JURNAL PERIKANAN
UNIVERSITAS GADJAH MADA
Terakreditasi Ristekdikti No: 158/E/KPT/2021
ISSN: 2502-5066 (Online)
ISSN: 0853-6384 (Print)
Vol. 26 (2), 135-140
DOI 10.22146/jfs.92919

Application of Barracuda Fish Skin Gelatin (*Sphyraena barracuda*) on Characteristics of Liquid Smoke Flavored Ice Cream

Riris Sitoresmi, Fronthea Swastawati* & Slamet Suharto
Department of Fishery Product Technology, Faculty of Fisheries and Marine Science, Diponegoro University, Semarang, Central Java, Indonesia
*Corresponding author, email: fronthea.swastawati@live.undip.ac.id
Submitted: 07 January 2024; Revised: 24 July 2024; Accepted: 30 August 2024; Published: 30 December 2024

ABSTRACT Gelatin can be applied to ice cream as a stabilizer. The flavors of ice cream on the market only focus on ordinary flavors such as chocolate, vanilla, and strawberry. Liquid smoke as a flavoring in ice cream can be used as an innovation. The purpose of this study was to determine the best concentration of liquid smoke in ice cream and determine the effect of adding gelatin with different concentrations on the physical quality of ice cream. The treatments used were liquid smoke with different concentrations (0%, 0.3%, 0.5%, and 0.7%) in the opening study and gelatin concentrations of 0%, 0.2%, 0.4%, and 0.6% in the main study with three repetition times. Parameters observed were hedonic, overrun, melting time, pH, and viscosity. The analysis showed that all test treatments had a significant effect (P<0.05). Adding liquid smoke with a concentration of 0,7% was the best treatment, with a hedonic value of 7.97<μ<8.17 (preferred by the panelists). The best treatment results for barracuda fish skin gelatin on the characteristics of ice cream were at a concentration of 0,4% with overrun results of 62,67% ± 0,58, melting speed 31.37±0.95 minutes, pH 6.33±0.02, viscosity of 2567.67±142.38 cP and hedonic value of 7.61 <μ <7.79 (preferred by the panelists).

Keywords: Barracuda fish; fish skin; gelatin; ice cream; stabilizer

INTRODUCTION

Barracuda fish (*Sphyraena barracuda*) is a type of pelagic fish that has high economic value in Indonesia. The total production of barracuda fish in 2019 was 32.334,26 tons and in 2021 it had increased to 37.794,61 tons (KKP, 2021). The increase in production shows that the public often consumes barracuda fish barracuda as a variety of diversified products. Processing these products has by-products in the form of skin, head, scales, bones, and stomach contents. According to Salimah *et al*. (2016), there is currently no processing of fishery waste in the form of fish skin into products with economic value. Small industries have only recently used fish skin as a raw material for making fish crackers and animal feed mixtures.

Fish skin can be used as a raw material for making gelatin. Gelatin is the result of denaturation of collagen protein, which has properties that can change reversibly from sol to gel form, expand in cold water, form films, and affect the viscosity of a material (Sukkwai *et al*., 2011). Gelatin can be applied to the food and non-food industries. According to Siburian *et al*. (2020), the application of gelatin in the food industry, for example in the manufacture of ice cream is used to form foam, increase viscosity, binder, and as a thickener.

Ice cream is a frozen dessert made from fats, sweeteners, stabilizers, emulsifiers, and flavors. Stabilizers are needed in making ice cream to maintain the shape of the ice cream and not melt quickly. The function of the party ingredient is to prevent the formation of larger ice crystals, improve the texture to make it softer, and maintain melting when served at room temperature. According to Ferdiansyah *et al*. (2016), one of the stabilizers is gelatin. Stabilizers are part of the food additives often used in ice cream processing. A stabilizer is necessary so that the product's physical form is denser, and the level of homogeneity is more stable.

The flavors of ice cream on the market today only focus on normal flavors such as chocolate, vanilla, strawberry, and others. Ice cream with unique flavors is very rare, including liquid smoke flavor. Liquid smoke as a flavoring in ice cream can be used as an innovation. According to Prasteyowati *et al*. (2014), liquid smoke can act as a specific taste and aroma as well as a preservative because of its antimicrobial and antioxidant properties.

MATERIALS AND METHODS

Materials

The raw materials for making gelatin are barracuda fish skin, 3% acetic acid, and distilled water. The raw materials for making ice cream are full cream milk, powdered skim milk, sugar, barracuda fish skin gelatin, SP emulsifier, and liquid smoke flavor.

Methods

This research consists of 2 stages, namely preliminary research and main research. Preliminary research was conducted to determine the best concentration of liquid smoke as a flavor in ice cream. The main research was conducted to determine the best concentration of barracuda fish skin gelatin in its application in ice cream. The barracuda fish gelatin concentration ranges used were 0%, 0.2%, 0.4% and 0.6%.

According to the journal Rahmawati & Pranoto (2012), barracuda skin gelatin production begins with the preparation of skin samples by removing scales, flesh, and dirt attached to the skin, then the skin is washed and processed to the next stage which includes four steps, namely boiling, soaking with 3% acetic acid, extraction and drying.

The process of making ice cream refers to research by Mulyani *et al*. (2017), making ice cream begins with weighing all the ingredients according to the formulation, mixing the ingredients, and heating to a temperature of 70^{0}C. The ice cream is then frozen in the freezer for 10-12 hours at a temperature of -18^{0}C. The ice cream dough and the dough foaming process are carried out using a mixer until it be-

comes a creamy dough, then froze again in the freezer for 24 hours.

Hedonic test (SNI, 2015)
In the preference test assessment, panelists were asked to give an impression of the preference of the appearance, odor, taste, and texture of the sample on a scale of 1-9.

Overrun (Arbuckle, 1986)
Ice cream mixture is added until it reaches a volume of 100 mL, then weighed. The ice cream dough is then processed according to the procedure for making ice cream. Next, the processed ice cream mixture is put into the container. Ice cream that has frozen then the surface of the ice cream in the container is leveled so that the volume during freezing remains 100 ml and weighed. Overrun can be calculated using the formula:

% Overrun= (Weigh of ice cream dough-Weigh of ice cream)/(Weigh of ice cream dough)×100%

Melting Time (Bodyfelt et al., 1998)
The melting time of ice cream is calculated by freezing the ice cream in the freezer (-4 °C) for 24 hours. Ice cream that has been frozen is taken out and placed at room temperature then wait until it melts completely and count the time.

pH Test (SNI, 2004)
The pH test is carried out using a pH meter. The method for testing the pH begins with calibrating the pH meter with a buffer solution of pH 4 and 7, then rinsing with distilled water and drying. A sample of 10 mL of ice cream was taken then the electrode was dipped into the sample and the pH value could be read on the pH meter screen.

Viscosity (SNI, 2008)
Viscosity can be measured using a Brookfield Viscosimeter. The sample is placed in a 250 mL beaker glass then the spindle needle no. 3 is mounted on a expand and the rotation speed is set at 60 rpm. The material's viscosity is measured. The scale indicated by the tool is read after a certain number of revolutions.

RESULTS AND DISCUSSION

Preliminary research
Test hedonic

Table 1. Hedonic results of ice cream with addition of different liquid smoke treatment.

Treatment	Specification				
	Appearance	Odor	Taste	Texture	Confidence Interval
Control	7,33±0,76^{a}	7,17±0,79^{a}	6,67±0,61^{a}	7,4±0,56^{a}	7,04<μ<7,24
0,3%	7,53±0,73^{ac}	7,5±0,68^{a}	7,43±0,5^{bc}	7,53±0,68^{a}	7,38<μ<7,62
0,5%	7,87±0,82^{bc}	7,7±0,6^{ab}	7,73±0,69^{bc}	7,6±0,56^{a}	7,6<μ< 7,84
0,7%	7,93±0,69^{bc}	8,33±0,48^{c}	8,27±0,69^{d}	7,73±0,69^{a}	7,97<μ<8,17

Note:

- The data is the result of the average of thirty panellists ± standard deviation.
- Data followed by different lowercase letters in the same column indicate a significant difference.
- Data followed by the same lowercase letter in the same column showed no significant difference (ρ <0.05).

Appearance
It can be seen from the sense of sight directly. The data on the appearance of the hedonic test on ice cream, shows that each treatment is still at a value of 7, which means that there is no significant difference physically from each treatment. The appearance of the ice cream is milky white, froth of ice crystals which tend to be smooth and sturdy. The liquid smoke added to the ice cream does not affect the colour of the ice cream because the liquid smoke used is premium liquid smoke which is clear in colour. According to Agustina *et al*. (2022), colour determines the appearance of food, which is the main sensory for the senses of the eye. The colour of good ice cream according to SNI is with normal colour criteria according to the ingredients used in making the ice cream.

Odor
The addition of different concentrations of liquid smoke into the ice cream mixture has a strong effect. Panellists said that they liked the smell of ice because of the raw materials used. Control ice cream usually has an aroma like ice cream, namely the smell of milk. Along with the increase in the addition of liquid smoke, it affects the smell of ice cream and becomes more characteristic of smoke. The unique smell of smoke is due to the presence of phenol and carbonyl components contained in the smoke. Ice cream with the addition of 0.3% liquid smoke concentration has a weak liquid smoke aroma. Ice cream with 0.5% liquid smoke has a relatively strong liquid smoke aroma. Ice cream with 0.7% liquid smoke has a strong liquid smoke smell. According to Khairina *et al*. (2018), the smell of ice cream is mostly dominated by the smell of milk. The increase in the mean score for each treatment indicated that the more Flavors added to the ice cream, the lower the milky aroma of the ice cream.

Taste
The addition of liquid smoke into ice cream gives a real effect, where liquid smoke has a unique taste. Control ice cream has a taste like ice cream usually, which is milk flavour. Along with increasing the addition of liquid smoke affects the taste of ice cream. Ice cream with the addition of 0.3% liquid smoke concentration has a weak liquid smoke taste. Ice cream with the addition of 0.5% liquid smoke has a relatively strong liquid smoke taste. Ice cream with the addition of 0.7% liquid smoke has a strong liquid smoke taste. The taste of the ice cream leaves an aftertaste in the form of a soft smoky taste.

Based on these results it can be concluded that the higher the concentration of liquid smoke used, the higher the unique taste of smoke produced in ice cream. The distinctive taste produced is because liquid smoke contains phenolic compounds. According to research by Jakung *et al*. (2020), the higher the concentration given, the more the smoke taste of a material will increase.

Texture

The addition of liquid smoke into ice cream does not affect the texture. This is because what plays an important role in the formation of texture is not liquid smoke but gelatin. Gelatin is a food additive that aims to improve the quality of ice cream because it functions to prevent the separation of weak constituents from other constituents to prevent the formation of large ice crystals, increase softness and maintain stability in ice cream products. According to Ntau *et al*. (2021), the presence of stabilizers such as gelatin in the ice cream formula will keep the ice cream homogeneous, prevent the dispersion of fat globules during freezing, and improve texture. The stabilizer serves to keep the water in the ice cream from freezing and reduces ice crystallization.

Main research

Hedonic test

Table 2. Hedonic results of ice cream with the addition of different gelatin treatments.

Treatment	Specification				
	Appearance	Odor	Taste	Texture	Confidence Interval
Control	7,17±0,75^{a}	7,13±0,63^{a}	6,93±0,58^{a}	6,63±0,67^{a}	6,83<μ<7,11
0,2%	7,27±0,64^{a}	7,20±0,61^{a}	7,23±0,57^{ab}	7,20±0,61^{b}	7,11<μ<7,35
0,4%	7,73±0,64^{b}	7,47±0,57^{ab}	7,50±0,51^{ab}	8,10±0,61^{c}	7,61<μ< 7,79
0,6%	6,50±0,63^{c}	6,97±0,61^{a}	6,87±0,51^{a}	6,37±0,67^{a}	6,6<μ<6,76

Note:

- The data is the result of the average of thirty panellists ± standard deviation.
- Data followed by different lowercase letters in the same column indicate a significant difference.
- Data followed by the same lowercase letter in the same column showed no significant difference (ρ <0.05).

Appearance

The highest average value was found in ice cream with the addition of 0.4% gelatin concentration, which was 7.73. The characteristics of the control ice cream are milky white colour and quite coarse ice crystals. Characteristics of ice cream with the addition of gelatin concentrations of 0.2% and 0.6% include a milky white colour and ice crystal foam which tends to be smooth, but ice cream with the addition of 0.6% gelatin has characteristics in the form of a brownish white colour and crystalline foam very fine ice. This is also by with the research of Hidayah *et al*. (2017), the hedonic value of ice cream without the addition of gelatin is 4.95, while ice cream with the addition of 0.5% gelatin is 5.30. This shows that the appearance of ice cream with the addition of gelatin is better than ice cream without the addition of gelatin. Ice cream made from *full cream* and skim milk with catfish bone gelatin has a distinctive white colour of milk.

Odor

The best results were obtained in the treatment of ice cream with the addition of 0.4% gelatin concentration. Panellists stated that they liked the smell of ice because of the raw materials used. The aroma of ice cream produced from this research is the typical aroma of milk but there is an aroma of smoke. The addition of barracuda fish skin gelatin can affect the level of panellists' preference for aroma parameters, but the concentration of barracuda fish skin gelatin does not affect the level of preference for the aroma of ice cream. According to research by Swastawati *et al*. (2022), the lowest hedonic value for aroma parameters in ice cream, namely without the addition of milkfish scale gelatin is 6.5 and the highest hedonic value is with the addition of milkfish scale gelatin with a concentration of 0.7% of 8.3. This shows that the addition of milkfish scales gelatin has a significant effect on the aroma of ice cream. The aroma of ice cream can determine its delicacy. The aroma with the addition of milkfish scales gelatin has a characteristic because the main ingredient is milk. The more milk you add, the less gelatin the flavour will be in the ice cream.

Taste

The best results were obtained from treatment with the addition of 0.4% gelatin concentration. Ice cream has a sweet milky taste which is obtained from added sugar and has a unique taste of smoke or *Smokey*. The addition of gelatin to each ice cream treatment did not interfere with the taste of the ice cream because the concentration of gelatin was small. According to research by Ayudiarti *et al*. (2020), the taste parameter shows that the highest taste score is shown by ice cream using 0.1% tuna gelatin, while the lowest score is shown by ice cream using 0.3% tuna gelatin. Panellists stated that the addition of gelatin concentration did not affect the taste of ice cream even though commercial gelatin and fish gelatin were added. Gelatin or the fishy taste in ice cream cannot be detected because it is covered by the sweet taste of sugar and the savoury taste of milk.

Texture

The most preferred result by the panellists was ice cream with the addition of 0.4% gelatin concentration because it has a soft and non-sticky texture. Ice cream with the addition of gelatin with a concentration of 0.6% has a very soft texture, but is sticky, so the panellists don't like it. The texture of the resulting ice cream product is affected by the addition of gelatin. The addition of gelatin with a large concentration produces a thick dough, so the higher the viscosity value the softer the texture of the ice cream. Gelatin is a material that has the function of maintaining emulsion stability, preventing the formation of coarse ice crystals, and providing better resistance during the melting process. This is not much different from

the research conducted by Hidayah *et al*. (2017), the panellist's highest scores for the texture of ice cream with the addition of 0.4% and 0.5% gelatin had successive values of 4.80 and 4.90 (somewhat like). The addition of the concentration of the African catfish bone gelatin stabilizer to the ice cream can affect the panellist's preference for the texture of the ice cream. The higher the concentration of gelatin used, the panellist's preference for the texture of ice cream also increases.

Overrun

In Table 3. shows that the overrun value of ice cream tends to increase with the addition of barracuda fish skin gelatin. The greater the concentration of gelatin used in ice cream, the greater the resulting overrun value. However, the addition of gelatin with a concentration of 0.6% decreased the value of overrun in ice cream. This is caused by the addition of gelatin to ice cream causing the ice cream mixture to become thicker by forming a gel

Table 3. Results of overrun, melting time, pH, and viscosity in ice cream.

Treatment	Parameter			
	Overrun (%)	Melting Time	pH	Viscosity
Control	36,33±1,15[a]	22,12±1,03[a]	6,33±0,04[a]	1087±100,95[a]
0,2%	51,67±0,58[b]	26,67±0,53[b]	6,34±0,08[a]	1887±61,44[b]
0,4%	62,67±0,58[c]	31,27±0,95[c]	6,33±0,02[a]	2557±142,38[c]
0,6%	41,00±1[d]	37,79±2[d]	6,22±0[a]	3695±0,67[a]

Note:

- Data are the average of three replications ± standard deviation.
- Data followed by different lowercase letters indicates a significant difference ($p < 0.05$).

matrix and holding the dispersed liquid phase. The thicker the ice cream mixture, the lower its ability to form air voids in the ice cream mixture. This shows that the addition of gelatin with a concentration of 0.4% is the optimal amount in increasing the overrun value in ice cream. This is confirmed by research by Ntau *et al*. (2021), the results of an overrun study of sweet corn essence ice cream obtained an average value of 65.11 – 78.92%. These results indicate that the higher the concentration of the stabilizer added to the ice cream mixture, the overrun value will decrease. This is due to the higher concentration of gelatin used, the thicker the dough, and the higher the surface tension, making it difficult for the product to expand.

Melting time

Based on testing the melting time of ice cream, the average value was 22.12 – 37.79 minutes. Table 3 shows that the melting time value of ice cream tends to decrease with the addition of gelatin to the ice cream. The greater the concentration of gelatin used in ice cream, the longer the melting time. This is because gelatin has high water holding capacity so it can slow down the melting time of ice cream. The melting time test results in this study were higher compared to research by Malik *et al*. (2013), ice cream added with a stabilizer in the form of spirulina had greater melting power compared to the control. The melting power of the ice cream was 13 minutes, while the ice cream with the addition of spirulina had a melting power of 17.8 minutes. The difference in melting speed results for the two products is due to the difference in the type of stabilizer used.

pH

Based on the pH test on ice cream, the average value was 6.22 – 6.34. The pH value in this study is close to the statement from Goff & Hartel (2013), which explains that the normal pH for ice cream dough is around 6.3. The acidity or pH of ice cream is influenced by the ingredients used.

Table 3. shows that the control ice cream has a pH value of 6.33, but the ice cream added with gelatin with a concentration of 0.2% has an increase in pH value to 6.34. Ice cream added with gelatin with a 0.4% and 0.6% concentration decreased the pH value to 6.33 and 6.22. The pH value is still classified as acidic. This shows that the greater the concentration of gelatin used in ice cream, the lower the pH value. The pH value decreased due to the addition of barracuda fish gelatin, which has an acidic pH. This is by the results of research by Hermanto *et al*. (2014), the results of measuring the pH value of gelatin from 4% phosphoric acid isolated from phosphoric acid had an acidic pH of 4.78 which was still in the pH range of type A gelatin. The pH value of type A gelatin ranged from 3.8 to 5.5.

Viscosity

Viscosity is one of the parameters used to determine the desired texture in making ice cream. Viscosity can describe the nature of a solution that has resistance to a flow which can increase the strength to withstand friction. Viscosity testing is carried out to determine the level of thickness in ice cream. The results of the analysis of the viscosity test can be seen in Table 3.

Viscosity on ice cream obtained an average value of 1087-3695 cP. The results of this study have results that are not much different from the research by Ahsan *et al*. (2015), the viscosity value of ice cream was the same as that of the control of 1780 cP, while soy milk ice cream with the addition of guar gum at a concentration of 0.3% to 0.6% as a stabilizer had an average viscosity value of 3273.3 – 4460 cP. The difference in the resulting viscosity values for the two products is due to differences in the raw materials used, stabilizers, and the manufacturing process.

Table 3. shows that the greater the concentration of gelatin added to the ice cream can increase the viscosity value of the ice cream. This is because gelatin has the property to bind water and form a gel that can prevent water molecules from moving freely. Viscosity can increase because water will be trapped in a 3-dimensional structure due to the cross-links formed by the helical arrangement and their interactions. In the presence of gelatin, water that was previously outside the granules and free to move cannot move freely because it will be absorbed

and bound by the gelatin, so the solution state becomes stronger due to the increase in viscosity. Ice cream that has a high viscosity or thickness value has a softer texture. This is confirmed by Violisa *et al*. (2012), viscosity is a measure of the viscosity of a liquid to flow, increasing the concentration of seaweed as a stabilizer causes an increase in the viscosity value. The increasing viscosity causes the ice cream to become thicker. Stabilizers can increase the viscosity of the ice cream dough, so the ice cream produced will have a low overrun value and a soft texture due to the formation of small ice crystals and slows down the melting of the ice cream when served.

CONCLUSION AND RECOMMENDATION

Conclusion

Barracuda fish gelatin can be used as a stabilizer in ice cream with the addition of liquid smoke which functions as a specific natural flavor and is acceptable to the panelists. The best addition of liquid smoke based on the results of the hedonic test applied to ice cream is a concentration of 0.7%. The addition of barracuda fish skin gelatin concentration can influence the characteristics of ice cream with an optimal limit of use of 0.4% and is the best result for application to ice cream.

Recommendation

The recommendation that can be given from research on the application of barracuda skin gelatin (*Sphyraena barracuda*) in making ice cream with the addition of liquid smoke as a flavoring is that further and in-depth research needs to be carried out to be able to add nutritional value to ice cream so that it can become a highly nutritious product.

AUTHOR'S CONTRIBUTIONS

The author's contribution to this research is as follows, FS and SS contributed to finding ideas, developing ideas, conceptsand drafting the manuscript. All authors actively contributed to ideas, concepts, data collection, data analysis and manuscript preparation.

ACKNOWLEDGEMENT

Thank you to The Department of Fishery Product Technology, Faculty of Fisheries and Marine Science, Diponegoro University, for facilitating the successful implementation of research. Thanks, are also expressed to the relevant parties who have assisted in the process of preparing this publication.

REFERENCE

Agustina, N., R. Maulana & H. P. Widayat. 2022. Karakteristik organoleptik es krim dengan penambahan pewarna alami bunga telang (*Clitoria Ternatea* L.). Jurnal Ilmiah Mahasiswa Pertanian. 7 (2): 366-371. https://doi.org/10.17969/jimfp.v7i2.20052

Ahsan, S., T. Zahoor, M. Hussain, N Khalid, A. Khaliq & M. Umar. 2015. Preparation and quality characterization of soy milk based non-dairy ice cream. International Journal of Food and Allied Sciences. 1 (1): 25-31.

Arbuckle, W. S. 1986. Ice Cream. 5 th Edit. New York: LCC.

Ayudiarti, D.L., Suryanti & D.A. Oktavia. 2020. The effect of different types and gelatin concentrations on ice cream quality. In E3S Web of Conferences. 147 (03026): 1-8. https://doi.org/10.1051/e3sconf/202014703026

Bodyfelt, F., J. Tobias & G. Trout. 1998. The Sensory Evaluation of Diary Product. New York: Van Nostrand Reinhold.

Ferdiansyah, M.K., D.W. Marseno & Y. Pranoto. 2016. Kajian karakteristik karboksimetil selulosa (CMC) dari pelepah kelapa sawit sebagai upaya diversifikasi bahan tambahan pangan yang halal. Jurnal Aplikasi Teknologi Pangan. 5 (4): 136-139. http://dx.doi.org/10.17728/jatp.198

Goff, H.D & R.W. Hartel. 2013. Ice Cream Seventh Edition. London: Springer Science & Business Media.

Hermanto, S., M.R. Hudzaifah & A. Muawanah. 2014. Karakteristik fisikokimia gelatin kulit ikan sapu-sapu (*Hyposarcus pardalis*) hasil ekstraksi asam. Jurnal Kimia Valensi. 4 (2): 109-120. https://doi.org/10.15408/jkv.v0i0.3608

Jakung, M.L.Y., A.R.P. Pudja & P.K.D. Kencana. 2020. Pengaruh konsentrasi asap cair bambu tabah (*Gigantochloa nigrociliata* Buse-Kurz) dan suhu pemasakan terhadap mutu se'i bandeng. Jurnal BETA (Biosistem Dan Teknik Pertanian. 8 (1): 93-102. https://doi.org/10.24843/JBETA.2020.v08.i01.p12

Khairina, A., B. Dwiloka & S. Susanti. 2018. Aktivitas antioksidan, sifat fisik dan sensoris es krim dengan penambahan sari apel. Jurnal Teknologi Pertanian. 19 (1): 51-60. https://doi.org/10.21776/ub.jtp.2018.019.01.6

KKP (Kementrian Kelautan dan Perikanan). 2021. Statistik Produksi Perikanan Indonesia. https://statistik.kkp.go.id/home.php?m=total&i=2#panel-footer (Accessed November 30, 2023).

Malik, P., C. Kempanna & A. Paul. 2013. Quality characteristics of ice cream enriched with spirulina powder. International Journal of Food and Nutrition Science. 2 (1): 44-50.

Mulyani, D.R., E.N. Dewi & R. A. Kurniasih. 2017. Karakteristik es krim dengan penambahan alginat sebagai penstabil. Jurnal Pengolahan dan Bioteknologi Hasil Perikanan. 6 (3): 36-42. https://ejournal3.undip.ac.id/index.php/jpbhp/article/view/20295

Ntau, E., G.S. Djarkasi & L.E. Lalujan. 2021. pengaruh penambahan gelatin terhadap kualitas fisik es krim sari jagung manis. Sam Ratulangi Journal of Food Research. 1 (1): 10-19. https://ejournal.unsrat.ac.id/v3/index.php/srjfr/article/view/33899

Prasetyowati, P., M. Hermanto & S. Farizy. 2015. Pembuatan asap cair dari cangkang buah karet sebagai koagulan lateks. Jurnal Teknik Kimia. 20 (4): 14-21. https://doi.org/10.34128/jtai.v6i2.100

Rahmawati, H & Y. Pranoto. 2012. Rendemen dan komposisi proksimat gelatin kulit ikan belut dan lele pada keadaan segar dan kering. Jurnal Fish Scientiae. 2 (4): 111-123. https://doi.org/10.20527/fs.v2i4.1167

Razak, Q. A., R. Faridah & B. Syamsuryadi. 2021. Penambahan madu sebagai pemanis alami untuk meningkatkan nilai organoleptik, *overrun* dan daya leleh pada es krim. Tarjih Tropical Livestock Journal.1 (1): 8-14. https://doi.org/10.47030/tropical.v1i1.97

Salimah, T., W.F. Ma'ruf & R. Romadhon. 2016. Pengaruh transglutaminase terhadap mutu edible film gelatin kulit ikan kakap putih *(Lates calcalifer*). Jurnal Pengolahan dan Bioteknologi Hasil Perikanan. 5 (1): 49-55. https://ejournal3.undip.ac.id/index.php/jpbhp/article/view/10818

Siburian, W.Z., E. Rochima, Y. Andriani & D. Praseptiangga. 2020. Fish gelatin (definition, manufacture, analysis of quality characteristics, and application): A review. International Journal of Fisheries and Aquatic Studies. 8 (4): 90-95.

Sukkwai, S., K. Kijroongrojana & S. Benjakul. 2011. Extraction of gelatin from bigeye snapper (*Priacanthus tayenus*) skin for gelatin

hydrolysate production. International Food Research Journal. 18 (3): 1129-1134. https://www.scopus.com/record/display.uri?eid=2-s2.0-79956039734&origin=inward&txGid=46e6847d5aa55a0e70e76995d54bb587

Violisa, A., A. Nyoto & N. Nurjanah. 2012. penggunaan rumput laut sebagai stabilizer es krim susu sari kedelai. Teknologi dan Kejuruan: Jurnal teknologi, Kejuruan dan Pengajarannya. 35 (1): 103-144.

Zahro, C. & F.C. Nisa. 2014. Pengaruh penambahan sari anggur (*vitis vinifera* l.) dan penstabil terhadap karakteristik fisik, kimia dan organoleptik es krim. Jurnal Pangan dan Agroindustri. 3 (4): 1481- 1491. https://repository.ub.ac.id/id/eprint/149751

How to cite this article Sitoresmi, R., F. Swastawati & S. Suharto. 2024. Application of barracuda fish skin gelatin (Sphyraena barracuda) on characteristics of liquid smoke flavored ice cream. Jurnal Perikanan Universitas Gadjah Mada. 26 (2): 135-140. https://doi.org/10.22146/jfs.92919