

Tin Coating Requirements in Fish Cans

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Prawn, crab and clam meat were processed in experimental cans having reduced internal tin coating of 5.6 GSM. Conventional cans having 11.2 GSM tin coating were used as control. Results showed that experimental cans behaved normally when used for canning prawns, provided the lacquer film was perfect with no exposure of metal. When there was a discontinuity in lacquer film exposing the metal blackening took place in such areas. Areas subjected to severe strains like the lock seam side and expansion rings on can ends were found to be more prone to blackening. Experimental cans were found unsuitable for canning crab meat or clam meat because in both cases the can wall as well as the contents underwent discolouration, in all cases.

Open top sanitary (OTS) cans popularly used for canning fish in India are made of cold reduced base steel plate over which a thin coating of tin is electrolytically deposited (IS: 9396-1976). Tin coating prevents the food in can from coming into direct contact with steel, thus avoiding any possible interaction between the two which can otherwise lead to undesirable changes. Tin coating on the external surface prevents rusting of steel plate on exposure to atmospheric conditions. Thickness of the coating, expressed as weight of tin over a specified area, may be different for internal and external surfaces. Indian Standards specify a differential coating D 11.2/5.6 g per sq. m (GSM) tin for OTS cans, the higher coating specified being for the internal surface (IS: 9396-1976). The coating thickness will depend on whether or not a protective coating of lacquer is supplied over it as also the type of food material packed in the can.

Materials and Methods

Cans with D 11.2/5.6 GSM tin with SR lacquer inside and plain decorative lacquer outside, presently used by the Indian fish canning industry were used as control. Experimental cans had internal tin coating of 5.6 GSM tin with similar lacquer coatings as for control. Both were specially made for experimental purposes by M/s Poysha Industrial Company Ltd., Bombay. Prawn, crab meat and clam meat were processed in both types of cans employing the methods earlier reported (Choudhury & Balachandran,

1964; Balachandran & Unnikrishnan Nair, 1975; Vijayan & Balachandran, 1981). Visual observations were made on incidence of discolouration or other malformations taking place on the can wall as well as contents. Processed cans were stored at ambient temperature and periodically examined.

Results and Discussion

Prawn was used in the initial studies. The processed cans were periodically opened and examined. Two cans each were examined every time. The observations are summarised in Table 1.

Immediately after canning all the cans, experimental as well as control, were normal in the can interior and contents. By one week's storage one of the two experimental cans examined showed slight blackening on inner can wall, so also after two week's storage. Both the experimental cans opened after three week's storage were normal in all respects. After four weeks both cans opened showed blackening on can wall as well as on contents, blackening on can wall of one of the cans being more than the other. No discolouration of any sort was noticed in the control cans throughout this period.

Even on repeating the experiments under more controlled conditions, right from selection of raw materials through handling and processing, similar erratic results were obtained in the case of experimental cans, some showing blackness while others not

Table 1. *Results of examination of experimental and control cans*

Storage period	Observations on can and contents							
	Can interior				Contents			
	Experimental		Control		Experimental		Control	
	1	2	1	2	1	2	1	2
1 day	N	N	N	N	N	N	N	N
1 week	+	N	N	N	N	N	N	N
2 weeks	—+	N	N	N	N	N	N	N
3 weeks	N	N	N	N	N	N	N	N
4 weeks	+	+	N	N	+	+	N	N

N = normal appearance; —+ = very little blackening; + = slight blackening; ++ = blackening moderate

Table 2. *Behaviour of experimental cans with perfect and imperfect lacquer film*

Storage period	Cans with perfect lacquer film				Cans with scratches on lacquer film			
	Can wall		Contents		Can wall		Contents	
	1	2	1	2	1	2	1	2
1 day	N	N	N	N	+	—+	N	N
1 week	N	N	N	N	++	+	N	N
2 weeks	N	N	N	N	+	++	N	—+
3 weeks	N	N	N	N	++	+	+	+
4 weeks	N	N	N	N	+++	++	++	++
5 weeks	N	N	N	N	+++	++	++	++

N = normal appearance; —+ = very little blackening; + = slight blackening; ++ = blackening moderate; +++ = blackening intense.

during same storage period. It was also observed that blackening and/or rusting was more pronounced in areas like lock seam side whereas blackening was less intense in isolated areas on other parts, mostly observed as lines.

Sufficiently large pieces of plates were cut out from the experimental cans from blackened and normal areas. After washing the pieces free of any oil using mild alkaline solution the plates were tested for any exposed metal without removing the lacquer film by the hot water test (Jones Osman, 1947). Results indicated metal exposure in blackened areas. It was also evident that the exposure was more at the lock seam side as well as on expansion rings, the areas normally subjected to greater strain during the can making process.

The above results indicated the possibility of exposed metal in blackened areas. Therefore the experimental cans for further studies

were carefully selected with no apparent imperfection in the lacquer film. Random checking was carried out for exposure of metal also. The experimental cans so selected were divided into two batches. One group was used as control. Some scratches were made on the inner can wall of the other group to make sure of exposed metal. Prawn was canned in both type of cans. As in the previous case two cans from each group were periodically examined. The observations are summarised in Table 2.

Cans with scratches on the lacquer film showed signs of blackening at the exposed area from the very next day after processing. However the product blackening was observed in one of the two cans tested after one and two weeks' storage. The intensity of can blackening increased after three weeks and by this time the product in all cans showed blackening. The intensity of blackening, both on container and prawn, increased with increase in storage period. By fifth

week the black product started getting detached from the can body and admixing with the contents, thus presenting a dirty appearance. However no blackening took place in the cans which had their lacquer film perfect.

From the above results it can be reasonably assumed that if the lacquer coating is perfect cans with a lower tin coating thickness of 5.6 GSM can be used for canning prawn.

In order to study the suitability of cans with lower tin coating for other types of shell fish a few experiments were carried out using crab and clam meat, both canned in brine. Cans with visibly perfect lacquer film were selected for the studies. Crab meat was packed with and without an additional parchment paper lining inside. Observations of the canned samples indicated in the case of crab meat definite signs of blackening, both of can wall as well as the meat from the very next day of processing, whether or not the parchment paper lining was provided in the can. Cans with clam meat showed slight blackening from the second week and this intensified on further storage. These results indicated that cans with lower tin coating of 5.6 GSM is not suitable for canning crab meat or clam meat irrespective of having a normal coating of lacquer.

The base steel plate is electrolytically coated with tin so that more uniform and thinner coating is obtainable with less quantity than by other methods. Irrespective of the method employed it is probable to have some degree of discontinuity in the tin film and therefore the tin coating is further protected by a coating of suitable quality lacquer.

Tin plate is lacquered before it is converted into cans. The can making process involves a series of steps, some of which are likely to cause severe stress and strain on the lacquer film resulting in minor exposure of metal film which may be unnoticed. When the tin coating is thick and uniform enough to have left any area of base steel plate exposed, some malformation in the lacquer film may not be serious enough to materially affect either the container or contents. On the other hand when the tin coating is very thin with greater probability to porosity any imperfection in the lacquer film, however minor it may be, runs the risk of exposure of base plate which can affect the can as well as the contents in it. It is quite probable that

such imperfection in the lacquer film coupled with greater chances of porosity in tin coating might have been responsible for the incidence of blackening observed when prawn was canned in experimental cans with 5.6 GSM tin coating. This explanation is supported by the fact that no blackening was met with in experimental cans which had perfect lacquer coating.

Crab meat is quite prone to blackening/bluing which is species specific. Great care has to be taken in its preprocess handling to reduce its copper/iron content (Vijayan & Balachandran, 1981), still it is always canned with an additional parchment lining to prevent any possibility of the meat coming into contact with metal. Even very minor imperfection in the lacquer film can lead to discolouration of the meat.

Clam meat is normally canned without an additional parchment lining in can. However the fact that even cans with lower tin coating with perfect lacquer leads to blackening indicates that such cans are not suitable for processing either clam meat or crab meat.

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