STUDIES ON THE PROCESSING AND STORAGE OF DRIED SPLIT-SALTED *BISUGO (NEMIPTERUS* SPP.)

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ABSTRACT

The standard method of preparing dried split-salted 'bisugo' *(Nemipterus* spp.) may be considered as the representative method for all dried split-salted fishery products, 'daeng'.

The scaled, split and eviscerated fish were cured in concentrated brine for not less than 12 hours, soaked in fresh water for 0 to 120 minutes and then dried in the sun for 16 hours. The sodium chloride content ranges from 27.41 to 17.44 per cent.

For keeping qualities moisture-proof cellophane bags were found effective. Treating the dried fish with one percent solution of antimold Sorbistat K, the storage quality is greatly improved.

INTRODUCTION

The manufacture of dried salted fishery products is an old and flourishing industry in the Philippines but for lack of standard methods of preparation, the appearance, presentation, taste and storage qualities of the products have yet to be improved.

In the belief that heavy salting would prolong the keeping quality of salted fishery products, the present tendency is to oversalt them with the result that they are too salty and susceptible to the attack of molds due to the hygroscopic nature of solar salt impurities, especially magnesium chloride (Hamm, 1949 and Lafont, 1952.)

The salt compound of sorbic acid, Sorbistat K, (CH_3 CH=CHCH=CHCOOK)* which is commonly used as an anti-mold agent was used in this study.

The study on the processing and storage of dried split-salted 'bisugo' (*Nemipterus* spp.) was conducted to standardize the method of its manufacture so that standard quality products may be prepared for both local and export trades.

EXPERIMENTAL METHODS

To determine the effects of refined and solar salt in the manufacture of dried split-salted fishery product, two kinds of concentrated brines were prepared and the scaled, split and eviscerated fish were soaked in them for not less than 12 hours.

Soaking in fresh water. The cured, brinesalted fish were soaked in equal amounts of fresh water according to the following intervals of time:

1. 0 minutes
2. 30 ,,
3. 60 ,,
4. 90 ,,
5. 120 ,,

The fish were the dried in the sun for 16 hours and set aside for observation and keeping qualities.

Chemical analysis. As soon as dried, the experimental products were chemically analyzed for moisture, sodium chloride, and fat contents.

Storage studies. To determine the anti-molding quality of Sorbistat K on the dried fishery product, experiments were undertaken and the fish were treated & stored as follows:

* Sorbistat K is a product of the Pfizer International, Inc. New York, N.Y., U.S.A.

SOLAR SALT

A. Control (not treated with Sorbistat K) B. Treated with Sorbistat K

I. Washed but not soaked in fresh water:
   a. Exposed - - - - - (a) Exposed
   b. Sealed - - - - - (b) Sealed

II. Soaked for 30 minutes in fresh water:
   c. Exposed - - - - - (c) Exposed
   d. Sealed - - - - - (d) Sealed

III. Soaked for 60 minutes in fresh water:
   e. Exposed - - - - - (e) Exposed
   f. Sealed - - - - - (f) Sealed

IV. Soaked for 90 minutes in fresh water:
   g. Exposed - - - - - (g) Exposed
   h. Sealed - - - - - (h) Sealed

V. Soaked for 120 minutes in fresh water:
   i. Exposed - - - - - (i) Exposed
   j. Sealed - - - - - (j) Sealed

Experiments on the storage of dried salted fishery products using refined salt with and without Sorbistat K were conducted in the same manner as with solar salt.

RESULTS AND DISCUSSION

Drying. To avoid abrupt drying, the salted fish were turned over every two hours so that drying may be accomplished evenly.

Fatty fish when dried abruptly in the hot sun formed a paint-like coating in the surface that prevents inner drying (Empey, 1953).

The fish were dried completely in the hot sun for 16 hours (Fig. 1).

Color. Immediately after drying, the color of the product is golden brown and the shade becomes lighter according to the length of soaking in fresh water, that is, the longer the cured fish were soaked in fresh water, the lighter is the color of the dried product.

Tanikawa (1951), Sulit *et al* (1957), Dyer (1949) and Luypen *et al* (1953) claimed that, upon storage, the color of dried salted fishery product becomes darker in the shade especially in tropical countries when the hot summer months hasten darkening of the color. He added that in many cases when the moisture content is high, unpleasant odor is developed and the rate of spoilage increases as the temperature rises. Dried fish packed in cans and stored at 25°C remained in good condition from 6-9 months.

In this study, it was very significant that the original color of the salted fish is retained effectively when packed in hermetically sealed containers. The product which had been stored for more than four months still retained the original golden brown color, but those exposed in the atmosphere without packing in hermetically sealed containers, developed darkening in color.

Hygroscopic action of salt. Upon storage, the dried salted fish that were soaked from 0-30 minutes in fresh water accumulated moisture on the surface, and those that were soaked from 90-120 minutes remained thoroughly dry. It is claimed that during the soaking period of the cured fish in fresh water, salt impurities were eliminated together with the sodium chloride, as also magnesium chloride which is more soluble than sodium chloride.

It is quite advantageous to wash the cured fish with fresh water because only part of the pure sodium chloride remained in the dried salted fish and the impurities are completely removed therefrom. In this connection, the use of solar salt with high impurities would not affect materially the quality of the finished product.

Salt content. Chemical analysis of the salted dried fishery product is shown in Table 3. It is very significant that those that were not soaked in fresh water contain high amount of sodium chloride, 27.41. per cent, and the percentages of salt are lessened according to the length of time of soaking in fresh water. The amount of salt went down as low as 17.44 per cent in those cured fish soaked for as long as 120 minutes.

Action of Sorbistat K. Sorbistat K, an anhydrous water soluble potassium salt of sorbic acid ($CH_3CH = CHCH = CHCOOK$) has been known to prolong the shelf-life of various salted and smoked fishery products.

In this study, those that were treated with 0.5 to 1 per cent Sorbistat solution did not develop mold even after four months storage. Even those that were kept exposed without putting in hermetically sealed containers are not yet moldy up to the present time. The

control without Sorbistat began to get moldy within one month's time of storage, and those that were sealed in hermetically sealed containers developed molding at the beginning of the third month of storage. It is very significant that those with higher percentage of salt (Table 3) are the ones that developed early molding.

SUMMARY AND CONCLUSION

With the aim of standardizing the method of preparing dried split-salted fishery product, a standard species of fish (Nemipterus spp.) was used in the experiment.

The dressed fish were soaked in two kinds of concentrated brine solutions prepared from the crude solar and refined salts, and cured for not less than twelve hours. After brining, the cured fish were soaked in fresh water at various intervals of time to remove partially the salt and then dried in the sun for at least sixteen hours (Table 2).

The dried salted fish were packed accordingly and set aside for studies on the storage qualities.

The cured fish soaked in fresh water from 90-120 minutes are considered ideal from the standpoint of physical appearance, taste and storage qualities, and the amount of salt ranges from 18.86 to 17.44 per cent.

Sorbistat K, a potassium salt of sorbic acid ($CH_3CH = CHCH = CHCOOK$) at a concentration of 0.5 to 1 per cent was found to be very effective as anti-mold in the salted fishery product; those stored in hermetically sealed containers for a period of more than four months did not develop any mold at all.

At present, Sorbistat K is being experimented with whole dried salted fishery products and the results obtained are similar with dried split-salted *bisugo (daeng)*.

Those that were soaked in fresh water from 90-120 minutes have ideal appearance and salty taste and keep much longer than those with higher percentage of salt.

The average yield of dried split-salted bisugo is 50.95 per cent when cured with pure salt and 47.54 per cent with solar salt (Table 2).

In the light of the aforementioned results and findings, it is quite safe to recommend to cure the fish in concentrated brine of either pure or solar salt, and dry in the sun for not less than sixteen (16) hours.

The soaking time to remove partial amount of salt in cured fish is 90 to 120 minutes which results in the production of standard salted fishery products containing 18.86 to 17.44 per cent salt.

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Table I. Percentage yield in drying of cured split salted *bisugo* (Nemipterus spp.)

Weight of whole fish (3 pieces)	Weight of dried fish		Length of soaking in fresh water	Weight of cured fish after soaking in fresh water		Yield	
grams	grams	Per cent	Minutes	grams	Per cent	grams	Per cent
Treated with pure salt:							
1. 503.0	430.5	85.59	0	390.4	77.61	272.5	54.17
2. 453.0	396.8	87.59	30	365.6	80.71	230.5	50.88
3. 367.2	307.4	83.71	60	304.2	82.84	175.5	47.80
4. 519.3	472.9	91.06	90	446.9	86.06	272.9	52.55
5. 363.3	325.4	89.57	120	321.8	88.58	179.3	49.35
Treated with solar salt:							
1. 364.5	318.2	87.30	0	275.5	75.58	182.2	49.99
2. 330.5	311.9	94.37	30	279.3	84.51	166.5	50.38
3. 413.1	364.9	88.33	60	335.8	81.29	196.8	47.64
4. 310.4	269.1	86.69	90	264.6	85.24	148.6	47.87
5. 328.9	279.3	86.23	120	273.5	84.44	135.4	41.80

Table 2. Periodical weight of cured split salted *bisugo* (Nemipterus spp) while in the process of drying.

Weight of fish in whole	Length of soaking in fresh water	Weight of cured fish while in the process of drying							
		7.30 A.M. — 11.30		12.00 — 4.00		7.30 A.M. — 11.30		12.00 — 4.00	
grams	Minutes	grams	Per cent	grams	Per cent	grams	Per cent	grams	Per cent
Treated with pure salt:									
1. 503.0	0	394.80	78.49	312.51	62.13	278.11	55.29	272.5	54.17
2. 453.0	30	349.26	77.10	280.31	61.88	245.80	54.26	230.5	50.88
3. 367.2	60	282.89	77.04	220.39	60.02	195.20	53.16	175.5	47.79
4. 519.3	90	401.05	77.23	331.78	63.89	284.52	54.79	272.9	52.55
5. 363.3	120	284.10	78.20	221.57	60.99	192.62	53.02	179.3	49.35
Average			77.61		61.78		54.10		50.95
Treated with solar salt:									
1. 364.5	0	288.89	79.12	219.75	60.29	197.89	54.29	182.2	49.99
2. 330.5	30	260.03	78.68	198.03	59.92	178.21	53.92	166.5	50.38
3. 413.1	60	320.06	77.48	259.55	62.83	225.68	54.63	196.8	47.64
4. 310.4	90	239.50	77.16	189.09	60.92	167.24	53.88	148.6	47.89
5. 323.9	120	249.27	76.96	197.77	61.06	175.42	54.16	135.4	41.80
Average - - - -			77.88		61.00		54.18		47.54

Table 3. Chemical analysis of dried split-salted *bisugo* (Nemipterus spp.) soaked at various intervals in fresh water.

Time of soaking in fresh water	Moisture	Fat	Sodium chloride
Minutes	Per cent	Per cent	Per cent
0	36.99	1.09	27.41
30	40.24	1.12	22.19
60	36.78	1.14	20.59
90	38.53	1.67	18.86
120	38.18	0.65	17.44

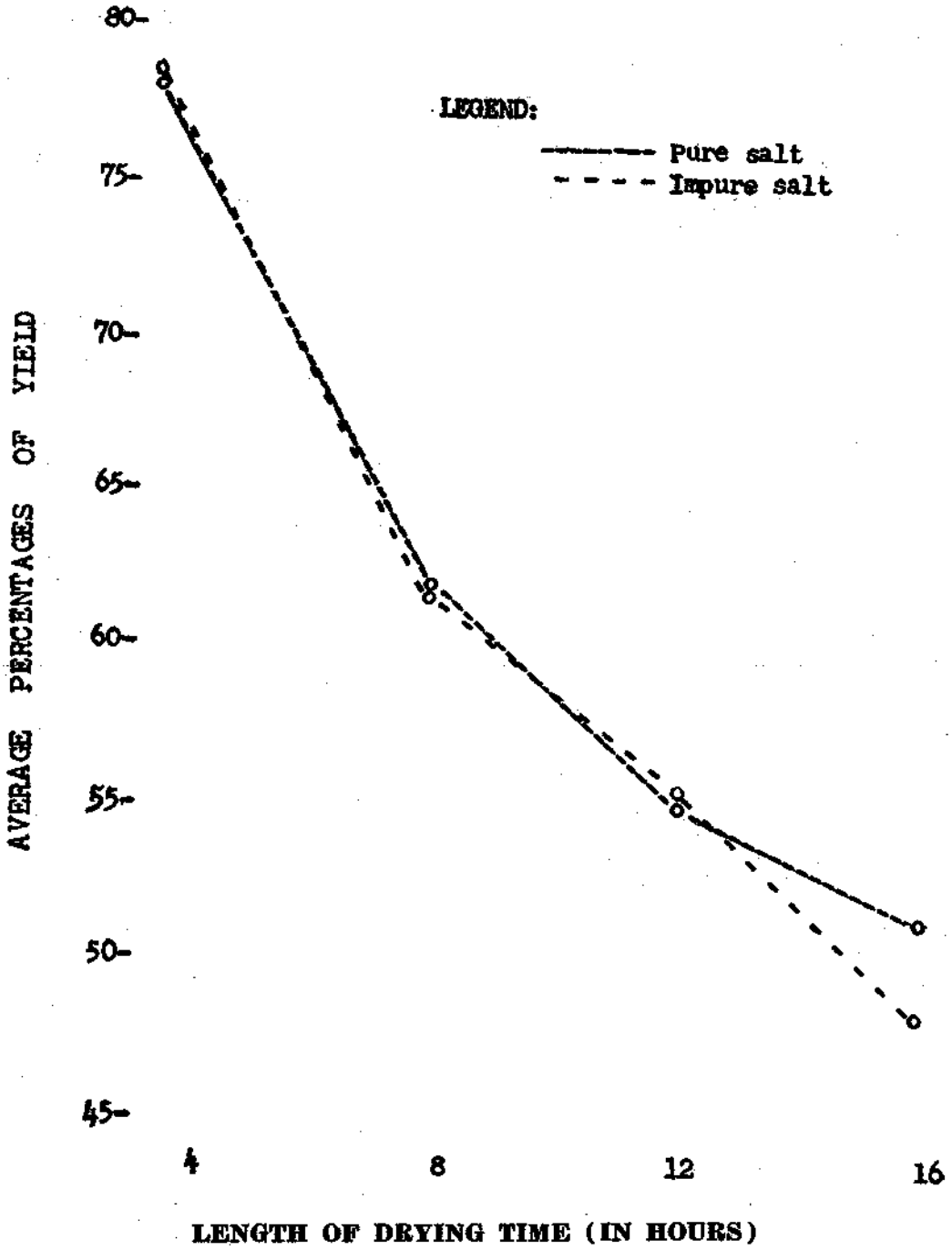

Fig. 1 Comparative weights in per cent of cured fish during the process of drying using pure and impure salts.

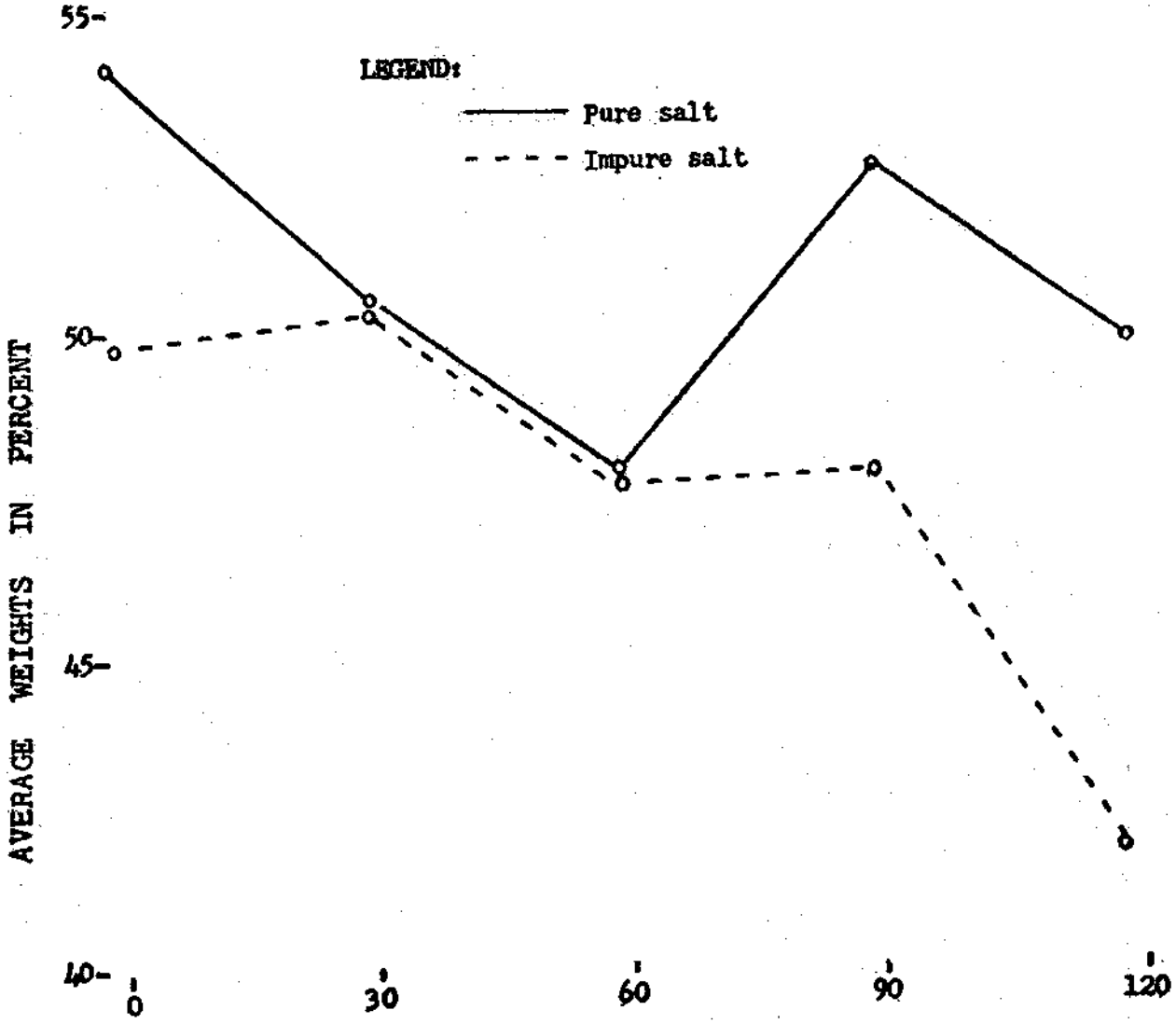

Fig. 2 Comparative average yields in per cent of dried split-salted bisugo (*Nemipterus* sp). using pure and impure salts.