PROFILE OF FISH SMOKING (PANGASIUS HYPOPTHALMUS) IN RIAU PROVINCE INDONESIA

by:
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Abstract

This study was aimed to describe the method and process of traditional fish smoking in Riau Province of Indonesia and to determine the best species of wood among several species of wood commonly used as fuel and smoke source of fish smoking in the province. Survey on smoking catfish was carried in Kampar regency, as the area was becoming a center for the development of catfish (Pangasius hypopthalmus) farming and processing. Some species of wood that commonly used as smoking fuel were including Laban wood (Vitex pubescens), Modang Salawai wood (Cinnamomum porrectum), and Rambutan wood (Nephelium lappaceum). Results had shown that fish smoking in the province was applying direct hot smoking method. The best kind of wood was Laban wood (Vitex pubescens), and so, it became to be a characteristically species of wood for fuel and smoke source of fish smoking in Riau Province Indonesia. The smoked catfish yielded was the most preferred by consumers with the sensory value of 7.3 ± 0.2. The content of total phenols in smoked catfish using Laban wood as smoke source showed the highest content of total phenols (29.17 ± 0.87 ppm), content of total acid 1.42 ± 0.07 %, pH values 6.77 ± 0.08, water content 19.0 ± 1.8 and the value of Aw 0.68 ± 0.02.

Key words: Direct hot smoking, Fish smoking, Pangasius hypopthalmus, Vitex pubescens

1. INTRODUCTION

Utilization of waters potential and aquaculture development in the Province of Riau Indonesia has contributed to fulfilment of nutrition as well as increasing economic growth of the community. Aquaculture production from rivers, ponds, and brackish in 2005 was totally 23,144 tonnes, increasing to 38,676 tonnes in 2006 (Annual Statistics of Fishery and Marine Department Province of Riau, 2007). One species of fish that is growing in the Province of Riau and currently intensively cultured is catfish Jambal Siam (Pangasius hypopthalmus) or better known as Patin.

Diversification of the fishery products is necessary to maintain prices and to increase the reach of its marketing place. According to Leksono and Suparmi (2007), processing of farmed catfish into smoked fish is an effort to anticipate production excess and to provide added value to the product. Smoking is one of the oldest processes used for fish preservation purposes, but in its development, smoked fish was appreciated for its organoleptic quality. Hadiwiyoto (1997) said that the initial purpose was changed into obtaining certain taste and aroma of the
smoke and the appearance of certain foodstuffs. Varlet, et al (2007) had also considered to a recent study on European consumer preferences which showed that these preferences were represented by a whole range of smoke odours and flavours.

According to Berkel, et al. (2004), there are three ways of smoking, namely: cold smoke method, that is the temperature during the smoking is at most 30 °C which means the product does not get cooked; hot smoke method, that is the temperature during the smoking varies between 65 and ±100 °C, and so, in this process, the product does get cooked but not dried; and smoke drying, that is the temperatures during this process vary between 45-85 °C, the product is first hot smoked, so that it gets cooked, and then, with continued smoking the product is dried. Most traditional smoked products in the tropics belong to the third category, hot drying. They are hot smoked and subsequently dried under continued smoking (smoke drying). The process takes about 12-18 hours or even days, depending on the product.

In the Province of Riau Indonesia, the smoked fish processing is conducted traditionally by processors by using a simple means of trays composed in the smoking chamber at about 1 meter above the ground surface and covered with zinc-roofed. They conducted smoking by arranging the fish on the rack, which there is a coal and wood burning beneath. As a source of heat and smoke, the farmer use any type of wood according to the availability of wood surrounding the village, regardless the influence of the type of wood to the flavour of smoked fish yielded.

Fish smoking is a way of fish processing or preservation by utilizing a combination of drying treatment and the provision of natural chemical compounds produced by combustion of natural fuel-wood. The smoke compounds will be formed through the combustion in the form of vapour and droplets of tar and heat generated. Smoke compounds are attached to the fish and dissolved in the water layer at the surface of the fish, thus forming a distinctive aroma and flavour to the product and its colour becomes golden yellow or brownish (Adawyah, 2007).

Berkel, et al. (2004) explained that the preserving effect of the smoke is a result of dehydration of the product during the smoking. The smoke particles absorbed by the fish flesh surface also have a preserving effect which is less than the drying effect. The smoke particles, after being absorbed by the product, inhibit bacterial growth on the surface of the product. The smoke particles also have a positive effect on the taste and colour of smoked product. The heat of the fire dries the fish during the smoking process and if the temperature gets high enough, the flesh is cooked. This means that bacterial spoilage and spoilage due to enzyme activity is prevented. Cooking and drying of the flesh when being smoked play an important role in the preservation. If a product is well dried during smoking then it can be stored for a long time.

Thickness of the smoke or the amount of smoke absorbed by the fish surface will determine the aroma and flavour of smoked fish. Phenols are the major contributors to wood smoke aroma, but other compound classes are also important. Various phenols (guaiacol, 4-methylphenol, 2,6-dimethoxyphenol) have been described as possessing smoky aromas (Maga, 1988). Kostyra and Barylko-Pikielna (2006) stated that phenolic compounds seem to be mainly responsible for the strength of smoky odour, whereas carbonyl compounds seems to increase its palatability.

According to Girard (1992), certain properties in the smoke have functional compounds in meat processing and preservation because of their roles as an antioxidant, antimicrobial and product flavour and colour-forming. However, behind the benefit of fish smoking aimed to preserve and provide smoke flavour to the fish, there is a potential hazard to human health risks associated with the content of polycyclic aromatic hydrocarbons (PAH) in smoked fish produced by direct heat smoking. PAH compounds may be formed on the pyrolysis of wood.

The quality of smoked fish products are influenced by the manner or method of smoking applied as well as by the types of fuel-wood used, which are less considered by the
fishermen or fish processors (Leksono, et al., 2009). The fish smoking process was performed based on the traditional skills handed down from generation to generation. Types of wood used for smoking fuel were uncertain because the local farmers or processors were depended on the availability of the wood surrounding the fish processing area in their village. However, the result of interviews of some smoke fish processors in that province was indicating that the use of the type of wood *Laban* (*Vitex pubescens*) produced better quality of smoked fish. So, the objectives of this research are to describe the method and process of traditional fish smoking in the Province of Riau Indonesia and to determine the best type of firewood among several types of wood commonly used as fuel and smoke source of fish smoking in the province.

**2. MATERIALS AND METHODS**

**Sample Fish**

This research used freshwater catfish (*Pangasius hypopthalmus*), the species of fish usually processed as smoked fish in Province of Riau, especially in District of Kampar. The fishes were cultured in pond and their condition was very fresh because they were alive when handled and prepared for smoking. The size of catfish samples were 250-275 gram each.

Survey on smoking catfish was carried in the Regency of Kampar Riau Indonesia, as the area was becoming a centre for the development of catfish (*Pangasius hypopthalmus*) farming and processing.

**Firewood**

Some types of wood that commonly used as smoking fuel were including Laban wood (*Vitex pubescens*), Modang Salawai wood (*Cinnamomum porrectum*), and Rambutan wood (*Nephelium lappaceum*).

**Methods of Liquid Smoking**

The first step of the study was conducting surveys on the traditionally smoked fish in Riau province, especially in Kampar regency where the catfish smoking were well developed. The survey was conducted to obtain data about the profile of traditional smoked catfish in this area.

Catfish smoking is traditionally conducted in the village where the fish smoking was taken by the fish processors, so the process of smoking and smoked catfish products yielded can be observed directly.

Some types of firewood used as fuel for catfish smoking were compared and identified the differences of sensory quality and consumer acceptance to each of smoked fish produced. Organoleptic methods were conducted by using the ranking and scoring tests to assess the value of appearance, smell, texture and taste. In addition, chemically tested was carried out to determine the value of pH and the content of smoked catfish total phenol. The results of the survey in the field, organoleptic and chemical analyses will generate information on the traditional smoked catfish products with the best flavor and the best firewood used for fish smoking in Riau Province.

**3. RESULTS AND DISCUSSIONS**

**Traditional Fish Smoking in Riau Indonesia**

Generally, fish smoking in the Riau region was conducted traditionally by applying direct heat smoking method. The fresh catfish that has been gutted and cleaned placed on the rack with a height of 110 cm above the ground, then heated directly over a flame of fire wood for 5-6 hours, until catfish meat cooked and almost all the fat melted, and so this process called as the stage of roasting. The next stage after roasting was the drying. This drying stage was
conducted by reducing the flame of fire wood burning and turned it into the embers. It was carried on in the next day for about 4-6 hours from morning until noon.

Figure 1 below is showing the traditional smoking house used by processor to smoke the fish in the Province of Riau Indonesia and the processor was inserting the rack containing the fish into the smoking chamber.

![Figure 1. Traditional Smoking House (left) and Fish Smoking (right) in the Province of Riau Indonesia](image)

The size of catfish used was about 25-30 cm length and had average weight about 240-260 g each. It cleaved from the back and shaped a butterfly like, and then gutted and cleaned. Blood may cause the actual resulted products becoming to be black, so the gills and entrails were removed and washed. Weight of the catfish after weeding was reduced 8%.

The earlier smoking process conducted with the initial temperature of 80 - 90° C for 2 hours, then the temperature is lowered to about 70° C for 1 hour, then the temperature is lowered again to 60° C for 1 hour. In the next day, the smoking process was being continued by using enough embers for drying process with temperature of 40° C for about 5 hours. The smoking process was finished when the smoked catfish yielded had been showing somewhat blackish brown, shiny, dry and clay textured, and weight reduction becoming to be 31% of weight.

**Hedonic Value**

The appearance of smoked catfishes yielded by traditional direct hot smoking by using varied types of fire-woods is showed as Figure 2 below.
Figure 2. Smoked Catfishes Yielded by Traditional Direct Hot Smoking by Using Three Types of Fire-woods: Laban wood (Vitex pubescens) (K-1), Modang Salawai wood (Cinnamomum porrectum) (K-2), and Rambutan wood (Nephelium lappaceum) (K-3)

Mean value of hedonic value of smoked catfish yielded by using of varied types of fire-woods are shown in Table 1.

Tabel 1. Mean of Hedonic Value of Smoked Catfish Yielded by Using of Varied Types of Firewoods

<table>
<thead>
<tr>
<th>Type of Firewood</th>
<th>Appear.</th>
<th>Flavour</th>
<th>Texture</th>
<th>Odour</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laban</td>
<td>7.5</td>
<td>7.2</td>
<td>7.1</td>
<td>7.5</td>
<td>7.3 ± 0.21 a</td>
</tr>
<tr>
<td>Md. Salawai</td>
<td>6.6</td>
<td>7.1</td>
<td>6.6</td>
<td>7.1</td>
<td>6.8 ± 0.29 b</td>
</tr>
<tr>
<td>Rambutan</td>
<td>6.9</td>
<td>7.2</td>
<td>7.0</td>
<td>7.2</td>
<td>7.1 ± 0.15 ab</td>
</tr>
</tbody>
</table>

Note: Different superscript letters within the same column indicate significant differences (P<0.05)

Table 1 shows that the smoked catfish yielded by using Laban wood as a fuel and source of smoke indicates the highest hedonic value but not significantly different to it using Rambutan wood (P<0.05). Laban wood (Vitex pubescens) produced better sensory quality of smoked fish. The appearance is brownish but more shin rather than the others. Its flavour and odour is more tasty and smelt characteristically smoked fish. It may be caused by the higher total phenol contained in the smoked fish yielded.

Especially, the texture of the smoked catfish yielded by using Laban wood was not significantly different to others by using Rambutan wood nor Modang Salawai wood (P>0.05). It was also correlated its lowest of water content (19.0 ± 1.8%) and the value of Aw 0.68 ± 0.02 that was not significantly different to others.

Value of pH

Value of pH in the smoked catfish yielded traditionally smoking by using of varied types of fire-woods are shown in Table 2 below.

Tabel 2. Value of pH in the Smoked Catfish Yielded by Using of Varied Types of Firewoods
Table 2 shows that the pH value of all samples are closed to neutral acidity. The value of pH in the smoked catfish yielded by using Laban wood as a fuel and source of smoke indicates the lowest value (6.73 ± 0.11), but not significantly different to others by using Rambutan wood nor Modang Salawai wood (P>0.05).

**Content of Total Phenol**

Content of total phenol in smoked catfish yielded traditionally smoking by using varied types of fire-woods are shown in Table 3 below.

<table>
<thead>
<tr>
<th>Type of Firewood</th>
<th>Repl 1</th>
<th>Repl 2</th>
<th>Repl 3</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laban</td>
<td>6.68</td>
<td>6.62</td>
<td>6.88</td>
<td>6.73 ± 0.11 a</td>
</tr>
<tr>
<td>Md. Salawai</td>
<td>6.85</td>
<td>6.65</td>
<td>6.84</td>
<td>6.78 ± 0.09 a</td>
</tr>
<tr>
<td>Rambutan</td>
<td>6.77</td>
<td>6.76</td>
<td>6.91</td>
<td>6.81 ± 0.07 a</td>
</tr>
</tbody>
</table>

Note: Different superscript letters within the same column indicate significant differences (P<0.05)

Table 3 shows that the pH value of all samples are closed to neutral acidity. The value of pH in the smoked catfish yielded by using Laban wood as a fuel and source of smoke indicates the lowest value (6.73 ± 0.11), but not significantly different to others by using Rambutan wood nor Modang Salawai wood (P>0.05).

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<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laban</td>
<td>15.74</td>
<td>13.52</td>
<td>8.89</td>
<td>14.6 ± 1.1 b</td>
</tr>
<tr>
<td>Md. Salawai</td>
<td>11.65</td>
<td>10.08</td>
<td>8.48</td>
<td>10.1 ± 1.3 a</td>
</tr>
<tr>
<td>Rambutan</td>
<td>12.34</td>
<td>14.86</td>
<td>9.77</td>
<td>12.3 ± 2.1 ab</td>
</tr>
</tbody>
</table>

Note: Different superscript letters within the same column indicate significant differences (P<0.05)

Table 3 shows the content of total phenol in the smoked catfish yielded by using Laban wood as a fuel and source of smoke indicates the lowest value (14.6 ± 1.1), significantly different to it by using Modang Salawai wood (P<0.05), but not significantly different to it by using Rambutan wood. The higher content of total phenol may cause to the higher value of hedonic, because panelists was more preferred to the smoked fish using Laban wood, especially for its odour and taste that is more stronger than the others.

**4. CONCLUSION AND SUGGESTION**

**Conclusion**

The catfish (*Pangasius hypopthalmus*) smoking in Riau Province Indonesia was applying direct hot smoking method.

The best type of firewood was Laban (*Vitex pubescens*), and so, it became to be a characteristically type of wood for fuel and smoke source of fish smoking in Riau Province Indonesia.

The smoked catfish yielded had been showing somewhat blackish brown, shiny, dry and clay textured, and weight reduction becoming to be 31% of weight. It was the most preferred by consumers with the average of sensory value 7.3, above the minimum standard value 7.0 determined by National Standard of Indonesia (SNI).

**Suggestion**
For Laban (*Vitex pubescens*) is the best type of firewood and it became to be a characteristically type of wood for fuel and smoke source of fish smoking in Riau Province Indonesia, it is suggested to used Laban wood consistently for flavouring and preserving fish by applying a liquid smoking method, so that the quality of smoked fish produced can be improved.

**REFERENCES**

Annual Statistics of Fishery and Marine Department Riau Province, 2007. Agency of Marine and Fisheries of Riau Province, Pekanbaru Indonesia


