

NOTE II

STUDIES ON SMOKE CURING OF TROPICAL FISHES

In spite of the tremendous progress made by our freezing and canning industries, curing still continues to be a very important method of fish preservation in our country. This is especially so for our internal market, since our freezing and canning industries are completely export oriented. But surprisingly, smoke curing, a simple and efficient method, is not yet very popular among our fish curers. Smoking is a favourite method of curing in the Far East and Continental countries, where a variety of smoked products like Bloater, Kipper, Red herring, Buckling, pale cure Finnan, Golden cutlets, Scotch fillets, Smokies etc. are prepared. Extensive studies have also been conducted there on the various aspects of this method of curing (Shewan 1945, 1949; House and Cutting, 1956; Cutting 1951; Simpson 1961; Foster and Simpson 1961; Simpson and Campbell 1962; Linton and French 1945). However very little attention has been given in India to develop this method of fish curing (Moorjani *et al.* 1972; Solanki *et al.* 1970). This note reports results of a study on smoke curing of some of our common food fishes.

The relatively shorter storage life of smoke cured products when compared to dry cured products, and the early onset of fungus and mites are the main reasons for their lesser popularity. The use of sodium propionate has been found to be very effective in enhancing their storage life. But because of the difficulty in procuring this chemical and also due to the

prejudice among the local processors engaged in fish curing against chemical preservatives, it has not yet become very popular. So, as an alternative, a well known natural preservative and food additive *viz*; turmeric was tried as preservative for such products. This treatment is found to increase the storage life of the final smoked products, besides imparting an attractive appearance.

Fresh fish [mackerel (*Rastrelliger kanagurta*) cat fish (*Tachisurus dussumeri*) and sole (*Cynoglossus dubis*)] were procured from local fish landing centres. They were gutted, cleaned and washed. In the case of sole the upper hard skin was removed before washing. The cleaned fish were first brined for uniform salt uptake. In pale cures, salt is used mainly for the formation of a surface pellicle and also as a condiment. Though it contributes to the quality of the smoked products, salt does not appear to prevent bacterial growth or spoilage at low concentrations (Weekel and Wosje 1966, F A O Report). But in heavily salted products salt is found to have a definite preservative action. The effect of pH and temperature on the action of salt has already been reviewed by Ingram and Kitchell (1967). The salt uptake during brining depends on various factors like age and size of fish, concentration of brine, temperature of brine, duration of brining, ratio of the weight of fish brined to the weight of brine etc. It was found from experiments that brining by dipping the fish in an equal amount

TABLE I
Initial Analysis of smoked samples

	1. Control			2. Propionate treated			3. Turmeric treated		
	Mackerel			Sole			Cat fish		
	1	2	3	1	2	3	1	2	3
Moisture %	21.94	15.54	15.32	21.98	13.95	13.64	15.14	16.82	16.14
Chloride % DWB	11.50	12.82	11.98	10.28	11.93	10.92	10.98	11.12	11.88

(W/V) of saturated brine for 15 minutes at room temperature, prior to smoking, is quite satisfactory for reasonably uniform and sufficiently high salt uptake.

The control sample was dipped in saturated brine and the experimental samples were dipped in (1) saturated brine containing 3% sodium propionate, (2) a saturated extract of turmeric in water containing salt to saturation. The turmeric extract was prepared by boiling sufficient turmeric powder in water, cooling it to room temperature and then saturating it with solid refined salt. All these dip treated samples were then drained well.

The well drained fish were then smoked in a laboratory model smoke kiln, in which the fish were hung from hooks. Smoke was generated by burning coconut husks and saw dust. The smoking was continued for about 5 hrs. in the case of mackerel. In the case of sole 4 hours smoking was found to be sufficient. Further increase in the smoking time was found to impart an undesirable taste to the product. After this the fish were taken out and dried in sun to a moisture level of about 20%. The smoked and dried products were then cooled to room temperature and stored as such in dry air tight bottles. Periodic analysis of these products were

conducted at regular intervals to follow the course of their spoilage. Moisture and chloride were estimated according to A. O. A. C. (1960) procedures and total volatile nitrogen by the method of Conway (1947).

In all the three cases, smoked products of good appearance and taste were obtained. The turmeric treated samples had a very attractive appearance especially in the case of sole. The samples had a moisture content of 15-20% and salt content of 10 - 12% (Table I). The course of spoilage in these products as followed by changes in the total volatile nitrogen content is given in Table II. In all cases the control samples were spoiled within 3 months. But the turmeric and propionate treated samples remained in good condition for over 6 months. The products had a high salt content which is found essential for its storage life. Propionate had a slightly better antifungal action but this is apparent only after 5 months, until which time turmeric also gives equally good preservation, as is evident from the data given in the table. This storage life is quite sufficient for all practical purposes. Along with its abundant availability and easy acceptability to the layman makes turmeric an ideal preservative for smoke cured fishery products.

TABLE II
Storage characteristics of smoked mackerel, sole and catfish.
Spoilage as assessed by changes in Total Volatile Nitrogen.

Weeks of Storage	Total Volatile Nitrogen. mg. % DWB									Physical Observation.
	Mackerel			Sole			Cat fish			
	1	2	3	1	2	3	1	2	3	
Initial	62.42	60.98	61.45	32.14	31.98	32.01	62.32	61.95	61.85	Smoking flavour fading in control samples in all the three cases.
4	98.68	62.68	65.38	44.24	38.15	39.86	75.74	65.42	66.48	
8	122.98	70.89	72.15	59.14	42.67	46.14	81.95	71.98	73.52	
12	148.42	76.54	79.35	70.05	58.57	58.54	92.54	78.30	81.65	Smoking flavour lost and stray patches of fungus appeared in control samples. In mackerel control samples had some mites also.
16	161.58	81.35	89.97	115.76	65.53	64.98	104.20	85.42	89.52	Control samples had widespread fungus in all cases. Propionate and turmeric treated samples showed slight fading of smoking flavour.
20	165.42	84.75	92.67	135.42	69.12	68.85	120.85	99.56	104.75	Control samples completely spoiled - Heavy fungus and mites-slight fading of smoky flavour in propionate and turmeric treated samples. Slight fungus in treated mackerels also.
24	182.08	91.07	98.74	154.87	74.12	73.89	133.50	112.84	118.87	Control samples crumbled and spoiled. Heavy fungus and mites in all cases. Slight fungus in turmeric treated samples. Very slight fungus in propionate samples.

The authors wish to acknowledge their indebtedness to Shri. M. R. Nair, Fishery Scientist (Processing), Central Institute of Fisheries Technology, Ernakulam, Cochin for his keen interest in the work. They are also thankful to Shri. G. K. Kuriyan, Director, Central Institute of Fisheries Technology, Cochin -11, for his kind permission to publish this note. The technical assistance of Shri. P. Sadanandan of this Laboratory is gratefully acknowledged.

REFERENCES

- A. O. A. C. 1960. *Official methods of Analysis.*, 9th Edn. Association of Official Agricultural Chemists, Washington 4, D. C.
- Conway, E. J. 1947. *Microdiffusion Analysis and Volumetric Errors.*, Crossby Lockwood and sons, London.
- Cutting C. L. 1954. *Fishing News.*, No. 1984:11.
- FAO. 1970. *Smoke curing of fish.*, Fisheries Report No. 88:43.
- Foster W. and T. H. Simpson. 1961. *J. Sci. Fd Agric.*, 12, 5:363.
- Foster W. and T. H. Simpson. 1961. *J. Sci. Fd Agric.*, 12, 9:635.
- House, C. T. and C. L. Cutting. 1956. *Fd Mf.*, 31 : 427.
- Ingram, M. and A. G. Kitchell. 1967. *J. Food Technol.*, 2 : 1.
- Linton, E. P. and H. V. French. 1945. *J. Fish. Res. Bd Can.* 6, 4:338.
- Moorjani, M. N. and Vasantha. 1972. *Sea Food Export Journal.*, 4, 3:25.
- Shewan, J. M. 1945. *Chemistry Ind.*, 32, 13:98.
- Shewan, J. M. 1962. *Chemistry Ind.*, p. 501.
- Simpson, T. H. and D. Campbell. 1962. *Methods of analysis of smoke deposits.*, Yugoslavia meat Industry. Belgard, Special Edition.
- Simpson, T. H. 1961. *Fd Mf.*, 36, 3.
- Solanki, K. K., M. K. Kandoran and R. Venkataraman. 1970. *Fish. Technol.*, 7, 2:169.
- Weckel, K. G. and D. Wosge. 1966. *Brine salting of great lake chub for smoking.*, University of Wisconsin, College of Agriculture, Madison, Research Report, 24.

Central Institute of Fisheries Technology Unit,
West Hill,
Calicut-673005.

K. Devadasan,
V. Muraleedharan,
K. George Joseph.