



Volatile Flavor Compounds Composition of Steamed Marble Goby (*Oxyeleotris marmorata*)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The identification and composition of volatile flavor compounds was carried out for steamed marble goby (*Oxyeleotris marmorata*). This study was carried out in Fishery Processing Laboratory at Faculty of Fishery and Marine Science, Universitas Padjadjaran, Jatinangor; Flavor Laboratory, Indonesian Center of Rice Research, Sukamandi, Subang; Inter-University Center Laboratory of Bogor Agricultural Institute. The study were carried out on steamed marble goby (at 100°C, for period of ±30 minutes). The Solid Phase Microextraction (SPME) method was used to extract volatile flavor compound and identified by using Gas Chromatography-Mass Spectrometry (GC / MS). Steamed marble goby has 27 compounds. The major volatile compound in steamed marble goby is naphthalene. Proximate analysis shows that steamed marble goby has 79.70% water content, 1.48% ash, 0.36% lipid, and 16.65% protein.

Keywords: *Volatile flavor; marble goby; streaming; proximate.*

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1. INTRODUCTION

The potential for fishery production in West Java is enormous and growing every year. The volume of aquaculture production in 2018 increased by 1.17% from 2017. The commodities of cultured fish with the highest prices in 2017 were pearly razorfish, lobster, pompano, grouper, eel, marble goby, and shrimp [1]. Marble goby's flesh has a delicious taste, the flesh is white, tender, and has few spines, so it has a high selling price [2]. Marble goby has various health benefits, such as being suitable for the skin and strengthen the immune system because it has complete nutritional content [3]. High-temperature processes such as frying, baking, and steaming make the marble goby's flesh delicious and nutritious health benefits can be well derived [4].

Steaming is a thermal process where this process aims to cook food using water vapour. Steaming has the advantage but affect adversely vitamins or other food components sensitive to heat [5]. The high temperature used in the steaming process can extend the shelf life and affect the flavor composition of fishery products [6]. Every fresh ingredient or processed product will have a different flavor composition due to a specific chemical reactions. Flavor is a sensation produced by food ingredients when placed in the mouth, especially those caused by taste and aroma.

The volatile compound is a component of flavor compound that gives an aromas sensation, perceived by aroma receptors from olfactory organs such as the olfactory tissue in the nasal cavity [7]. Volatile compounds provide an aroma sensation when inhaling a food ingredient that gives the initial impression or is called top notes on the food ingredient. Top notes are one of the essential factors in determining the quality of food so that volatile compounds play a role in the level of acceptance by consumers. The main volatile compounds detected in fishery products are aldehydes, alcohols, ketones, acids, and hydrocarbons [8].

Currently, research on volatile compound composition in fishery products has not been carried out in Indonesia. This research has a role for preliminary data of fish commodities aroma and can be developed into an advanced product. This research aims to study and identify the volatile compound composition of steamed marble goby.

2. MATERIALS AND METHODS

2.1 Time and Place

This study was conducted on the product obtained during the period of from March to April 2021. The sample preparation process was carried out at the Fishery Product Processing Laboratory, Faculty of Fisheries and Marine Sciences, Universitas Padjadjaran. Analysis of volatile flavor compounds was carried out at the Flavor Laboratory of the Indonesian Rice Research Center, Sukamandi, Subang, and proximate analysis at the Laboratory for Conservation of Endangered Animals IPB.

2.2 Materials and Tools

The material, chemicals, and equipment used in this study were marble goby, ice cubes, HCl, CuSO₄, K₂SO₄, NaOH, H₂SO₄, chloroform, aluminum foil, cling wrap, cool box, Gas Chromatography (Agilent Technologies 7890A GC System) / Mass Spectrometry (Agilent Technologies 5975 Inert XL EI CI/MSD), label paper, stove (Rinnai), Kjeldahl flask, Soxhlet flask, mortar, panic steamer, knife, plastic zip-lock, furnace, scale (Tanita), water bath (Mettler WNB 7).

2.3 Research Procedure

For sample preparation, a 3kg of marble goby was collected from Cirata Lake in an oxygen-filled plastic to Fishery Processing Laboratory at Faculty of Fishery and Marine Science, Universitas Padjadjaran.

The sample preparation procedure includes cleaning and removing the innards then steamed at 100°C for 30 minutes in the steamer. The steamed sample was weighed 50 grams for volatile compound identification and 40 gram for proximate analysis.

The weighed sample is packed in an aluminium foil, then labelled, covered with cling wrap, and put in a zip lock plastic. Packed samples were taken in a cool box to their destination to be identified. The method of identification of volatile compound was as described by Pratama (2013) using Gas Chromatography (GC) (Agilent Technologies 7980A GC System) and Mass Spectrometry (MS) (Agilent Technologies 5975C Inert XL EI CI / MSD). Volatile compounds from the sample were extracted using Solid Phase Microextraction (SPME) method and absorbed

using DVB/fibre Carboxen Siloxane/Poly Dimethyl. A sample of 1.5 grams was put into 22 ml SPME vial. The extraction temperature was 80°C for a period of 45 minutes (in the water bath). The GC column was used is HP-INNOWax (30m x 250um x 0.25 um), helium carrier gas, the initial temperature was 45°C (hold for 2 minutes), ramping up the temperature up at 6°C/minute to a final temperature is 250°C (hold for 5 minutes) for 45 minutes [9].

2.4 Data Analysis

For identification of the compounds the mass spectra was compared with the mass spectra patterns found in the data center or the NIST library version 0.5a (National Institute of Standard and Technology) on the computer database. Data of the volatile flavor compound were analyzed further using the Automatic Mass Spectral Devolution and Identification System (AMDIS) software [10]. The data that has been collected were discussed using a comparative descriptive study [6].

3. RESULTS AND DISCUSSION

3.1 Identification of Volatile Flavor Compounds of Steamed Marble Goby

Based on the analysis of volatile flavor 27 compounds, were identified in the steamed sample (Table 1), consisting of 7 hydrocarbons, 10 of aldehydes, 2 of ketones, 7 of alcohols, and amines.

The hydrocarbon form has the highest proportion 46.78% in the steamed marble goby samples. There were 7 hydrocarbon compounds detected. The highest proportion compounds were naphthalene with 36.87%, limonene as much as 6.06%, and hexadecane as much as 1.72%. Naphthalene was the compound with the highest proportion identified in parrotfish samples after steaming. Naphthalene was produced by plant degradation and accumulated in animals as environmental contaminants. Naphthalene is obtained and accumulated in animals through the food chain or the environment [11]. Naphthalene has a similar effect on mothball-like aroma. Naphthalene has also been previously identified in samples of crabs, cooked crayfish [12] and raw, cooked, reheated silver carp [8].

The alcohol group detected in the steamed marble goby sample comprised of 7 compounds,

next highest to the hydrocarbon group. 2-Octen-1-ol is a compound with a relatively high proportion of 15.35%, and 2-Hexen-1-ol, (E)- has a proportion of 7.07%. The compound 2-Octen-1-ol has a mushroom-like smell [13]. 2-octen-1-ol was identified in shellfish and turbot meat. Alcoholic compounds are formed from fish unsaturated fatty acids [14]. Alcohol compounds have a minimal role in flavor because of their high thresholds unless they are present at high concentrations or are unsaturated [15].

The aldehyde group identified in the steamed marble goby sample consisted of 10 aldehyde compounds, which the highest proportions were hexadecanal, nonanal, and 2-octenal (E) - each compound proportions were 13.22%, 7.03%, and 1.15%. Hexadecanal gives fatty aroma, although the proportion of compounds is hexadecanal relatively high, hexadecanal always gives a low contributes flavor of foodstuffs. [16]. Hexadecanal was the dominant aldehyde in heat-treated tuna and canned tuna [17]. Hexadecanal has also been identified in fish samples of fresh, cooked, reheated silver carp [8]. Nonanal is formed from oleic acid and linoleic oxidation and has green and fatty aroma [18]. Nonanal was identified in fresh, cooked, and reheated silver carp [8].

The ketonic compounds identified in the steamed marble goby sample were 2,3-Pentanedione with a proportion of 0.21% and 2,3-Octanedione with a proportion of 0.10%. 2,3-Pentanedione gives buttery, caramel-like aroma to cooked food [19]. 2,3-Pentanedione is a compound formed as a result of fat oxidation in fishery products. 2,3-Pentanedione gives squid a pungent aroma [20]. 2,3-Pentanedione was identified in other samples, namely, Chinese Mitten Crab [21] clams, turbot meat, anchovies [20]. 2,3-Octadione has impression metallic aroma [22] and is formed from fat oxidation [23]. 2,3-Octadione was found in brown trout [22] sea bass [19] and identified in fresh sardines [24].

In addition to the compounds above, an amine group was detected in the steamed marble goby sample consisting of 1 compound, namely Methylamine, N, N-dimethyl- with a proportion of 0.06%. Methylamine, N, N-dimethyl- or trimethylamine is produced by bacterial metabolism from trimethylamine oxide (TMAO). Fish can synthesize TMAO in their bodies or accumulate through the consumption of shrimp or other invertebrate prey [25]. Trimethylamine is widely found in seafood and has been described

as having an ammonia-like aroma and fishy smell [16]. The fishy smell caused by trimethylamine is often described as crab, old fishy, or fish house-like scent. Trimethylamine with low concentrations is used as a flavor for surimi products that require a crab-like flavor.

3.2 Proximate Analysis

Proximate analysis was performed on steamed marble goby samples. The proximate analysis includes water, ash, protein, and fat content. The result of the proximate analysis was shown in Table 2.

Water content is one of the most crucial chemical laboratory test methods in the food industry to determine food quality and resistance to possible

damage. The water content in the sample is 79.70%. The steaming process can reduce the water content in the sample because the space between the connective tissue of the sample shrinks and decreases in volume so that the water in the meat evaporates and comes out as a liquid [25].

Ash content is a mixture of inorganic or mineral components contained in a food ingredient [26]. Determination of ash content aims to determine the content of non-volatile components (inorganic components or mineral salts) that remain in the combustion of organic matter [6]. The ash content in the sample is 1.48%. The high ash content is related to the decrease in water content during the steaming process.

Table 1. Identified volatile compounds of steamed marble goby

No	Group	RT	Compound	CAS	Proportion (%)
1	Hydrocarbon	18.3762	Naphthalene	91-20-3	36.87
2		14.3979	Limonene	138-86-3	6.06
3		24.5664	Hexadecane	544-76-3	1.72
4		16.3513	Undecane	1120-21-4	0.96
5		28.2347	Hexane, 1-(hexyloxy)-3-methyl-	74421-18-4	0.94
6		16.8307	Furan, 2-pentyl-	3777-69-3	0.22
7		13.9416	Toluene	108-88-3	0.02
8	Aldehyde	30.302	Hexadecanal	629-80-1	13.22
9		16.1217	Nonanal	124-19-6	7.03
10		31.3493	2-Octenal, (E)-	2548-87-0	1.15
11		4.4001	Pentanal	110-62-3	0.38
12		15.7415	2,6-Nonadienal, (E,Z)-	557-48-2	0.24
13		27.9224	2-Heptenal, (E)-	18829-55-5	0.08
14		31.3475	2-Nonenal, (E)-	18829-56-6	0.08
15		19.9972	2,4-Heptadienal, (E,E)-	4313-03-5	0.03
16		13.6836	2-Pentenal, (E)-	1576-87-0	0.03
17		28.5771	Undecanal	112-44-7	0.01
18	Ketones	15.9275	2,3-Pentanedione	600-14-6	0.21
19		16.4865	2,3-Octanedione	585-25-1	0.11
20	Alcohol	13.1736	2-Octen-1-ol	22104-78-5	15.35
21		13.1925	2-Hexen-1-ol, (E)-	928-95-0	7.08
22		13.1925	1-Octen-3-ol	3391-86-4	5.82
23		16.3732	1-Hexanol, 2-ethyl-	104-76-7	1.78
24		15.4198	2-Penten-1-ol, (Z)-	1576-95-0	0.25
25		15.944	1-Heptanol	111-70-6	0.25
26		18.2805	1-Penten-3-ol	616-25-1	0.06
27		Amine	5523	Methylamine, N,N-dimethyl-	75-50-3

Table 2. Proximate analysis of steamed marble goby

Samples	Water (%)	Ash (%)	Fat (%)	Protein (%)
Steamed Marble Goby	79.70	1.48	0.36	16.65

Fat is a source of volatile compounds formed and can affect the overall product aroma. The fat content in the sample is 0.36%, the measured fat content is influenced by the water content. The higher the water content, the greater the fat content measured in the proximate test.

Protein is a food substance that is very important for the body because this substance, in addition to functioning as fuel in the body, also functions as a building block and regulator. The protein content in the sample is 16.65%, the protein content is inversely proportional to the water content. The decreased water content will cause the protein content in the sample to increase. The use of heat in the food processing process can damage the percentage of water content which causes protein levels to increase.

4. CONCLUSION

Analysis of volatile compounds using GC/MS succeeded in detecting as many as 27 compounds consisting of 7 hydrocarbon compounds, 10 aldehyde compounds, 2 ketone compounds, 7 alcohol compounds, and 1 amine compound. Naphthalene is the compound that dominates the sample (36.866%). The proximate content of steamed marble goby is 79.70% water content, 1.48% ash, 0.36% fat, 16.65% protein.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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