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Effects of a Prototype Solar Dryer on the Quality of Solar Dried Fish: Reducing Post-Harvest Losses at the Artisanal Fisheries Sector of Ghana

Emmanuel Adokwei Saka. Email: emmanuelsaka@yahoo.co.uk, phone: +233- 302519091, 277673138, fax: 233-302500111,

Lawrence Abbey[a] and Charles Tortoe[a]

[a]Council for Scientific and Industrial Research - Food Research Institute,
P. O. Box M20, Accra, Ghana.

Introduction

Fish is among the rich protein sources preferred by many people. It abounds in a many non – protein nutrients which are exist in limited quantities in other foods, such as; vitamin D, omega-3 long chain polyunsaturated fatty acids (n-3 LC-PUFAs), iodine, calcium, , iron and zinc (McManus and Newton, 2011). Consumption of n-3 LC-PUFAs, fish, seafood or fish oils helps has been proven to improve cognitive abilities and reduces the risk of chronic conditions such as diabetes, rheumatoid arthritis, coronary heart disease, some cancers, dementia and Alzheimer 's disease (McManus and Newton, 2011). Trade in fish provides revenue and employment for a lot of people globally (Delgado et. al., 2003). In 2010 the worlds' consumption of fish was US$ 17.5 billion, and an estimated 4.3 billion people depend on fish globally (FAO, 2012). Fish produced by aquaculture now exceed catch fish (FAO, 2012). Fresh fish contains a lot of water making it highly perishable and leading to post harvest losses in some instances. Ghana's fisheries is largely artisanal (Ministry of Fisheries, 2008). Fish trade contribute 4.5 % of local GDP; accounting for US$ 186 million (Ministry of Fisheries Ghana, 2008). The major operators are artisanal fishers and processors including women processors, marketers and ancillary workers

(Ministry of Fisheries Ghana, 2008). Locally fish is processed by smoke drying, open sun drying. Smoke drying increases production cost and increases greenhouse emissions. Anchovies, which are small fish species are among the fishes which are either open air or smoke dried since their texture is destroyed with prolonged cold or freeze storage (Abbey, 1998). The open sun drying on the other hand is unhygienic, reduces the value of fish and leads to losses. Preliminary sensory evaluation studies on anchovies carried out in University of Ghana Legon Accra, showed that consumers still preferred native quality of anchovy. Innovation gap exists for dryers that are insect tight and improve quality at the same time reducing processing time. This study was aimed at testing the effect of a prototype solar dryer on some quality indices of a selected marine fish, i.e. anchovy (*Engraulis encrasicolus*).

Material and Methods

Sample and sample preparation:

Fresh anchovies (*Engraulis encrasicolus*), obtained from the James Town Accra Ghana Landing beach. The fish samples were washed in sea water and transported on ice to the laboratory. They were then transferred into a perforated cold chest containing flaked ice (ratio of flaked ice to fish being 1:1) for use the next day.

Solar drying:

Drying was done in a rectangular shaped, insect tight container with dimensions; 1.04m X 0.69m Perspex glass cover, 0.64m X 1.03m metal base, 0.64m X 1.03m X 0.35m insect protection frames. Batch drying was done at temperature of 36.67 ºC ± 3.14 ºC for 24 hours and 42.65 ºC ± 2.99 ºC for 12 hours, with a portable digital thermometer. Fish samples arranged thin layers on a grid tray were dried for a total of 36 hours.

Physical analysis on solar dried fish:

Water activity (a_W) measurement: The water activity of the dried fish was measured using the HygroLab Ro-tronic meter at 28ºC for duplicate samples. The equipment was calibrated using saturated salt solution before readings were taken.

Colour measurement: The surface colour of the dried fish samples was measured as reflected colour in the CIELAB (L a b) colour space with a Hunter Lab Minolta Chroma meter (CR-310, Minolta, Japan). The colour coordinates L (darkness/ whiteness), a (greenness/ redness) and b(blueness/ yellowness) were recorded by means of duplicate determinations. The instrument was calibrated with a calibration plate L (97.57) a (+ 0.29) and b (+1.88) before measurements.

Statistical analysis:

The results were analysed using simple means and standard deviation values via the Minitab statistical software.

Results and Discussion

PHYSICAL ANALYSIS ON SOLAR DRIED ANCHOVIES

ATTRIBUTE	MEAN	SD.
Water activity (a_W)	0.6233	0.01
CIELAB Space		
L*	52.767	1.180
a*	0.87	0.13
b*	3.23	0.599

Colour (L a b):

The colour values obtained by the L* a* b* scale were 52.767 ± 1.180, 0.87 ± 0.13 and 3.23 ± 0.599 respectively. These values were evidence of browning reaction due to the presence of heat and oxygen.

Water activity (a_W):

The water activity (a_W) obtained was 0.6233 ± 0.01 which was very good for shelf life purpose but not the best in terms of fish texture.

Conclusions and Outlook

The study proved that drying fish (anchovy) using the prototype solar dryer can reduce drying time and the water activity significantly. The study also revealed that the drying regime inside the prototype dryer reduces the surface whiteness of the fish as browning increases.

Further studies must be carried out to look at other quality characteristics such as the rancidity, sensory, microbiological and shelf life which would provide extended information on the performance of the dryer on fish. Other fish types can also be tested using the dryer and models develop for future purposes.

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