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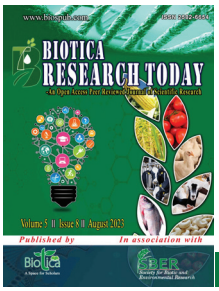

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Smoked Fish Laminates: A Product from Pangas Fillet for Better Drying Efficiency and Reduced Processing Time

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Abstract

The North-East India is well-known for having various traditional fish products and preservation techniques. One such product is '*Smoked fish*'. It's a cured fish product made of small indigenous fishes like *Puntius* spp., *Mystus* spp., *Mola* spp., *Channa* spp., *etc*. and it is most popular in Manipur among all the Northeastern States. Pangas fish, which is less preferred and consumed, was used for the study. Prior to dehydration, Pangas fish laminates were prepared by applying constant pressure to fillets making it flat which increases surface area ensuring uniform drying. Further, laminates were smoked at standard temperature till characteristic colour and flavour and moisture content reduced to 28.66% with high protein content of 36.96% and improved the shelf life upto 10 weeks. Fat and ash content increased to smoked laminates from 5.77 to 7.26% and 0.94 to 4.8% respectively. Vacuum packaging ensures good shelf life of smoked laminates under ambient storage.

Keywords: Fish Laminates, *Pangasius* spp., Smoked fish, Smoking

Introduction

Northeast India is a rich basket of ethnic fish products. These include fermented, dried, smoked, salt-dried, *etc*. A variety of dried and smoked fish products are available in the state of Tripura and Manipur. These cured products are hugely popular in the Northeastern States and relished by all classes of people. Salting, smoking, drying and other curing practices on fish are commonly applied by the farmers of NE region of India. Maximum rate of consumption of smoked fish products are by the people of Manipur and smoking is a traditional household practice where they expose the fish above flame in household furnace to smoke the fish. On the other hand, dried fish products are popular among the tribal and Bengali population of Tripura. Fishes like *Puntius* sp., *Mystus* sp., *A. mola*, small fresh water prawns *etc*. are commonly dried under sun without much processing and sold in the markets of Tripura at higher price.

Pangas (*Pangasius* sp.) is high yield variety and widely cultured and utilized for value addition of fish. The year-round availability of the fish at a low price and in good quantity in the markets of Tripura is also the reason for opting the fish as a potential candidate species for value addition. With about 16% of protein and meat yield of 45-50%, the fish can be a very good source of product development or curing. Recent market survey also suggested the popularity of this fish in the catering business. Pangas is a fatty fish and linked with unacceptable aroma when it is raw. Therefore, the fish is mostly processed with extra spices to mask the stinky aroma and need further research to develop flesh colour and flavour of meat.

Fillets from big fishes can be cut into small size with thinner section to develop laminates and dehydrate the same. Bigger fishes are generally dressed to slit open from dorsal part to increase surface area to volume ratio and then dried or smoked. This takes comparatively less time for drying than drying a whole fish of same size. The fish fillets are pressed by some roller or screw press to remove some water and then dried to get dehydrated laminates. This process helps to flatten the fillet portion increasing surface area and also remove some moisture from fish meat before actual drying. This also helps in uniform drying/ smoking with efficient water removal and reduced time.

Sun-drying and smoking are the most prominent traditional processing methods of fish particularly in NE India. However, unsanitary premises and handling of materials during this indigenous processing, bring a poor quality

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final product. Laboratory-process of dehydration and smoking using mechanical means will enhance shelf life. Hygienic preparation of cured products using improved technologies is still not so popular among the farmers. The preparation of such products is basically depends on the traditional knowledge of local people and hence need scientific intervention and standardization of the process. Application of curing on Pangas is not much studied except few attempts. Here, an effort is made with the objective to develop smoked laminates with desired consistency, colour and aroma from Pangas fillet which will have better quality and can fetch good demand among the farmers involved in smoking and drying of fishes.

Materials and Method

The scientific study of smoked fish laminates was carried out at College of Fisheries, Central Agricultural University, Lembucherra, West Tripura during the period of 2014-15.

The standard procedure developed for laminates from fish fillets reported by Jeevanandam *et al.* (2001) has been followed in this experiment with further modification as required for Pangas fish fillet. Drying and smoking of laminates in mechanical chambers was done following the process as described by Karthikeyan *et al.* (2007). After several trial and errors, the operational key parameters such as temperature, drying time, smoking time and temperature, process of laminating the fillets and time, *etc.* were optimized.

The samples were analyzed in triplicate for moisture, protein, fat and ash by standard method of AOAC (Horwitz, 2000). Sensory attributes like appearance, colour, texture, *etc*. were evaluated and descriptions were presented.

The detailed process of preparation and pictorial presentation of the smoked laminates from Pangasius fillet are described here and given in figure 1.

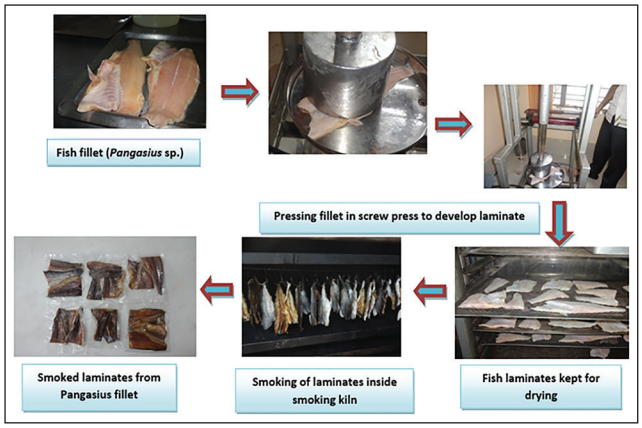

Figure 1: Pictorial representation of preparation of smoked laminates from Pangas fish

1. Collection and Dressing

Fresh Pangasius fish was purchased from local fish market of Agartala and brought to laboratory under iced condition inside insulated boxes. Each fish weighing about 600-700 g has been selected for the experiment as better and faster development of laminates can be achieved in small size fillets than the larger ones. If a bigger size fish is used, they may be cut into smaller pieces of 10 cm size (approx.) before pressing. The length and weight of the fish were taken and average value calculated. The fishes were washed with chilled water (fish:water = 1:4) for 5-10 min. to remove fat, pigments and foreign matters. Dressed to remove entrails, head and slit into fillets.

2. Pressing of Fillets for Laminate Preparation

The fish pieces were pressed between two metal plates of a screw press in order to remove a portion of moisture (approx. 10%) and get a uniform flat shape. A second pressing is given for the pieces to remove some more moisture as the flesh of Pangas is thicker. Fish pieces are treated with salt @ 3% of wt. for 30 min. An anti-fungal treatment was given in sorbic acid @ 0.3% for 15 min. (as per dose recommended/ prescribed).

3. Dehydration

The treated laminates were spread on the perforated trays to remove the dripping of brine and then spread uniformly on wire mesh trays of a mechanical dryer. The trays along with the fish are placed inside the dryer and dried for about 12 hr at 55-60 °C temperature until moisture content comes down below 30%.

4. Packing and Storage

The laminate after drying, is smoked in a mechanical smoking kiln by burning saw dust to produce smoke and is passed over the fish in trays inside the chamber at a temperature of 60 °C. The laminates were smoked for 2 and half hours till characteristic golden-brown color and smoky flavor arises. Smoked laminates were packed under vacuum using vacuum packing machine (Model: SPINCO, Jumbo type). The packs were stored at ambient temperature (28 to 30 °C). The product can be consumed as such or after frying in vegetable oil.

Results and Discussion

1. Quality of the Smoked Fish Laminates

The mean weight of the fish used for preparation of the laminate was 675 g and the mean length of the fish was 35 cm. The dressing yield was 53.5%. The process of lamination released some moisture which accounted for around 12%. The initial quality of raw material used for preparation of smoked laminates from Pangas fish is presented in table 1. All the biochemical parameters were within or much below the maximum acceptable limit representing the suitability of the fish for further processing. Several researches were conducted to optimize the salting, drying and smoking processes on fish (Doe *et al.*, 1998; Luc *et al.*, 2013). In the present study the laminate were prepared, dried and smoked based on the fish size following the standards of laminating process, time of lamination, drying temperature, drying time, smoking temperature, time as given by Dhar and Tripathy (2023) and presented in table 2. The uniqueness of the study is the preparation of laminates from fish fillet before drying. For big size and mostly fatty fishes like Pangas, pre-processing steps like salting or pre-drying is very important. This reduces the initial moisture to some extent and favours the drying process which is otherwise

slow comparatively. In the present study, the fillets pressed at a constant pressure to flatten the fillets or fish pieces, increases surface area reducing time for drying. This also provides a uniform drying and gives better appearance. This method is successfully utilized for production of dehydrated laminates from Bombay duck and Ribbon fish available in west coast of India (Lewis, 1978; Jeevanandam *et al.*, 2001). Similar processing was adopted by Siriskar *et al.* (2013) to produce salted and pressed anchovies in which the salted anchovies were pressed using wooden box to drain off the water from fish and making it into cake shape.

The proximate composition of fresh Pangas fish and freshly prepared smoked laminate is presented in table 1. Proximate composition of smoked laminates (Table 1) has the largest impact of nutritive value, calorific value, the functional properties, sensory quality and the storage stability (Sikorski *et al.*, 1990). The freshly prepared smoked laminates showed

Table 1: Quality characteristics of fresh flesh and smoked laminate from *Pangusius* sp.

Parameters	Pangas flesh	Smoked laminate
Moisture (%)	74.62 ± 0.068	28.76 ± 0.07
Protein (%)	15.08 ± 0.02	38.79 ± 0.19
Fat (%)	5.77 ± 0.075	7.26 ± 0.01
Ash/ mineral (%)	0.94 ± 0.04	4.80 ± 0.03

moisture content of 28.66 ± 0.07. It's a high protein food and the protein value of 36.96 ± 0.42 is in agreement with the finding of Somboonyarithi *et al.* (1996) on semi-dried cat fish steaks. The high fat content of Pangas fish (5.77%) is further increased after smoking the fish laminates. This may be attributed to the fact that loss of moisture in smoked laminates caused the augmentation of fat content. However, according to Abraha *et al.* (2018) smoking causes dripping of fats and more water from fish leading to physical loss of lipid. In the present study, the increased fat content in smoked laminates from fresh fish may be the reason of deposition of fat drippings on the product which resulted in higher estimation of fat.

Table 2: Processing parameters optimized for smoked laminate from Pangas fish

Sl. No.	Parameters optimized	Standards
1	Length of fish fillet	15-22 cm length
2	Weight of fillet	185 g
3	Processing time for preparation of laminate	5 min. in screw press at constant pressure
4	Temperature of drying	55-60 °C
5	Time of drying	10-12 hrs.
6	Temperature of smoking	60 °C
7	Time of Smoking	2 and 1/2 hrs.

The descriptive sensory evaluation of smoked laminates is given in table 3. There are few reports available on the acceptability study of semi-dried fish products. The freshly smoked samples had a hard texture, typical golden-brown color and high smoky odour which changed to soft texture, black color and low smoky odour associated with putrid ammoniacal odour and appearance of fluffy woolly mats of molds on surface of the product. This may be due to increase in moisture in products and changes in biochemical and microbial load in storage. Similar observation of increased moisture content and biochemical quality deterioration with increased microbial load in smoked *Colisa fasciata* after 150 days of storage was reported by Karthikeyan *et al.* (2007). The increase in intensity of brown color in the products could be due to occurrence of Maillard reaction between carbonyl compound generated during oxidation of lipid and amino group present in the fish protein. The acceptability score of the product evaluated through hedonic scale was 4.6 (scale of 5). This score reflects that the colour, odour, taste, texture and other sensory attributes of the product was acceptable by the consumers. The chemical and sensory studies of smoked laminates from Pangas fish under vacuum

Table 3: Descriptive analysis of sensory attributes of smoked laminates

Texture	Color	Characteristic odour	Taste	Visible fungal growth
Hard/ little crisp	Deep golden brown	High smoky odour	Characteristic smoky taste	Nil
Changes at deterioration:				
Little crispiness	Blackish to grayish	Very low smoky odour, Rancid smell emerges	Slightly bitter taste	Present on surface

storage at normal room temperature, revealed a shelf life of 10 weeks (Dhar and Tripathy, 2023).

Conclusion

The smoked laminate developed from Pangas fish has potential for long-term preservation of fish and also gives an idea about their packaging requirement. The fish was laminated successfully by pressing at a constant pressure for certain time before curing and was found suitable. Higher protein content of about 38% makes the product nutritionally rich. The fat drippings while smoke processing may be physically removed to get a low fat product. Since the product has a moisture content of about 28%, vacuum packaging can be a good option for extended storage life. Further, modified atmosphere packaging and periodic heating and drying may be suggested for keeping the storage life longer for the product. There is a need for future research especially in developing better packaging methods utilizing polythene, polyethylene terephthalate (PET) or modified atmosphere packaging (MAP) for better

preservation and shelf life of traditional fish products and its marketing.

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