

USE OF SOLAR ENERGY IN THE ELABORATION OF SALTED-DRIED FISH

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ABSTRACT

A new method to produce salted-dried fish is being developed in the South Atlantic Ocean coast of Uruguay, using hake (*Merluccius hubbsi*) as raw material. The first process consists in salting the suitably prepared fish with salt and brine. The fish's humidity decreases in this process from 80 % to a level of 60 % in two to three days. The second process consists in drying the salted product in a solar dryer, comprising a solar collector, product's cabin and fan exhaust. This process can be done in 7 days, depending in climate contingencies, reaching a final humidity of 40%.

KEYWORDS

salted-dried fish; solar drying; Uruguay

INTRODUCTION

A promising industry of salted-dried fish known as "Bacalao Nacional" is being developed in the South Atlantic Ocean coast of Uruguay (González, et al 1994). The species used are mainly

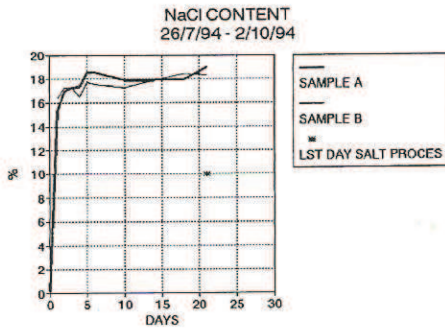


Fig. 1

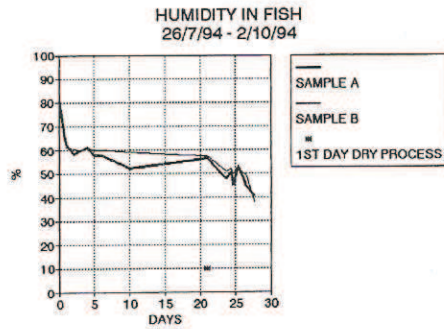


Fig. 2

livercil shark (*Galeorhinus viminicus*), sand shark (*Carcharias spp*), angel shark (*Squatina punctata*), smooth hound (*Mustelus schmitti*) and hake (*Merluccius hubbsi*). The annual production of this artisanal sector is around 100 tons that are sold in the internal market and for export, to satisfy the Holy Week demand. A new method of elaboration is proposed to advance the beginning of the harvest to october (early southern hemisphere spring), to increase the industrial efficiency and the quality of the product. The advantage of the new method lies in the fact that the drying takes place inside a close cabinet instead than being directly exposed to the sun. It provides protection against the attack of insects that cause considerable damage, and also to dust or sand storms (Martin *et al*, 1990; Borgstrom, 1965)

EQUIPMENT AND METHODS

Raw material

Samples of hake muscles from six well washed fishes were extracted to form a mean sample. Over this mean sample the following tests were made: 1) humidity, 2) proteins, 3) lipids, 4) ashes, 5) total basic volatit nitrogen (TBVN), 6) rancid index (TBA), 7) salt contents (NaCl). These analyses gives data of initial chemical composition and freshness.

Heading and splitting

The fish is washed, headed, split and gutted in manual form. Viscera, blood and other residues are carefully washed away.

Salting process

The salting process was made in humid stack. The split product was put in two covered basins with different concentrations of salt and antioxidants. The pieces were piled in stacks one over the other intercalated with salt. The stacks were covered with brine. Ascorbic acid was used as antioxidant dissolved in the brine. Stack A contained 2 gr/kg of ascorbic acid and stack B contained 5 gr/kg (Moschiar, 1980; Curran, 1985; Souness, 1988). To control the whole process a salting curve was made with determinations of humidity and salt content. Once the saturation in salt content was reached in the muscle, the fish is ready for the drying process.

Samples of the two types of salted products were analysed to evaluate the degree of freshness. The following tests were made: 1) humidity, 2) proteins, 3) lipids, 4) ashes, 5) total basic volatit nitrogen (TBVN), 6) rancid index (TBA), 7) salt contents (NaCl).

Drying process

A solar drier (González *et al*, 1989; Salleh, 1983), was used. It consists of solar collector, product's cabinet, and fan exhaust. The fish temperature during this process should be held below the 30° C mark. This temperature is a frontier between drying and cooking and must not be surpassed. If the air is too hot, the skin forms a hard case due to the proteins denaturalization, and water cannot escape from the core of the fish (Sikorski, 1990). The process was controlled by a curve of daily determinations of humidity of the product. Once the process was ended by determined

humidity tests, new freshness and chemical composition analyses were made. The following tests were done: 1) humidity,

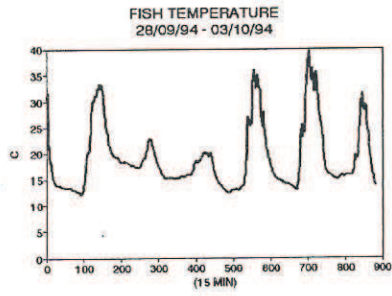


Fig. 3

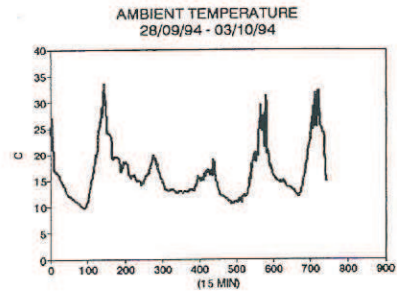


Fig. 4

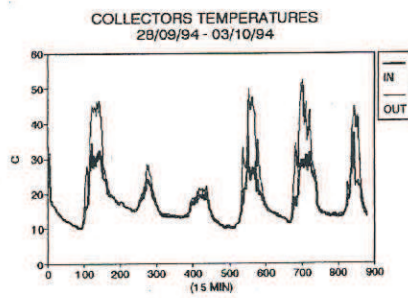


Fig. 5

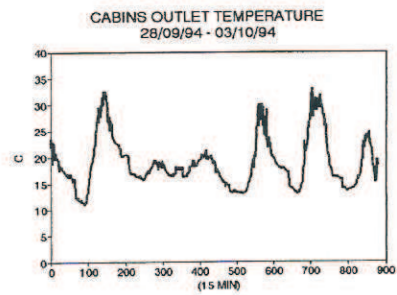


Fig. 6

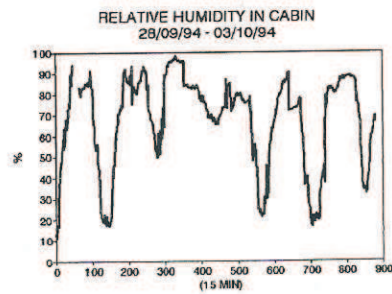


Fig. 7

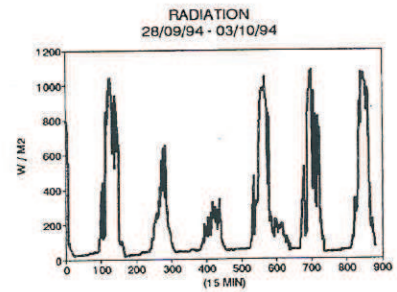


Fig. 8

2) proteins, 3) lipids, 4) ashes, 5) TBVN, 6) rancid index (TBA), 7) salt contents (NaCl), 8) Water Activity

Storage process

The salted-dried product was stored in stacks. Periodic determinations of 1) humidity, 2) total basic volatile nitrogen (TBVN), 3) rancid index (TBA) and 4) microbiological analysis were made.

RESULTS AND DISCUSSION

The results determinations obtained from monitoring the different process are drawn in the figures.

CONCLUSIONS

The studies carried out for the salting process were thoroughly made and the process is generally accepted.

In Uruguay the solar drying process has proven to be feasible only if made in spring or autumn, and has fulfilled our objective to increase the harvest period. The ambient temperature seldom gets over 30°C and the fan exhaust may be used as a safety element to prevent exceeding this temperature in the fish.

The summer fish drying, on the contrary, has to be done outside our drier as the temperatures may exceed the 30° C mark in the fish, easily.

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