

## Reference

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(2016) 1-14.

## Drying characteristics of nandan (*Chanda nama*) fish in portable household electrical dryer

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Fresh fish is a highly perishable food product since it contains up to 80% of water. It has a very short span of shelf life (Bala and Mondol, 2001). Fish spoilage occurs as a result of the action of enzymes and microorganisms present in fish and also chemical oxidation of fat which causes rancidity. Fish become putrid within a few hours of capture unless it is preserved or processed in some way to reduce this microbial and autolytic activity. Salting and drying are traditional preservation technique and salted dried fish products are popular in many areas.

Drying preserves fish by inactivating enzymes and removing the moisture necessary for bacterial and mould growth (Duan et al., 2004). Traditionally, drying of fish is carried out under open sun with the natural flow of air. Open air sun drying is a low cost processing technique to preserve fish. However it has some limitations like no control over drying process and parameter, weather uncertainties, high labour costs, requirement of large drying area, insect infestation, mixing with dust and other foreign materials and so on. To overcome those limitations, it is necessary to dry fish in simple closed chamber made up of low cost materials. A low cost, multipurpose, portable electrical dryer for fish and other agricultural commodities is designed and developed at Engineering division, ICAR-Central Institute of Fisheries Technology, Cochin. It can be used in

small scale fish processing units, laboratories and household environments for in-house drying of fishes throughout the year. In this study nandan (Elongate glassy perchlet, *Chanda nama*) fish was dried in portable household electrical dryer in order to evaluate the performance of dryer and drying characteristics of fish during drying.

Portable household electrical dryer (Fig. 1) comprises of a base frame, fan housing, two heating coils of 1.5 kW each, drying chamber with ten stainless steel trays and an exit for exhaust air. Base frame of dryer is fabricated using angle iron bar with dimensions (865×498×770 mm).

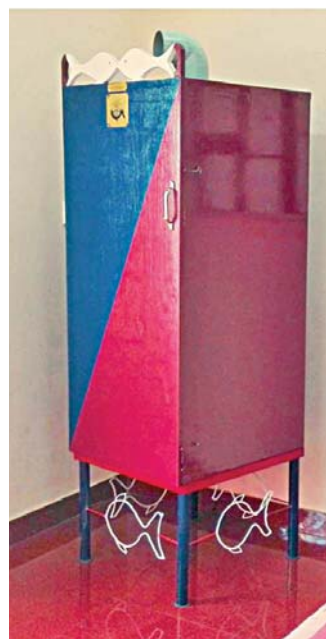


Fig. 1 Portable household electrical dryer

The frame is welded to shape and provides support for other components of the dryer. The rectangular shaped drying chamber is made up of marine plywood which can withstand humid and wet conditions. The dimensions of the drying chamber were 560×610×1650 mm. Inside of the chamber is coated with Aluminium foil for insulation. Air inlet to the chamber is located at the bottom end and the moisture laden air escapes through the exhaust at the top end. The ambient air is forced into the dryer by a fan located at the bottom which in turn gets heated by two electrical coils of 1500 W each arranged parallel to each other for heating the incoming air. Then, the resulting hot air passes through the drying chamber across the material to be dried. The chamber consists of ten trays which are made up of Aluminium frames and Stainless Steel mesh. The trays are stacked one over the other at a spacing of 10 mm. Dimensions of each tray is 560×500×250 mm accounting for a total tray area of 2.8 m<sup>2</sup>. Also the chamber has provisions for a hinged door which permits easy access for loading and unloading of fishes. Capacity of dryer is 10 kg of fish per batch. The drying time required is around 6-7 hours for fishes and the maximum temperature attainable in the drying chamber is 50°C.

Nandan (*Chanda nama*) fish for this drying study was purchased from the fishing harbour kalamukku, Cochin. Fish was cleaned using water and salted in the ratio of 1:8 (Salt: Fish) for 24 h. Next day excess salt was rinsed and then fish was placed in household electrical dryer for drying. Moisture content of fish was determined by using the following formula (AOAC, 1990):

$$\text{Moisture content } (M_{wb}), \% = \frac{\text{Weight of water removed (g)}}{\text{Weight of sample taken (g)}} \times 100 \dots\dots(1)$$

$$\text{Moisture content } (M_{db}), \% = \frac{\text{Weight of water removed (g)}}{\text{Weight of dry matter in sample (g)}} \times 100 \dots\dots(2)$$

Drying rate of fish sample during drying period was determined as follows:

$$k = \frac{W_w}{T} \dots\dots(3)$$

where, k - drying rate, kg/h; W<sub>w</sub> - quantity of moisture evaporated, kg; T - time taken (for drying) to remove water W<sub>w</sub> g of moisture, h

The moisture ratio of fish was calculated as

$$MR = \frac{M}{M_o} \dots\dots(4)$$

where, MR - moisture ratio, dimensionless value; M - moisture content at any time t (%db); M<sub>o</sub> - initial moisture content (%db)

Five kilograms of nandan (*Chanda nama*) fish was placed inside the dryer. Initial moisture content of fish was found to be 67.71±1.68 (% wb) and the time required for complete drying of nandan (*Chanda nama*) fish was observed as 6 hours. Drying behaviour of nandan (*Chanda nama*) fish in portable household electrical dryer has been studied and the variation of moisture content and drying rate with respect to time at specified drying temperature of 50±2°C was also observed (Fig. 2 and 3).

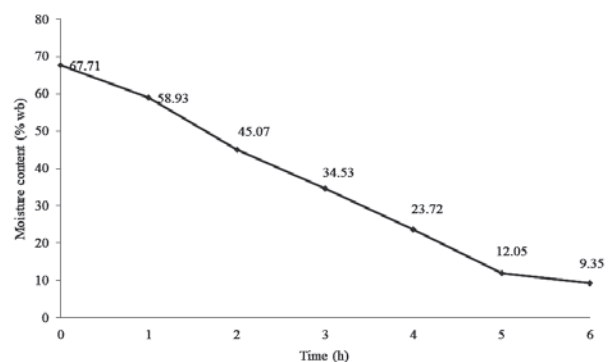


Fig. 2 Changes in moisture content of nandan (*Chanda nama*) fish during drying

Moisture content of fish samples decreased as drying time progresses. Moisture content of fish was reduced from 67.71 (% wb) to 9.35 (% wb) in 6 hours of drying (Fig. 2). This moisture reduction with increased drying time might be due to the reduction of water content of fish. Drying rate of fish was observed to be 1.305 kg/h during the first hour of drying and then drying rate

was gradually decreased as drying proceeded (Fig.3). Generally drying rate reduces with increased drying time. As the drying process

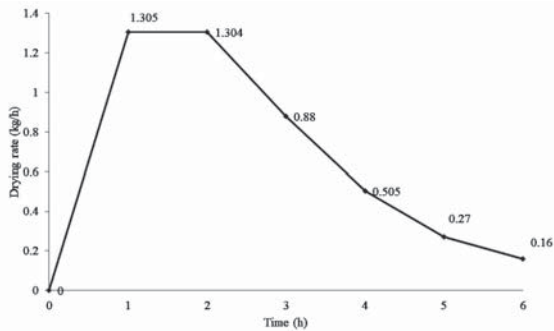


Fig. 3 Drying rate curve of nandan fish during drying in portable electrical dryer

continues, less free water is available on fish surface and then drying rate could be dominated by the moisture diffusion from inside to the surface of fishes. Therefore, drying rate starts

to decrease as drying time increase. The entire drying process occurred under falling rate drying period (Fig. 3).

This study showed that nandan (*Chanda nama*) fish drying using portable household electrical dryer is a suitable method for quality dry fish production within 6 hours.

### References

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## CIFTFISHPRO - A mobile APP for android systems on CIFT Value Added Fish Products

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ICAR-CIFT has developed an interactive mobile application on CIFT Value Added Fish Products (CIFTFISHPRO). CIFTFISHPRO is a web based mobile APP for android systems. This system contains information about series of value added fish products including description about the product, active ingredients of the product and method of preparation. The series of fish products includes coated fish products like fish cutlets, fish fingers, fish burger, fish balls etc.; marinated products like fish and prawn pickles; extruded products like fish kure and noodles; wrapped fish products like fish momos, fish kebabs, fish samosa and fish rolls; cured products

