquid-smoke as the treatment and duration of liquid-smoke as the block. The fixed variables are the weight of fish, fish thickness, temperature, salt contained and duration of measurement. The non-fixed variable is concentration of smoked-liquid.

At the condition where the concentration was 6% , 25 minutes of the soaking time gave the best optimal condition which the score shown was EPA = 0.6066 g/100g ,DHA = 0.4033g/100g, TBA = 0.86 mg/kg, TVB = 4.432 mg N/100g, TMA = 5.47% mgN and the total of microorganism is 3.62 x 10^6 CFU.

Keywords: Liquid Smoke, lemuru fish, ginger flavour

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INTRODUCTION

One of the significant factors for quality of a fish is the fish's freshness. For fish from the sea production, the change of quality can be happened from the side of taste, smells, texture, and colour. This things can be happened because of the growth of bacteria. The changes of quality have a speed that depends on the initial bacterial rate, storage conditions, temperature, humidity, and the atmosphere pressure. The sea product have the characteristic that easier to be decomposed than other high protein product. The safety of sea product mainly depends on the probability of to be impured with patogenic microbia, and will be caused by histamin from the unappropriate action. (Bender, 1992, Gokalp, 1993).

Lemuru fish (*Sardinella longiceps*) have a high enough protein rate (17.8 – 20%). Beside that, lemuru fish also contains essential fatty-acid, especially omega-3 (Bender,1992). Fatty-acid of omega-3 consists of linoleat-

acid, eikosapentanoat acid (EPA) from dokosaheksanoat acid (DHA), while fatty acid of omega-6 consist of linoleat acid, andarachidonat acid. Fatty acid of EPA and DHA have a specific physiological function on human body and become the part of fatty-acid omega 3 that has a very important rule for human body. After this far, the source of fatty acid omega-3, EPA, and DHA is very limited from the food produced by sea product.

Fatty decomposition will produce unexpected taste and smells. The process hapens because of oxidation or fat hydrolisis which both happened autisisally or because of microbial activities. (Gokalp and Eckerman, 1983).

Fatty oxidation was the main factor of decreasement of fish quality and product from fish or generally on food. (Asghar, 1988).

The Thiobarbutic method (TBA) with various differences generally is used for measure fatty acid damage on food tissue (Hoyland and Taylor, 1991).

The changes of TBA values based on the contents of malonaldekid was the most often methods that was used for determine the rancid of oxidation (Simopoulus, 1991). While Girard (1992) use the rancid measurement on fish products with the quantitative changes of malonaldehid.

MATERIALS AND METHODS

Characteristic of Fish

Lemuru fish (*Sardinella longiceps)* with overage size beween 40 -50 gram used for expriment were procured from Semarang.

Exprimental Design

The exprimental design used was completely random block design with liquid smoke concenrtation as treatment and soaking time in liquid smoke was used as block. The dependent variables were fish weight, fish tickness, temperature, salinity, and steaming time. Mean while liquid smoke concentration was used as independent variable.

Fish Preparation

Fish were beheaded and eviscerated. After through cleaning dan draining, the fish were immersed in 19 % salt solution for 1 hour (Cutting, 1995). Then they were leaked to dry, and steamed for 5 minutes to inactivate enzymes.

Soaking Process

Liquid smoke was made from shell of coconut and ginger that were pirolyzed at 250^0 C temperature for 3-4 hours, Phenol vapor as pyrolization products were taken from refrigerator tube using water as cooling mediumn. Condenced products were taken refrigerator into container and filtered. The results in liquid smoke with ginger flavor. The fatty acid produced was used for fish plunging that had been done previonsly.

Fish Plunging on Liquid Smoke

The liquid smokes were melted at the various concentration which included : 2 , 4, 6, 8, 10 %. Fish pluging was carried out for the following duration : 5 , 10, 15, 20 and 25 minutes.

Tested Parameter

The parameters tested was the quality of fish, consisted of fatty damage TBA methods (Hoyland, 1991), rate of omega 3, chromatoghraphy or measurements of EPA and DHA (Sinclair, 1992), purified level TMA Methods, consist is of protein damage TVB methods (Hoyland, 1991), Microbial number (Medigar et al, 2000).

RESULTS

The changes in EPA and DHA number of Lemuru fish during starage also showed steady increase Table (1) and Fig. (1).

Table 1. The Rate of EPA and DHA

Sampel	EPA g/100g	DHA g/100g
S	0,625	0,416
A1	0,519	0,355
A2	0,567	0,358
A3	0,548	0,387
A4	0,611	0,392
A5	0,621	0,383
B1	0,553	0,378
B2	0,562	0,379
B3	0,593	0,389
B4	0,613	0,409
B5	0,623	0,401
C1	0,581	0,397
C2	0,592	0,399
C3	0,612	0,401
C4	0,623	0,409
C5	0,625	0,413
D1	0,614	0,412
D2	0,615	0,412
D3	0,621	0,413
D4	0,622	0,413
D5	0,624	0,414
E1	0,624	0,415
E2	0,624	0,415
E3	0,625	0,416
E4	0,625	0,416
E5	0,625	0,416

Table description :
S : Fresh
A : Treatment with 2% of liquid smoke
B : Treatment with 4% of liquid smoke
C : Treatment with 6% of liquid smoke
D : Treatment with 8% of liquid smoke
E : Treatment with 10% of liquid smoke
1,2,3,4,5 : soaking time with liquid smoke for 5,10,15,20,25 minutes

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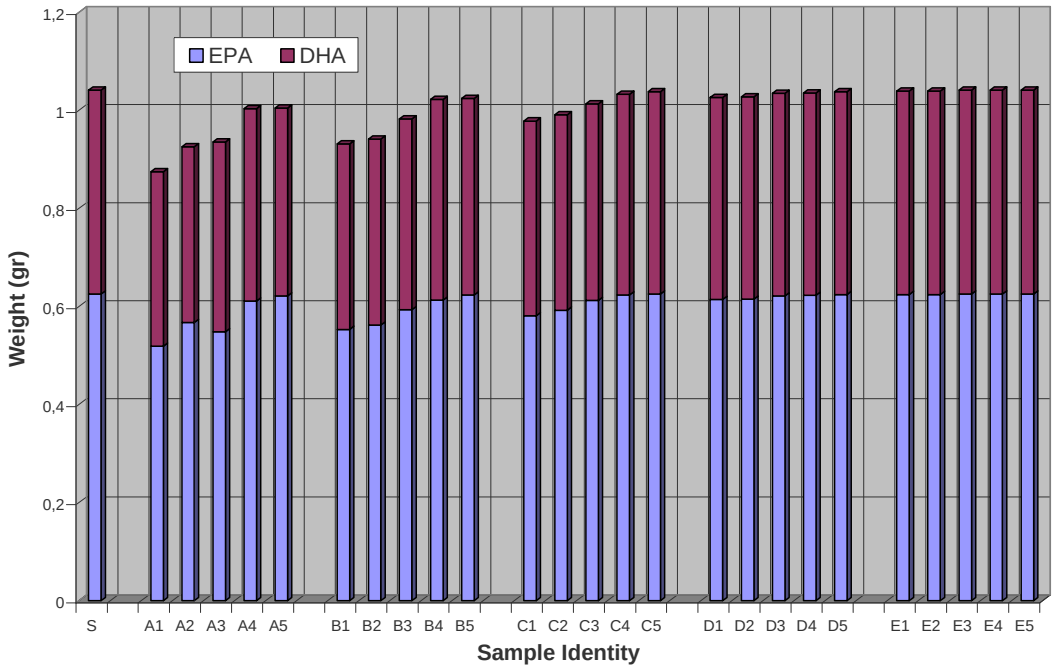

Fig. 1 EPA and DHA chart for all treatment

On this research, the result of the best EPA and DHA values for soaking with liquid smoke ginger-tasted were 10% concentration and soaking time 15-25 minutes. The number of test EPA and DHA shows that 0,6066 and 0,4038 g/100 g in optimum condition related to sensory test, which 6 % concentration of liquid smoke with ginger flavor, 25 minutes for time of soaking, while the beginnning number of EPA and DHA is 0,625 and 0,416 g/100 g.

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Table 2. The Values of TBA,TVB,TMA, and Microbe Number

Sampel	TBA mg/kg	TVB mg N/100g	TMA %mg N	Total Mikroba CFU (106)
S	0,03	4,3	5,3	4,1
A1	1,12	4,56	5,76	3,9
A2	1,01	4,55	5,75	3,8
A3	1	4,54	5,74	3,8
A4	0,98	4,53	5,73	3,7
A5	0,95	4,52	5,7	3,7
B1	0,99	4,48	5,64	3,8
B2	0,97	4,47	5,63	3,8
B3	0,95	4,46	5,62	3,7
B4	0,89	4,45	5,59	3,7
B5	0,85	4,43	5,57	3,6
C1	0,92	4,46	5,54	3,7
C2	0,9	4,45	5,51	3,7
C3	0,87	4,43	5,49	3,7
C4	0,83	4,42	5,42	3,5
C5	0,78	4,4	5,39	3,5
D1	0,86	4,36	5,49	3,5
D2	0,82	4,35	5,47	3,5
D3	0,8	4,34	5,46	3,4
D4	0,78	4,34	5,42	3,4
D5	0,76	4,32	5,36	3,3
E1	0,63	4,34	5,36	3,4
E2	0,62	4,33	5,33	3,4
E3	0,61	4,32	5,31	3,2
E4	0,59	4,31	5,3	3,1
E5	0,52	4,3	5,3	3,1

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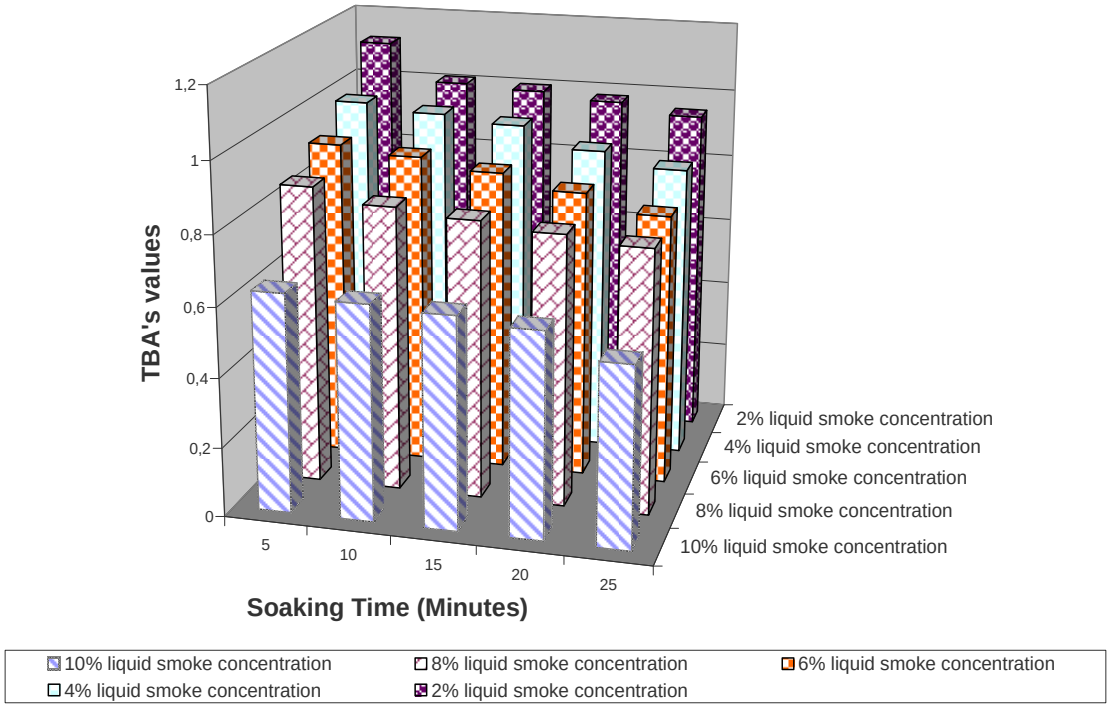

Fig. 2 Relation between liquid smoke concentration and soaking time for TBA values(Thiobarburic Acid)

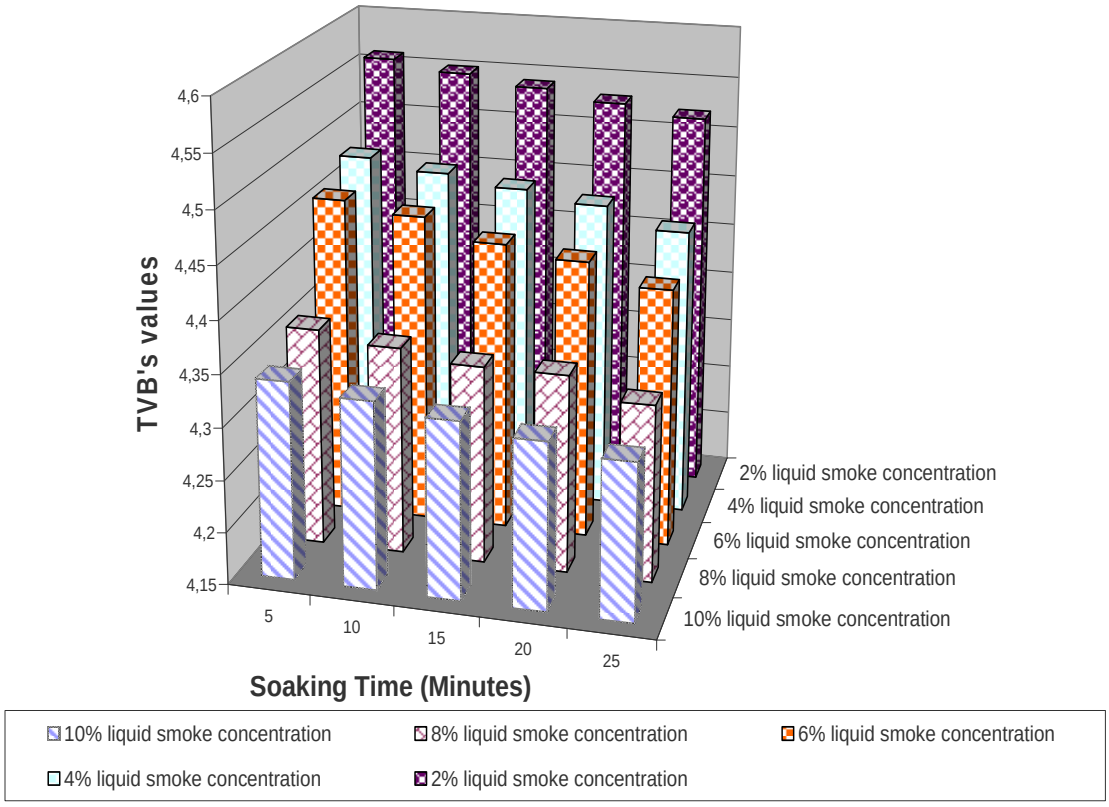

Fig. 3 Relation between liquid smoke concentration and soaking time for TVB values (Total Volatile Based)

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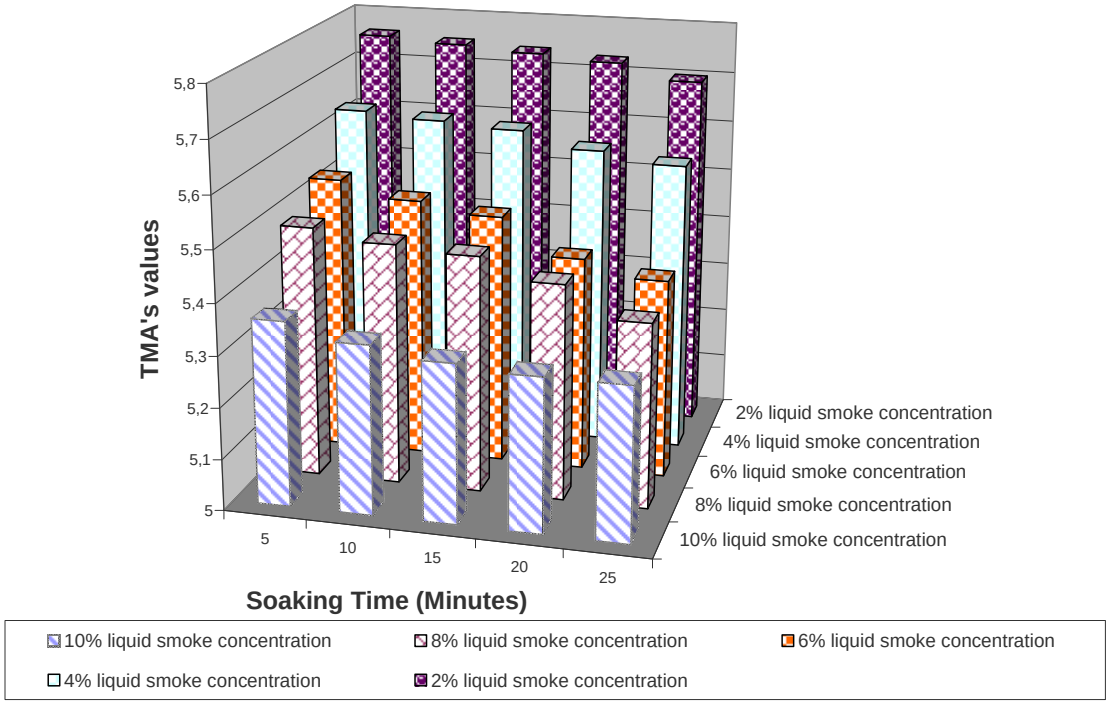

Fig. 4 Relation between liquid smoke concentration and soaking time for TMA values (Total Malonaldehyde acid)

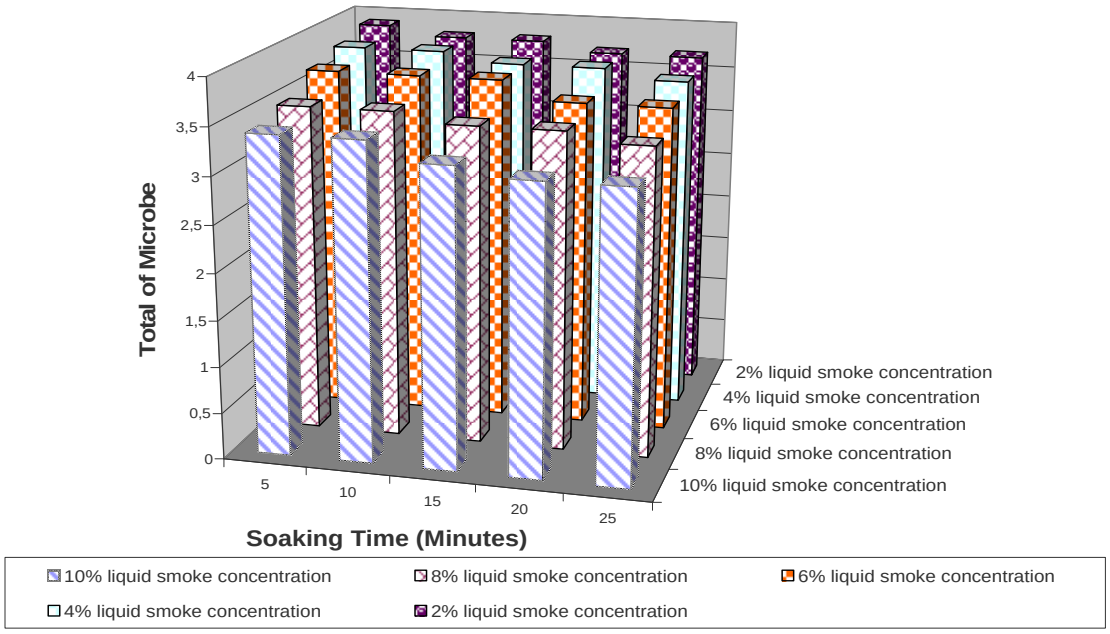

Fig. 4 Relation between liquid smoke concentration and soaking time for total of microbes values

The change in value TBA, TMb TMA and Microbe number also showed steady increase (**Table 2**) and **Fig. 2**, **3**, **4**, **5**. The highest TBA results was 1,12 mg /100 g at 2 % concentration of liquid smoke with 5 minutes soaking time. ; TVB value gained was 4,56 mg N/100 g from 2 % with liquid smoke also with 5 minutes soaking time ; TMA values was 5,76 % mg N for 2 % liquid some concentration and 5 minutes soaking time. The rate of microbial growth was 3,1 x 10 000000 CFU that happened on 2 % liquid smoke with 5 minutes soaking time.

DISCUSSION

Lemuru fish *(Sardinella longiceps)* content of sessential fatty acid, especially omega 3 but because of fatty high 9 1 – 24 %) and the texture of fish is not compact, it is easy for lemuru fish to get damage and rotten, also because of microbial or autolysis activity (Cornell,1995)

Liguid smoke capable to prevent microbial activities with phenol compounds and acetis acid (Cuppet, 1999). Antimicrobial compounds of ginger can cause preservation and increase the flavor. Fatty acid omega 3 consists of linoleat acid and Eikosapentanoat (EPA), from Doko-saheksanoat acid (DHA), while fatty acid omega 6.

Fatty oxidation was the main factor of decrease of fish quality and product from fish or generally on food (Hoyland and Taylor, 1991). The increase is due the amount malonaldehyde present resulted from breakdown of fatty acid. Fatty acid such as macherel while undergo rapid oxidation during storage and as the results of fatty acid degradation, peroxide, ketones, aldehyde and other organic substance are formed with cause rancid flavor. Eventthough all samples showed the decrease in quality, TBA number, Value TVB and value TMA.

The Thiobarbutic Method (TBA) with various differences is generally used for measure fatty acid damage on food tissue (Asghar, 1988). TBA standard value for consumeable fish is 3-4 mg/100g (Hoyland and Taylor, 1991). On the treatment for all liquid smoke concentration, the damage of fatty did not happen (< 3-4 mg/100g). The higher liquid smoke concentration and the longer soaking time the effect of pickling shows the better result. But this can be related to the taste test.While highest results was 1,12 mg / 100g.

TVB value for consumeable fish was 30 mg N/100g (Bender, 1992). The increase of protein damage that is shown by TVB values indicate that the lower concentration of liquid smoke used the damage increase become faster.

The standard of fish freshness that consumeable is 18-19.75 % mg N (Connel,1995). Freshness values was tested by TMA values. On this research the highest TMA values was 5.76 % mg N for 2 % liquid smoke concentration and 5 minutes soaking time, and the lowest values was 5.3 % mg N for 10% liquid smoke concentration and 20-25 minutes soaking times. Fish considered fresh if it contained of 10 000000 bacteria / gram 1000000000 CFU

The rate of microbial growth shows that the lower liquid smoke concentration gave the faster growth, and the longer of soaking time gave the slower growth. The slowest growth was 3.1×10^6 that happened on 10% liquid smoke concentration with 20-25 minutes soaking time on 105 liquid smoke concentration with 20 minutes soaking time.

CONCLUSION

Liquid smoke with ginger flavour with 2-10% concentration and 5-25 minutes of soaking time can conserve lemuru fish. Mean while the combination of liquid smoke concentration and the duration of soaking gave the following result : EPA = 0.6066 g/100g; DHA = 0.4038 g/100g; TBA = 0.86 mg/Kg ; TVB = 4.432 mg N /100g ; TMA = 5.47 % mg N ; TPC = 3.1×10^6 CFU.

The rate of liquid smoke with ginger flavor is good for lemuru fish pickling at the 5/10 % concentration.

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