COMPARATIVE STUDIES OF THE EFFICIENCY OF SOME ECONOMICALLY FEASIBLE FISH PROCESSORS IN THE NORTH – EAST ZONE OF NIGERIA

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ABSTRACT

Post harvest lost recorded by fisher folks has been demise to the profitability of both capture and culture fisheries which needs an urgent scientific and technological interventions. The processing efficiency of Improved FUTY Smoking Kiln (IFSK) and Solar Tent Drier (STD) were studied using Clarias gariepinus and Oreochromis niloticus as fish specimens. The fish samples were weighed, brined in 5% saline solution for 5 minutes, degutted and washed to remove slime from Catfish and Scales from Tilapia. 1kg each of the fish samples were placed in the fish processors outside the laboratory at the same time. The fish in the processors were observed at 3hrs interval for constant weight and dryness. The experiment was set in triplicates for standard error of means. Fresh and Processed fish samples were analysed for Proximate Compositions. The results of the experiment showed that there was significant difference ($p<0.05$) in the moisture loss rate within the fish and between the processors. Oreochromis niloticus obtained a constant weight at a lower time compared to catfish while processing of fish was faster in IFSK than STD. The proximate composition was generally better in fish processed with STD than IFSK safe the Ash content. The cost analysis

was cheaper in processing 1kg of any of the fish species using STD than IFSK and the products physical appearance were appealing as well. Based on these findings and the foregoing, utilization of STD is recommended for processing any tropical fish species for better products, nutrient value, consumer's preference and cost effectiveness.

***Keywords*:** Solar, Coal, Processing, Proximate, Catfish, Tilapia.

INTRODUCTION

Solar energy is a blessing in the North-Eastern zone of Nigeria that Adamawa state was tagged Sunshine state. Solar thermal technology is a technology that is rapidly gaining acceptance as an energy saving measure in both domestic and commercial application (Trim and Curran, 1983). It is fast becoming an alternative source of energy because of the high rate of depletion of conventional energy source. It is preferred to other alternative source of energy such as wind, electricity fuel because of its abundance.

Solar energy has been used for centuries by man for drying animal skin, beef (kilishi), clothes, persevering meat and fish, drying agriculture crop and evaporating sea water in order to extract salt during pelleted fish feed as documented by Olokor (1997).

The traditional practice of simply spreading items in the open place had proved very unsatisfactory because, large loses are generally incurred when this method is used .The losses are attributed to birds, rodents, and domestic animals Another disadvantage of this technology is due to lack of control over the drying rate, which usually result in under – drying or over-drying. Under-drying leads to deterioration of products due to fungi or bacterial while over drying may lead to hardening which will result to spoilage of product.

Solar thermal technology can be used in drying fish and fish products. Fish is an extremely perishable foodstuff. Spoilage occur as a result of the action of enzymes and bacteria present in the fish and also chemical oxidation of the fat which causes rancidity.

Therefore fish preservation techniques being practiced and finally considers the use of solar dryer as an important step toward reducing losses and improving quality of fish during fish drying. This study is aimed at determining the efficiency of two fish processor and preservatives on the shelf life of *C. anguillaris* and *O. niloticus.*

MATERIALS AND METHODS

Freshly caught *C. gariepinus* and *O. niloticus* were collected from Lake Geriyo area in Jimeta Yola, Adamawa state. They were weighed with Electronic sensitive weighing balance (Ohaus, Model 300).

Clarias species commonly known as catfish is commonly found in Nigeria freshwaters. They are scaleless fish, easily breed by man through artificial inbreeding and have the ability to survive out of water for a long period time. This species is highly demanded for in the Fish market either as fresh and preferably when dried.

Tilapia species they are commonly found anywhere in Nigeria, they are scaled fish, multiple very easy in water; they cannot survive out of water for a long time.

Transportation of fish: After collection from the Lake Geriyo the fish was transported in a bucket with water covered with net into the laboratory on September, 2009.

Fish processors: Two fish processor will be used for the experiment and these are:

i. FUTY improved Processor

ii. Solar Tent dryer

Futy improved processor: It was made of light metal steel in form of a rectangular box having four legs as stand. The rectangular box has the dimension of 99cm-45cm, while the legs that suspend the box from the ground. Joseph (200 8) stated that the Futy improved processor is fashioned with a door of a projecting design when pulled outside has three trays made of metallic wires and rods and 10cm apart. At the bottom of the box are perforated holes that allow the inflow of smoke and heat in order to be trapped in the smoking chamber. The box has a cover at the surface with perforated holes occupying 119cm2 (17cmx7cm) at the middle of the cover which is the chimney of the processor. The chimney allows excess heat and smoke out of the smoking chamber.

At the surface of the chimney of metal sheath is suspended on four pipes to prevent inflow rain water into the smoking chamber. Charcoal is ignited and placed at the bottom of the box, producing smoke and heat which will pass through the perforated holes under the box into the smoking chamber and reaching light temperature excess smoke and heat will be seen leaving the chamber through the chimney (Plates 1.0 and 2.0)

Solar tent dryer: Solar dryer employs some means of collecting solar radiation with the result that elevated temperature and in turn, lower relative humidity is achieved for drying. When using solar dryer, drying rate can be increased, lower moisture content can be attained and product quality is higher. .The dryers are less susceptible to variation in weather, although drying is obviously slower, but they provide shelter from the rain .The high internal temperatures also discourage the entry of pest into the dryer.

Solar dryers can be categorized into classes on the basis of the mode of air flow through the dryers i.e natural convection or forced convection dryers that employ force convention require a source of motive power, usually electricity, to drive the fan that provides the air flow.

Design and construction of a solar tent dryer: The principle of operation of a solar tent dryer is that insulation passes through the clean plastic side and ends of the tent and is absorbed on the back metal base (collector) tilted from the ground at an angle depending on the geographical of area being used. Air at the base is thereby heated and raises, this including a draught within the tent. Opening at the based along both sides allow air to be drain in, and tents .in the apex at both end allow air to exhaust. Design of the dryer is simple using wood frame work and transparent polythene Nylon sheet. The drying rack is made using a black wire mesh. Access to the rack is through a movable; Nylon flap forming half of one end of the tent .the flap could be closed and fastened when not in use. The size of the tent is (4-2mm) respectively (see Plate 3.0).

Preparation of fish for processing: Spoilage of fish can occur before, during or after processing/ preservation. The processing started immediately fish was caught onboard and

brought to the laboratory. Clean water was poured on the caught fish to remove slim, bacteria and debris on the surface of fish. Also the following fish preparation methods were employed. Washing of the fish, Weighing of the fish before removal of the guts and scale, Removal of the gill, Degutting, Weighing of the fish after removal of the guts, Washing and Brining with salt solution Processing methods: The fish samples were distributed into various fish processors. The weights were taking every three hours interval until a constant weigh was reached. The weights were recorded along with the timing.

Proximate analysis: Proximate analysis was done in other to determine the nutritive value of each of the processed. These include proximate composition determined were Ash, Crude Protein and Crude lipid and Crude Fibre using Association of Analytical Chemist Methods according to AOAC (2005).

Data analysis: The data collected were be subjected to one way analysis of variance and differences among means were determined with difference multiple range test at 0.5% probability to accept or reject the level (Sokal and Rohlf, 1981). Graphically, the weight of fish during processing and preservation were represented.

RESULTS

The tilapia and Catfish used for the processing in solar tent dryer have an average weight of 0.590kg and 0.394kg respectively before the removal of their gut. The moisture content of the fish processed in solar tent dryer is 71.07 and 73.56% for catfish and Tilapia respectively. Figure 1 shows weight loss of fish processed in solar tent dryer. The Tilapia and Catfish used for the processing in FUTY smoking kiln have an average weight of 0.340kg and 1.070kg respectively before the removal of their gut. The moisture content of the fish processed in FUTY smoking is 73.24 and 83.75% for catfish and Tilapia respectively. Figure 2 shows weight loss of fish processed in FUTY smoking kiln. It took 27hours for the fish to obtained constant weight in Solar Tent dryer and 18hours in FUTY smoking kiln. The drying time values are significantly different ($p<0.05$) within the fish processors

Table 1 shows the proximate analysis of the fish processed both in the solar tent and in the FUTY smoking kiln. Plate 4. Shows the smoking kiln processed *O. niloticus*. There was significant difference ($p<0.05$) between crude protein of the fish processed in different processor.

DISCUSSION

The result of this study shows that the solar tent dryer produce superior product than the FUTY improved processor, the solar tent dryer give a higher over all drying rate than the FUTY improved processor. The advantage of the solar tent dryer is clear. It makes use of a free source of abundant energy to speed up the drying process and protect the fish from micro-organism and insects. The keeping quality of the fish is improved significantly w hen dried in the solar tent dryer. The better quality of fish product improves the economic status of fish processor.

The moisture content of the fish processed in FUTY smoking and Solar tent dryer, 73.24 and 83.75% and 71.07 and 73.56% for catfish and Tilapia respectively agreed with that of

Ojutiku et al. 2009 and Clucas (1982). This showed that the two processors have the capacity of reducing the moisture content of fish. Clucas (1982) reported that a fish well dried or moisture content reduced to 25% will not be affected and if further dried to moisture content of 15%, the growth of mould will cease and increase the shelf-life.

The 17hours timing for fish to attain constant weight recorded in this work is not significantly different to 20hours timing recorded by Ogbonnaya (2009) when he used smoking kiln to processed Tilapia. The increase in crude lipid recorded in fish after preserving for weeks was similar to the observation made by Afolabi et al. (1984), Eyo (2001) and Ogbonnaya (2009). Tao and Linchun (2008) reported that the proximate composition of fish increase with processing especially when the temperature is regulated. The processors used have a means of regulating heat especially the FUTY smoking kiln.

Fish can be processed properly using the solar tend dryer under a specific temperature especially in the North-East where Solar Energy is abundant instead of burning coal which also pollute the environment. The nutrient quality of the fish is not significantly affected by the type of processor used. It implies that the Solar tent dryer remains a better fish processor and this technology is very simple to adopt by all fisherfolks. Finally fisherfolks, marketers, and aquaculturist in the business of fish processing and preservation are hereby encourage to use the solar tent dryer in processing.

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Plate 1. FUTY Smoking Kiln

Plate 2. Fish inside FUTY Smoking Kiln

Plate 3. Fishes inside the Solar Tent Dryer under the sun

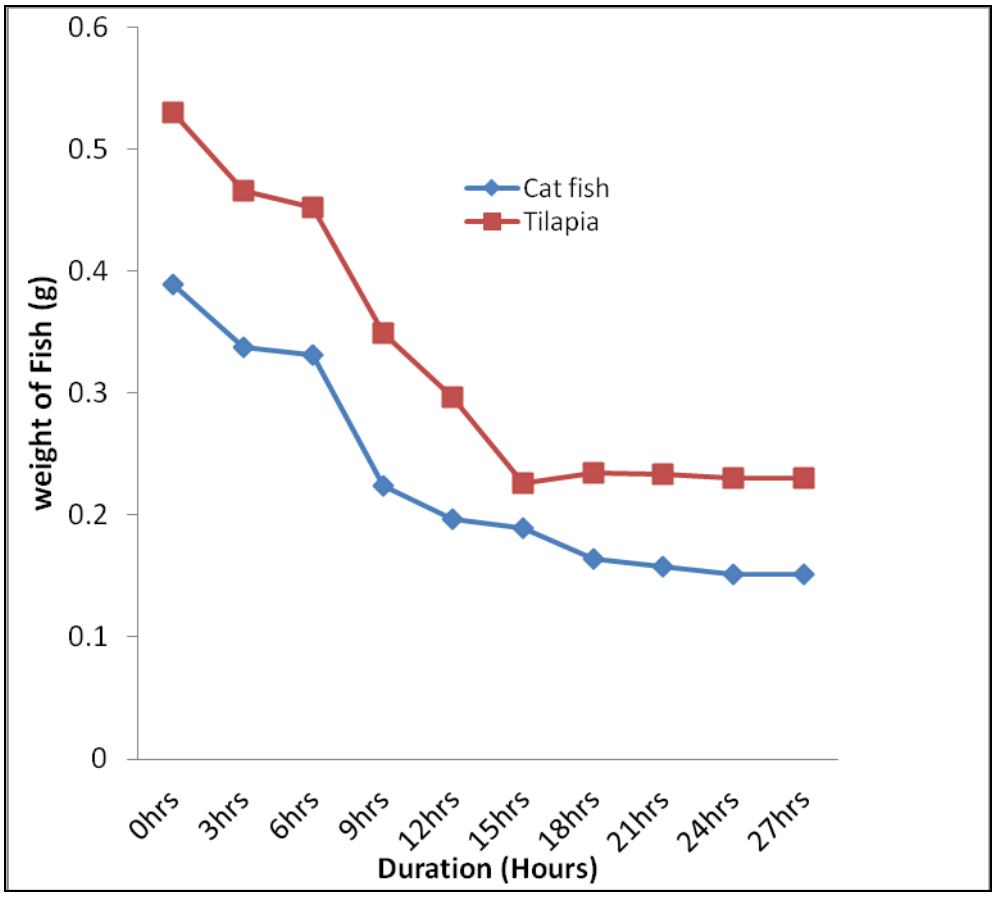

Figure 1. Weight loss in processed fish in solar tent dryer

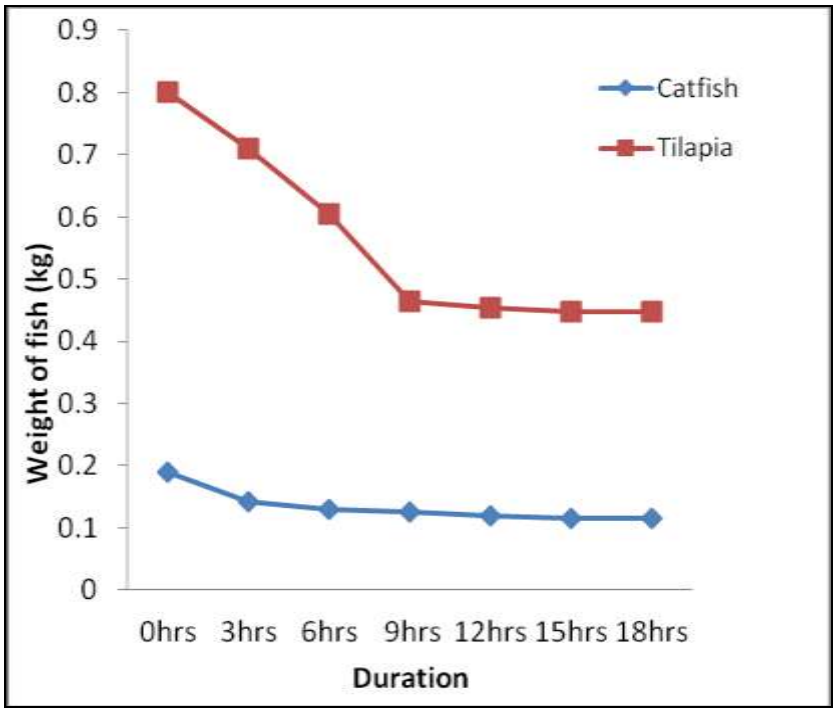

Figure 2. Weight loss in fish processsed with FUTY smoking kiln

Table 1. Proximate composition (% dry matter) of processed fish before preservation

PROXIMATE COMPOSITION (%)	PROCESSED FISH			
	TILAPIA SMOKED FISH	**CATFISH SMOKED FISH**	**TILAPIA SOLAR DRIED FISH**	**CATFISH SOLAR DRIED FISH**
Dry Matter	87.12	89.24	88.34	89.27
Crude Protein	62.78^{a}	54.09^{c}	63.84^{a}	59.08^{b}
Crude Fibre	1.12^{c}	1.62^{a}	1.32^{b}	1.63^{a}
Crude Lipid	20.76^{c}	20.96^{c}	22.34^{b}	24.94^{a}
Ash	14.34^{ab}	13.92^{b}	15.04^{a}	13.99^{b}

Data with different superscripts are significantly different ($p<0.05$)