African Journal of General Agriculture
Vol. 4, No. 2, June 30, 2008
Printed in Nigeria

1595-6984/2008 $12.00 + 0.00

http://www.asopah.org

AJGA 2008001/4208

Chemical Composition and Keeping Qualities of a Scaly Fish Tilapia, *Oreochromis niloticus* Smoked With Two Energy Sources

O. J. Abolagba* and O. O. Melle

Fisheries Department, University of Benin, Benin City, Nigeria

(January 12, 2008)

ABSTRACT: Twenty pieces of lean fish *Oreochromis niloticus* was used for this experiment. Ten were kench salted while the remaining ten were unsalted. The effect of dried and semi-dried rubber wood (Hevea brasillensis) as energy source on the quality of the smoked Tilapia using the improved Altona kiln while the electric oven served as the control.

The study showed that Tilapia fish smoked with semi-dried rubber wood smoked faster as it took 1hr. 15 minutes while those smoked with dried rubber wood took extra 30 minutes.

There was no significant difference ($P < 0.05$) protein-wise between Tilapia fish smoked with dried and semi-dried rubber wood and oven dried fish. There was however, significant changes ($P < 0.05$) in protein quality as a result of storage for 1 month, when compared with those that were analyzed immediately after processing. study also showed that it costs less to smoke fish with semi-dried rubber wood as a result of the less time it took to smoke fish with it. Consumers are advised to endeavour to consume their smoked fish products with minimal delay to ensure that the nutritional level of the product is not compromised.

Key Words**:** *Oreochromis niloticus,* Altona kiln, Electric Oven, *Hevea brassillensis* smoking.

Introduction

Fish constitute a very important component of the diet for many people and often provides the much needed nutrient that is not provided in cereal based diets (Clucas and Sutchitte, 1981). It was reported by Teutscher (1990); Saisithi (1994) that it provides between 30% and 80% of the total animal protein intake of the coastal people of West Africa. Additionally, Olomu, (1995); Kreuzer and Heen (1962); Waterman (1976) have also highlighted that fish is rich in protein with amino acid composition very well suited to human dietary requirements comparing favourably with egg, milk and meat in the nutritional value of its protein.

Fish is however susceptible to damage as soon as it harvested. Some factors responsible for this include the prevailing high temperatures in Nigeria and the facilities for processing, storing and distributing the fish caught that are frequently inadequate or non-existent in most cases. There is therefore enormous waste through spoilage of both fresh and dried fish (UNIFEM 1988; FAO 1981; and Rawson 1996). Preservation of fish therefore generally slows down spoilage. Preservation methods are applied with an intention to making the fish safer and extend its shelf-life (Ghazala, 1994).

*To whom correspondence should be addressed.

Preservation methods such as canning and freezing are technologies that are hardly used in the artisanal sub-sector, basically due to cost and non-availability of equipment and cold storage system (Eyabi-Eyabi, 1998). The methods commonly used are the traditional techniques such as salting/brining, sun-drying and smoking, which also increase fish availability to the consumers (Zakhia *et al;* 1988, Abolagba *et al;* 1996). Sink (1979) observed that smoke-drying other than lowering the pH of food, the amount of amino-nitrogen lysine and free sulphudryl groups may also be lowered. The heat and dryness associated with hot smoking reduces the water activity of the food (fish) thereby limiting microorganisms, a prerequisite for spoilage (Abolagba and Osifo, 2004).

Acceptability of smoke-dried products however depends on the type of wood used (Tilgner, 1958; Maga, 1987, Regenstein and Regenstein, 1990). Fish is often smoked in some parts (South central) of Nigeria with semi-dried rubber wood due to persistent rainfall and the abundance of the wood type in the region (Abolagba and Osifo; 2004).

Wood selection must be done with care as some wood like resinous types e.g. pine may impart unpleasant flavour and taste to the final product; while others like *Euphobia* species may be poisonous (UNIFEM 1988).

This study was therefore initiated to determine the effect of smoking *Oreochromis niloticus* (Tilapia) with smoke from dried and semi-dried wood *Hevea brasillensis* on the protein and amino acid constituent, shelf-life stability and the efficiency of the energy sources using Altona smoking kiln.

Materials and Methods

Twenty (20) live Tilapia *Oreochromis niloticus* of average weight 200g and about 3 months old were purchased from Yanga market in Benin City, Edo State, Nigeria. They were killed and gutted whole, then washed with clean tap water. The weights were taken before and after smoking.

The energy source *Hevea brasillensis* takes about 4 weeks to be completely dried when cut, although factors like rainfall, relative humidity, wood thickness, may affect drying duration. Two hot smoking exercises were carried out at a distance of 58cm from the fire point. Smoking with dried rubber wood was effected first for 1 hour 45 minutes followed by smoking with the semi-dried rubber wood, which lasted for 1 hour 15 minutes using the Altona Smoking Kiln. Uniform smoking was maintained by turning the fish regularly. After smoking, the fire was extinguished and the samples allowed to cool down sufficiently and then put in sealed polythene bags before analysis.

Five (5) gram each were taken from the left mid-section of the fish for analysis. After 28 days another set of samples were taken from the Tilapia on the opposite side for analysis. The smoked Tilapia were placed in a plastic container covered with mosquito netting during the period of storage.

Extraction of Protein

This was by physiological saline solution. 1g of each fish samples was homogemised with the aid of a blender and acid washed sand into a paste before it was diluted with about 80ml of 0.9% NaCl solution in a 100ml volumetric flask. This solution was stirred for another 3 hours in a magnetic stirrer plate in order to get more protein into the solution. After stirring, the solution was filtered and the filterate was wed to estimate for the amount of protein present in each fish sample according to Lowry (1957).

Hydrolysis of Protein into Amino-Acid

5ml of 1% protease enzyme solution was added to every 100ml of extracted protein solution. The mixture was t hen tested for both protein and amino-acid with buiret and ninhydrin solution at every 1 hour at room temperature until the buiret test proved negative which indicated the completion of hydrolysis of protein to amino-acids.

Estimation of Protein by Lowry Method

The method of protein or amino acid estimation was by Lowry (1957) through the optimal densities of the samples, gotten from the electronic spectrometer. A standard protein and distilled water were used with the following reagents and procedure: Add 0.5ml of 4% Solution of Sodium Potassium tartrate to 50ml of 2g% solution of $NaCO_3$ and shake, then adding 0.5ml of 2g% of $CuSO_45H_2O$ to the mixture and then shaken as well. Folin and Calteus solution is then added. These were initially added to standardize the spectrometer in a particular wavelength of 660nm. Various samples with the reagents added were placed in a special test tube (culvet) and put in its compartment in the electronic spectrometer. The values of the optical densities were then recorded as shown in table 3. The quantification of the proteins was gotten by tracing the various optical densities to that of a standard chart of protein. In order to get the various amino acids, the same technique was used, only that the standard protein (B.S.A. type) was not used. A standard amino acid like methionine being identified with known optical density (570nm) was used in its place to set the spectrometer.

Results and Discussion

The results obtained from the experiments are presented below:

Table 1: Characteristics of wood used and process time for Tilapia Treatments

Parameters	Tilapia Samples					
	A	B	C	D	E	F
No. of pieces (fish)	4	4	4	4	2	2
Processing time (hrs)	1.15	1.15	1.45	1.45	5.60	5.30

Av. Length of wood (dried)	58cm
Av. Length of wood (semi-dried)	59cm
No. of pieces (dried)	25pcs
No. of pieces (semidried)	18 pcs

Coding of the processed fish

The processed fish was coded as follows:

A - Fish (unsalted) processed with semi-dried wood

B - Fish (salted) processed with semi-dried wood

C - Fish (salted) processed with dried wood

D - Fish (unsalted) processed with dried wood

E - Fish (salted) processed with electric oven

F - Fish (unsalted) processed with electric oven.

Table 2: Optical Densities of Samples and their Protein Concentrations.

Sample code	DURATION					
	1 MONTH			2 MONTHS		
	Optical density value	Conc./g/100ml)	Conc. (g/%)	Optical density value	Conc. g/100ml	Conc. g/%
A	1.54	7.90	0.79	0.1	0.25	0.025
B	0.58	2.60	0.26	0.11	0.26	0.026
C	0.33	1.50	0.15	0.24	0.56	0.056
D	1.20	5.40	0.54	0.11	0.26	0.026
E	0.30	1.40	0.14	0.09	0.21	0.021
F	0.60	2.70	0.27	0.16	0.38	0.038

The study showed that tilapia fish smoked with semi-dried rubber wood smoked faster as it took just 1hr 15mins while those smoked with dried rubber wood took extra 30 minutes for adequate smoking, see Table 1. The smoking of cat fish *Clarias gariepinus* with similar wood reported by Abolagba and Osifo (2004) took 2hrs when compared to the ones smoked with dried rubber wood that took 2hrs 55mins. It was also revealed that there were no interactions due to kench salting except for the known fact that salting increases water loss during smoking Abolagba *et al* (1996); Abolagba and Osifo (2004); Dillon *et al* (2002); Igene (1983); and FAO (1981).

A study of the chemical differences protein-wise showed no significant ($P<0.05$) difference between Tilapia fish smoked with semi-dried rubber wood, dried rubber wood and oven dried fish which was the control. Nevertheless there were significant ($P<0.05$) changes as a result of storage period as indicated in Table 2 through the drop in protein concentration values. This confirmed the findings of Abolagba and Osifo (2004) who worked on fatty fish *Clarias gariepinus* that protein decomposes with passing time.

Also there was a reduction in the quantitative analysis of amino acids in fish stored for 1 month which may be due to the denaturing or even spoilage of the protein samples.

Conclusion

This study showed that there was no difference between Tilapia fish smoked with dried and semi-dried rubber wood. There was however, reduction in the protein and amino acid profiles after 1 month of storage indicating that the nutritional level of food particular fish are better consumed fresh. It was also revealed that it took less time for fish smoked with semi-dried rubber wood and costs less in addition than using dried rubber wood.

References

Abolagba, O.J. and Osifo, S.J. (2004). The effect of smoking on the chemical composition and keeping qualities of cat fish *Heterobranchus bidorsalis* using two energy sources. Journal of Agriculture, Forestry and Fisheries (JAFF), Vol. 5, NO. 1: 27-30.

Abolagba, O.J; Okonji, V.A. and Enobakhare D.A. (1996). Salting of fish as a means of reducing damage by *Dermestes maculates* (Coleoptera) Nig. J. of Entomology 13: 81-86.

Cihazala S. (1994). New packaging technology for seafood preservation, shelf-life extension and pathogen control. *In* Fisheries Processing Biotechnological Applications (Ed. Am Marthin). Chapman and Hall, London pp. 83-110.

Clucas I.J. and Sutcliffe P.J. (1981). An introduction to fish Handling and Processing. Tropical Products Institute. London, 86pp.

Eyabi-Eyabi,G.D.(1998) Techniques for Fish Handling, Marketing and Smoking in Cameroon. FAO Fisheries Report 574:98-106.

FAO (1981). The prevention of losses in cured fish. FAO Fish. Tech. Pap; (219) 87p.

Kreuzer, R. and Heen, E. (1962). Fish Nutrition. London Fishing News Book Ltd. 445p.

Maga, J.A. (1987). The flavour chemistry of wood smoke. Food Rev. int. 3:12, 139-183.

Olomu, J.M. (1995). Monogastric Animal Nutrition Jachem Publications, Benin City. Pp. 165-200.

Rawson G .C (1996). A Short Guide to Fish Preservation. Rome U.S Food and Agriculture Organisation. 1996. 42-58.

Regenstein, J.M. and Regenstein C.E. (1990). Smoke itself. *In:* Introduction to fish Technology. Van Nostrand Runhold, N.Y. pp. 127-131.

Saisithi, P. (1994). Traditional fermented fish source production. *In* Fisheries Processing Biotechnological Applications. Marthin A.M. (ed) Chapman and Hall, London p. 201-217.

Sink J.O. (1979). Efforts of smoke processing on muscle food produced characteristics. Food Technol. 33 pp 72-82.

Teutscher, F. (1990): The Present and Potential role of small Inland Species on food supply and income generation in Eastern Southern Africa. *In:* CIFA Tech. Pap. No. 19, Rome, FAO 1992, pp. 18-21.

Tilgner D.J. (1958). Analaysis and use of smoke from various kinds of wood. Fleschirtschaft 10: 751.

UNIFEM (1988). Fish Processing. The United Nations Development Fund for Women (UNIFEM) for Food Cycle Technology Source Book. Project GLO/85/W02. 9/pp.

Waterman (1976). The Production of Dried Fish. FAO Fish. Tech. Paper (160):115-120.