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# EFFECTS OF THREE SMOKING KILNS ON THE SENSORY QUALITY OF SMOKED DRIED TILAPIA FISH (*Oreochromis Niloticus*)

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## ABSTRACT
*The sensory characteristics (colour, texture and taste) of Tilapia (Oreochromis niloticus) smoked with three types of smoking kilns, used by artisanal fishermen in Nigeria were evaluated. Results showed that the best colour, texture and taste were produced from the modified drum kiln, followed by the traditional mud kiln, while the tripod stand production colour, texture and taste that were not acceptable by a panelist. The mean scores were as follows: 7.68, 6.72, and 1.64 for colour; 7.96, 6.48 and 2.88, for texture; 7.28, 6..24 and 1.48 for taste. It is therefore recommended that the modified drum and traditional mud kilns could be used for fish smoking to meet consumers acceptability.*
***KEY WORDS:*** *Sensory Quality, Smoked Tilapia, Kiln*

## INTRODUCTION
Fish are highly perishable foodstuffs that demand immediate processing and preservation soon after being caught. It has been discovered that in the high ambient temperature of the tropics, fish will spoil within 12-20 hours of death depending on the species and method of capture (Clucas and Ward, 1996).

Within four hours a fish is caught, it is characterized by bright colour with transparent mucus, (Tobor, 1984). If unprotected against bacteria and autolytic spoilage, the organoleptic characteristics automatically become less acceptable for human consumption (Orji & Uzoagba 2008).

Spoilage is the result of a whole series of complicated process brought about by bacteria (FAO, 1993). Some bacteria causing fish spoilage might have a generation time of 20 minutes at 30c. Bacteria are present in large numbers on the surface slime, on the gills and in the intestine of living fish. Thus, while fish is alive, it has resistance to bacteria. Preservation is a method used to keep the fish in a fresh state, so that the changes in texture, taste, appearance etc, are minimized (Clucas, 1983). Many methods have been used in preservation of fish, including salting, smoking, sun drying, chilling etc. The apparatus used for smoking fish in the traditional tropical fisheries is often rudimentary. The use of different types of local ovens depends on the location. Most types of kilns can be used for smoking fish, ranging from simple pit ovens to drum types. In the Southern and Northern Nigeria, "Banda" is generally used. The advantage of this simple

oven is the low capital cost. However, many disadvantages have been reported, including inefficient utilization of fuel wood, poor quality of fish production due to lack of control over temperature of the fire and the density of smoke (Clucas, 1983).

Smoking is still used not only to impart desirable flavours but also to accelerate the drying process. Smoked products are usually dark brown in colour, hard and have a strong flavour. The temperature of the smoking varies from place to place depending on the consumers requisite and the type of smoking kiln or oven (Clucas & Sutcliffe, 1981).

This study is aimed at evaluating the effects of three smoking kilns used by artisanal fishermen in Nigeria on the sensory quality of smoked fish.

## MATERIAS AND METHODS

### Pre-smoking preparations

The experiment was carried out at the fish farm of Michael Okpara University of Agriculture Umudike, Abia State, with three smoking kilns-the modified drum kiln, traditional mud kiln and tripod stand. The taste fish was Tilapia fish-*Oreochromis niloticus,* obtained from one of the Tilapia ponds. The fish were eviscerated, washed with clean water to remove blood and immersed in saturated brine solution for 30minutes. The fish were then put in a sieve for moisture to drip away.

### Smoking Process:

Smoking was carried out using the three different smoking kilns. The fire wood used in the three smoking kilns were of the plant-*Dialium guineensis* (Icheku in Ibo). The fish were divided into five batches of four each, laid on a rack and placed over each of the smoking kilns for six hours. After the hot smoking, the fish were removed from the kilns, exposed to the air to cool, packaged in film bags, labeled and immediately evaluated organoleptically for colour, texture and taste.

### Sensory Evaluation:

This was carried out to determine the taste, colour and texture of the smoked fish. A panel of 25 students of Michael Okpara University of Agriculture, Umudike, were used for sensory evaluation of the dried fish samples. The panel was asked to evaluate each fish sample, using a nine point hedonic scale as described by Iwe (2002). The panel rated the samples for colour, texture and taste using respectively their senses of visual appearance, touch and taste.

### Statistical Analysis

Non-parametric analysis (correlation) was performed on the results of the sensory quality characteristics of the three dried samples to determine whether there were significant differences and to what extent these differences exist. Least significant difference (LSD) was used in the mean separation to determine the level of significance.

**RESULT**

The mean sensory evaluation scores for the dried fish are presented in Table 1. The mean sensory evaluation scores of colour were 7.68 for modified drum kiln dried fish, 6.72 for traditional mud kiln dried fish and 1.64 for tripod stand dried fish. The same trend was obtained for texture and taste with means of 7.96, 6.448, 2.88 for texture and 7.28, 6.08 and 1.48, for taste respectively. The correlation analysis showed that the modified drum kiln and the traditional mud kiln are positively correlated ($p<0.01$) and are significantly different from the tripod stand ($p>0.05$).

**DISCUSSION**

This work compares favorably with that of Ayanda (1989) who stated that "in terms of return the traditional smoking techniques compares well with the improved smoking techniques, though each has its advantages and disadvantages in terms of capacity of fish that can be smoked"

The differences in colour, texture and taste of the three fish samples in this work could be as a result of the different designs. The modified drum kiln is covered all round and there was no room for un-uniform fire control.While the traditional mud kiln is open on one side and was affected by the wind, the tripod stand was open all round and there was the effect of the wind on the fire from all the sides. Colour formation in smoked fish involves a reaction of carbonyls in the smoke vapour phase with the amino groups on the fish surface (Foster, *et. al.,* 1991). The interstitial moisture in the tissues acts as adsorbent and causes the uptake of smoke by the fish during the smoking process.

Smoking is one of the traditional fish processing methods aimed at preventing or reducing post harvest losses. Compounds such as carbonyls and acids as well as phenolic fractions contribute significantly in the overall taste of smoked fish (Eyo, 2001). The reaction of the carbonyls in the smoke with the amino acid in the fish give the smoked fish the characteristics golden brown colour, (Eyo 2002). The variation in the intensity of the smoking apparatus causes variations in the colour of the fishes.

Smoking deposition is a rapid process but when fish dries, smoking deposition ceases. The texture impacted on the fish is as a result of the heat generated from the wood which dehydrates the fish (Eyo, 2001). The intense smoke production during smoking from different smoking kilns produced different effects on the colour, texture and taste of smoked Tilapia and these differences could easily be appreciated by the consumer whose assessment inevitable determines the marketability of the smoked fish.

**CONCLUSION AND RECOMMENDATION**

The taste, colour and texture of smoked Tilapia are important factors of consideration in the marketability of the smoked product since consumers preference of choice depends on them. From the result of this work, fish processors especially those in Umudike, Abia State as well as all those around the tropical rain forest can effectively increase acceptability of their smoked fish by using the modified drum kiln and traditional mud kiln.

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**Table 1:** The Mean Sensory Characteristics Values of Tilapia by Different Smoking Kilns

| Samples | Mean Sensory Sccores | | |
|---|---|---|---|
| | Colour | Texture | Taste |
| MDK | 7.68±0.26a | 7.96±0.20a | 7.28±0.29a |
| TMK | 6.72±0.29a | 6.48±0.25a | 6.08±0.24a |
| TS | 1.64±0.14b | 2.88±0.27b | 1.48±0.13b |

MDK=Modified drum Kiln.

TMK=Traditional drum Kiln.

TS=Tripod stand.