

## Identification of Aroma, Earthy Flavour and Aftertaste in Tilapia Using Sensory Evaluation Technique

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### ABSTRAK

Panel terlatih digunakan untuk mengenal pasti profil rasa yang merangkumi aroma, rasa dan rasa selepas ditelan bagi ikan tilapia hitam (*Oreochromia mossambica*). Untuk tujuan perbandingan, 2 jenis ikan laut iaitu ikan kembung (*Rastrellinger kanagurta*) dan ikan aya (*Euthynnus affinis*) dan ikan (*Clarias batrachus*), sejenis ikan air tawar, juga dinilai. Sepuluh, dan lapan ciri aroma, rasa dan rasa selepas ditelan telah dikenal pasti. Walau bagaimanapun, kehadiran ciri lumpur yang kuat hingga sederhana menguasai sifat aroma, rasa dan rasa selepas ditelan ikan tilapia yang juga sentiasa mendapat skor yang lebih tinggi daripada ikan keli kecuali bagi rasa selepas ditelan. Kehadiran geosmin di dalam otot ikan tilapia mungkin di dalam julat 1.0 hingga 10.0  $\mu\text{g}\text{m}^{-1}$ . Aroma lumpur mungkin boleh dikurangkan dengan memasak.

### ABSTRACT

Trained panelists were used to identify the flavour profile which consists of aroma, flavour and aftertaste of wild black tilapia (*Oreochromis mossambica*). For the purpose of comparison, 2 marine fish namely Indian mackerel (*Rastrellinger kanagurta*) and bonito (*Euthynnus affinis*) and catfish (*Clarias batrachus*), a freshwater fish, were also evaluated. Ten and eight aroma, flavour and aftertaste attributes respectively were recognized in tilapia. However, the presence of kerosine-like attribute could be due to petrochemical contaminants. The presence of strong to moderate earthy attribute is dominantly recognized in its aroma and flavour which are consistently scored higher than that in catfish except for the aftertaste. The presence of geosmin in the tilapia muscle could most probably be in the range of 1.0 to 10.0  $\mu\text{g}\text{m}^{-1}$ . The earthy aroma may be reduced upon cooking.

### INTRODUCTION

Acceptance of fishery products is dependent on safety, nutrition, flavour, texture, colour, appearance and the suitability of the raw material for processing and preservation. However, flavour seems to be the most important factor for acceptance (Haard 1992). Even though fish exhibits a similar recognizable flavour characteristic, each species has its unique attributes which are dependent on the non-nitrogenous constituents such as aldehydes, alcohols, volatile sulfur and ketones (Josephson 1991; Jones 1967). The consumer acceptance of muddy-flavoured catfish is very low (Mills *et al.* 1993). Black tilapia

is abundant and easily cultured in Malaysia, but its marketability is mainly constrained by the unpopular presence of the muddy odour and flavour.

The detection and the quantification of this unique and complex flavour notes could be carried out instrumentally such as by gas chromatography, but this cannot be done with ease. It is also a common practice in quality control laboratories to assess the presence of any particular odour and flavour through sensory evaluation by trained panelists. Johnsen and Dupree (1991) reported using trained panelist to investigate the role of feed ingredients on the flavour quality of farmed

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catfish. The use of trained panelists to assess the lipid oxidation in frozen stored catfish was reported by Brannan and Erickson (1996). The use of trained panelist to monitor quality changes in strawberry industry has also been reported (Shamaila *et al.* 1992). Trained panelists are frequently used for sensory-instrumental correlation. They are consistent, superior in describing odour notes, are articulate and highly motivated (Foss 1981). General methods for the sensory evaluation of food products have been outlined by several researchers such as Amerine *et al.* (1965), Larkin (1969), Larmond (1971) and Spencer (1971). Specific training of panelists to the earthy odour of pure extracts of known important compounds that contribute to the characteristic of muddy odour such as geosmin and 2-methylisoborneol (MIB) has been reported by Persson (1980). It is crucial that the identification and quantification of these flavour notes recognised by the trained sensory panelists since the ultimate marketability of the fish and its products are dependent on its acceptability by the consumers particularly the sensory perception of the buyers. To date, the flavour note of black tilapia has not been reported. Hence, this study was carried out to identify and quantify the flavour note of black tilapia as well as to identify the concentration of geosmin in the fish muscle detectable by panelists.

## MATERIALS AND METHODS

### Materials

Wild black tilapia (150-300 g each) were caught by netting from a lake near the university. The marine fish (Indian mackerel and bonito) and catfish used for comparison purposes were bought from the local wet market. The geosmin standard (1% solution in propylene glycol) was kindly donated by Mr. Romke Hengst of Bush Boarke Allen, Singapore.

### Sample Preparation

For the identification and quantification of the flavour profile, 2 pieces (5 g each) of Indian mackerel, bonito and tilapia muscle were placed in randomly labeled and sealed laminated aluminium pouches (7 x 6 cm) and cooked to an internal temperature of over 71°C (Sawyer *et al.* 1988). The internal temperature of the pouch was monitored by a thermocouple inserted in the centre of the pouch.

The samples for the quantification of the earthy characteristics were prepared as above. However, for raw sample evaluation, the sample was prepared by finely grinding 10 g of the muscle, placed in randomly labeled glass containers, and immediately evaluated.

### Preparation of the Standard Geosmin Solution

The geosmin solutions were prepared at 0.0 (control), 0.1, 1.0, 10.0 and 100.0 µgm<sup>-1</sup> concentrations. The series of standard solutions were arrived at after an initial trial to identify the threshold of the compound.

### Sensory Evaluation

Seven panelists, consisting of 3 females and 4 males, aged between 23 and 40 years old who had been selected and trained were used in this experiment. The identification and quantification of the flavour profile and the earthy characteristics (aroma, flavour and aftertaste) were carried out both individually and through group discussion. The design of the group discussion was a modification of the procedure described by Winger and Pope (1981), Persson (1980) and Zook and Wessman (1977). The evaluation was repeated 5 times before the list of descriptions of the flavour profile was generally agreed to.

For the flavour profile description, each panelist was asked to list the sensory profile as much as possible and the evaluation was assisted by the list of fish attribute descriptions which were developed by Prell and Sawyer (1988) and Chambers and Robel (1993). These identified characteristics were then quantified by scoring them on a 7-point scale (1 = slight, 4 = moderate and 7 = strong) (Prell and Sawyer 1988).

In the quantification of the earthy attributes, each panelist was presented with four warm samples and was requested to evaluate the aroma, flavour and the aftertaste characteristics of the samples. These attributes of the muscle were to be scored against the standard geosmin solutions after dipping a paper strip (3 x 50 mm) and snipping it. Those attributes were scored on a 100 mm unstructured line anchored 0.5 mm from both ends by pairs of terms modified from the method outlined by Stone *et al.* (1974). The results were measured as the distance from the left end of the line.

The aroma was evaluated right after the pouch was snipped opened. For flavour, the panelists were asked to chew the sample for 60 sec before

giving their evaluation and the aftertaste was recorded 60 sec after swallowing the samples (Chambers and Robel 1993). Only aroma was evaluated in raw samples.

#### Statistical Analysis

Statistical Analysis System (SAS) was used to analyse all the data for one way analysis of variance (ANOVA) and the difference between samples were analysed by Duncan's Multiple Range Test (DMRT).

### RESULTS AND DISCUSSION

The description of the flavour profile which consists of aroma, flavour and aftertaste attributes of the muscle of Indian mackerel, bonito, catfish and tilapia are as in Tables 1, 2 and 3 respectively. Basically, the identified individual flavour profile of the fish used are not the same and thus support the earlier findings that each fish has its unique flavour characteristics which is mainly attributed to the presence of specific component, recognition of the threshold value and their concentration (Josephson 1991).

Six aroma characteristics were recognized in Indian mackerel, 8 for bonito, 9 for catfish and 8 for tilapia (Table 1). Fish oil aroma was identified as the strongest characteristic in Indian mackerel, bonito and catfish. However, sweet and sour aromas scored the highest in the black tilapia. 'Sour' aroma also scored the highest in bonito. The same characteristic was also recognised in the

other three fish. The 'sweet', 'fish oil' and 'fresh fish' attributes which were scored high to moderate in all the four fish evaluated is most probably due to the presence of eight-carbon volatile ketones which were derived through lipooxygenase-mediated conversion of the polyunsaturated fatty acids which are abundant in seafoods (Josephson 1991). Earthy character scored highest in tilapia, although it is also recognizable in bonito and catfish. The concentration of this earthy compound, namely geosmin and MIB produced by blue-green algae accumulate in the muscle (Yukowski and Tabacher 1980; Kuusi and Shuiko 1983).

The earthy flavour characteristic was recognized in both the freshwater but not in the marine fish (Table 2). It was the dominant character detected in tilapia. Earthy aftertaste was not at all recognized in both marine fish studied. It is among the three characteristics that scored highest in tilapia. An equivalent score was also given to the earthy attribute in catfish.

The two additional attributes identified by the panelists were kerosene and blood which were not in the original listing as described by Prell and Sawyer (1988) and Chambers and Robel (1993). The kerosene-like character detected by panelists in black tilapia might be due to the contamination of the lake water by the petrochemical compounds discharged into it. The detection of the kerosene taint in mullet taken from the Moreton Bay and Brisbane River in Queensland, Australia was also reported by Vale *et al.* (1970) and Shipton *et al.* (1970) respectively. The detected blood

TABLE 1  
The description and scores for aroma in cooked muscle of Indian mackerel, bonito, catfish and tilapia

Description	Sensory scores*			
	Indian Mackerel	bonito	catfish	tilapia
1. Briny	4	4	3	3
2. Blood	2	4	NR**	NR**
3. Earthy	NR**	2	3	8
4. Fish oil	6	7	6	5
5. Fresh fish	5	4	5	5
6. Musty	NR**	NR**	3	3
7. Scorched	NR**	6	3	NR**
8. Smoke	NR**	NR**	3	3
9. Sour	5	7	5	6
10. Sweet	5	4	5	6

\*scores of 1 = light; 4 - moderate and 7 - strong

\*\*NR- not recognized

• Scores are average of 5 evaluations

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