Fishery Technology
1994, Vol. 31(2) pp : 181-184

Production of Salted and Pressed *Decapterus* sp. and its Storage Characteristics

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A process for the production and storage of salted and pressed *Decapterus* sp. for human consumption was standardised. It involved immersion of the dressed fish in saturated sodium chloride brine for seven days followed by pressing in a wooden box under 0.064 kg cm^{-2} pressure for 15 h, packing in 200 gauge polythene bags and storage at ambient temperature. The product could be stored well for one month. Addition of 0.1 and 0.2% propionic acid to the curing brine increased the shelf life of the pressed product to 45 and 60 days, respectively by preventing growth of red halophiles and moulds.

Decapterus sp. (scad), is abundant during January-March along Kakinada coast. Its average annual landing is 391 tonnes off Kakinada coast (CMFRI, 1981). Large quantities of this species are being cured and dried; but these products become unacceptable to human consumption within a short period due to discolouration and rancidity. Hiremath *et al.* (1985, 1989) increased the storage life of oil sardine, by using optimum curing time and pressure. Limados Santos (1977) reported the use of chilled storage to increase the storage life of salted ad pressed sardine. Chakrabarti *et al.* (1991) found that the storage life of salted and pressed *Psenes indicus* at ambient temperature could be increased by packing under vacuum. Propionic acid and its derivatives control growth of mould and red halophiles in cured fish (Valsan *et al.*, 1961, Rao & Valsan, 1961). This note describes a method to prepare salted and pressed *Decapterus* with longer storage life, using optimum curing time, optimum pressure and proper concentration of propionic acid.

Decapterus sp. (9-12 cm long) caught by shrimp trawlers were kept in ice for 4 to 6 h onboard. The fish were then dressed by removing head and viscera, followed by thorough washing with potable water. The dressed and cleaned fish were grouped into three batches and were treated separately by immersing in (1) saturated brine, or (2) saturated brine with 0.1% (V/V) propionic acid and (3) saturated brine with 0.2% (V/V) propionic acid. Some excess undissolved salt was always maintained in the brine throughout. The water activity of the salted fish was determined at 24 h intervals. The fish was kept in saturated brine till the water activity in fish flesh became nearly constant. After salting, the fish was removed from each saturated brine container separately, allowed to drain, divided into three parts and pressed under three different pressures: 0.048 kg cm^{-2} (A), 0.064 kg cm^{-2} (B) nd 0.08 kg cm^{-2} (C), respectively for 15 h. The salted and pressed fish from the saturated brine (A_0, B_0 and C_0), the saturated brine with 0.1% propionic acid (A_1, B_1 and C_1) and the saturated brine with 0.2% propionic acid (A_2, B_2 and C_2) were packed in 200 gauge polythene bags and sealed. The sealed fish packets stored in card board boxes at ambient temperature (35±5°C) and relative humidity (70±25%) were analysed fortnightly.

Table 1. *Proximate composition of Decapterus sp.*

Moisture, %	75.7 - 77.64
Protein, % (TN x 6.25)	16.8 - 17.36
Fat, %	4.8 - 5.1
Ash, %	1.65 - 1.71

Table 2. *Change in water activity (a_w) in the muscle of Decapterus sp. during curing in saturated brine*

Curing time, days	Water activity
0	0.96
1	0.93
2	0.90
3	0.88
4	0.87
5	0.86
6	0.85
7	0.85

Total nitrogen, moisture, fat, sodium chloride content and peroxide value (PV) of the samples were estimated according to AOAC methods (1975). Total volatile base nitrogen (TVBN) was estimated by Conway microdiffusion method (1947) in the trichloroacetic acid extract of meat. Water activity of the fish meat was measured by equilibrating the samples at different relative humidities (Stokes & Robenson, 1947) and measuring the equilibrium constant. After washing the samples in potable water, these were cooked by boiling in 10 volumes of water for 10 min. A taste panel of five members evaluated the organoleptic quality of the cooked fish on a five point scale. 5: very good, 4: good, 3: acceptable, 2: poor and 1: very poor. The proximate composition of *Decapterus* sp. (Table 1) shows that it contains considerable amount of fat (4.8 - 5.1%). Changes in water activity of the fish flesh during the salting process is presented in Table 2. It was found that 7 days was sufficient to attain equilibrium. On equilibrium the water activity of the fish was 0.85. Table 3 shows that the moisture level of the pressed product was reduced to a minimum of 53.3% in case of 0.08 kg cm^{-2} pressure. The salt content of the meat in all the pressed samples were around 16%; it showed that the cell fluids were completely saturated. The product became more tough with increased pressure during pressing. At 0.064 and 0.08 kg cm^{-2} pressure, significant difference in the moisture content of the muscle was not noticed. It was found that the product became too tough with slightly misshapen at 0.08 kg cm^{-2}. Pressure at 0.064 kg cm^{-2} was sufficient to reduce the moisture level to about 53% without damaging the fish and the product had a neutral flavour. Table 4 shows the decreasing trend of the moisture level in all the samples during storage at ambient temperature. Maximum moisture loss i.e. difference of mean values, occurred in B_0 samples (53.5 to 49.6% in 60 days). TVBN increased in all the packed products during the storage, but it showed a rapid increase in the case of the samples pressed at 0.08 kg cm^{-2} pressure.

Table 3. *Effect of applied pressure on the dressed and cured Decapterus sp.*

Pressure applied in kg cm^2	Yield from dressed fish, %	Moisture (Wb) %	Salt (Wb) %	Texture
0.000	65.52	59.41	15.32	
0.048	55.13	54.39	16.46	Slightly tough
0.064	50.11	53.55	16.25	Tough but shape retained
0.080	49.92	53.30	16.06	Too tough and slight change in shape

During the storage, PV increased slowly and then decreased in some samples;

Table 4. *Changes in moisture, TVBN, PV and overall quality of cured and pressed Decapterus sp. packed in polythene bag and stored at ambient temperatures (35±5°C) and RH (70±25%)*

Parameter	Sample	Storage in days 0	15	30	45	60	Mean
Moisture in % (Mean±SD)	A_0	54.3±1.4	54.2±1.0	53.1±1.2	51.8±1.8	51.6±1.4	
	A_1	53.8±1.3	53.4±1.5	52.8±1.8	52.1±1.3	51.8±1.3	51.8±1.2
	A_2	53.4±1.7	53.1±1.9	52.0±1.6	52.3±1.8	52.1±1.4	
	B_0	53.5±1.0	52.2±1.5	51.6±1.6	50.5±1.9	49.6±1.3	
	B_1	53.1±1.1	52.6±1.3	52.7±1.5	52.4±1.7	51.7±1.5	52.1±1.4
	B_2	53.7±1.3	53.4±1.2	53.3±1.6	53.1±1.2	52.9±1.7	
	C_0	53.3±1.2	52.1±1.3	51.3±1.4	50.6±1.0	50.1±1.2	
	C_1	53.2±1.5	52.8±1.3	52.6±1.8	52.5±1.4	52.2±1.1	51.5±1.4
	C_2	53.4±1.4	53.0±1.6	52.8±1.2	52.4±1.6	52.1±1.3	
TVBN in mg % (Mean±SD)	A_0	28.5±1.5	31.4±1.9	30.1±1.6	34.5±2.1	55.2±1.8	
	A_1	27.3±1.6	29.9±2.0	32.2±1.7	36.3±2.1	45.4±2.3	46.3±2.5
	A_2	26.5±1.8	29.2±2.1	31.7±1.8	33.6±1.6	37.5±1.9	
	B_0	17.9±2.0	18.4±2.2	29.8±2.0	32.2±1.6	52.2±2.6	
	B_1	20.1±1.8	20.8±1.9	28.9±1.9	34.8±1.9	40.5±2.3	44.8±2.6
	B_2	18.6±2.1	20.9±1.5	29.9±1.9	31.8±2.1	34.0±1.6	
	C_0	19.8±1.9	25.2±2.0	30.3±2.3	36.2±1.5	83.0±3.1	
	C_1	19.3±1.5	22.8±1.8	30.1±2.5	34.8±1.8	50.7±2.9	47.6±2.1
	C_2	18.4±1.8	20.1±1.6	27.8±2.1	32.1±2.3	36.2±1.8	
Peroxide value in meq O_2 kg^{-1} fat (Mean±SD)	A_0	14.8±1.2	28.6±1.9	33.3±2.4	36.4±2.1	50.0±3.5	
	A_1	15.6±1.4	31.4±1.9	35.2±2.1	20.6±1.6	12.4±1.4	31.9±2.1
	A_2	12.3±1.6	24.3±1.9	33.7±2.4	23.8±1.8	10.2±1.2	
	B_0	15.6±1.9	40.1±2.2	50.4±3.6	25.5±2.3	28.5±2.2	
	B_1	26.8±2.4	31.1±1.9	10.2±1.3	6.8±1.1	19.3±1.8	43.2±2.6
	B_2	22.2±2.3	33.2±2.8	33.8±2.8	23.4±1.8	12.6±1.4	
	C_0	14.2±1.5	57.1±3.2	7.5±1.1	37.8±1.9	189.4±4.9	
	C_1	14.6±1.7	35.3±2.3	26.6±1.8	33.1±2.8	73.6±3.3	66.6±3.1
	C_2	11.2±1.4	35.3±2.3	34.6±2.3	35.5±2.5	34.8±2.6	
Overall Quality (Mean value)	A_0	5.0	4.0	3.8	2.8**	2.0**	
	A_1	5.0	4.0	4.0	3.0	2.0*	2.0
	A_2	5.0	4.2	4.0	3.2	3.0	
	B_0	5.0	4.0	3.4	2.4	2.0	
	B_1	5.0	4.2	4.0	3.0	2.0*	2.0
	B_2	5.0	4.2	4.0	3.4	3.0	
	C_0	5.0	4.0	3.2	2.4**	-	
	C_1	5.0	4.0	4.0	3.0	2.0*	2.0
	C_2	5.0	4.0	4.0	4.0	3.0	

* Growth of red halophiles, **Growth of white mould and red halophiles

A_0, B_0 and C_0 Immersed in brine for 7 days, pressed at 0.048, 0.064 and 0.080 kg cm^{-2}, respectively

A_1, B_1 and C_1 Immersed in brine containing 0.1% propionic acid and pressed at 0.048, 0.064 and 0.084 kg cm^{-2}, respectively

A_2, B_2 and C_2 Immersed in brine containing 0.2% propionic acid and pressed at 0.048, 0.064 and 0.084 kg cm^{-2}, respectively

but the repetition of both increasing and decreasing trends was noticed in other samples. Akande *et al.* (1988) reported similar results, during storage of salted dried fish cakes from mackerel. Among the similarly treated A, B and C samples, the mean TVBN content in B samples was minimum in almost all cases.

Table 4 shows that the growth of red halophiles and mould was observed after 30 days of storage in all A_0, B_0 and C_0 samples. By applying 0.1% level of propionic acid, the growth of white mould was prevented during the entire storage period; but the growth of red halophiles was checked only up to 45 days. Similar results were reported by Hiremath *et al.* (1989) and Chakrabarti *et al.* (1991) for oil sardine and *Psenes* sp., respectively. Though the growth of red halophiles and white mould was prevented in 0.2% propionic acid treated samples up to 75 days storage, the samples were acceptable organoleptically only up to 60 days. Different pressures of pressing, did not have any effect on the storage life of similarly treated samples.

The authors are grateful to Dr. K. Gopakumar, Director, Central Institute of Fisheries Technology, Cochin for permission to publish this paper and Dr. C.C. Panduranga Rao for his valuable suggestions during the course of work. Technical assistance of Shri A.V. Anjaneyulu, Shri B. Ramaiah and Shri N. Venkat Rao is gratefully acknowledged.

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