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Properties of Indigenous and Imported Retort Pouches for the Thermal Processing of Freshwater Fish

A. ANSAR ALI, B. SUDHIR, T.K. SRINIVASA GOPAL and P.K. VIJAYAN

Central Institute of Fisheries Technology
P.O. Matsyapuri, Cochin - 682 029, India.

Flexible pouches are an ideal alternative to metal can. The physical properties of the pouches were studied after collecting different types of indigenous and imported flexible pouches, analysing their composition and conducting detailed studies on their physical and food contact application properties. The indigenous pouches usually consists of 12.5 to 17.5 μ polyester / 12.5 to 25 μ aluminium foil / 75 to 87.5 μ cast polypropylene and imported one with configuration of 12 μ polyester/ 15 μ aluminium foil / 75 μ cast polypropylene. The physical properties studied include tensile strength, elongation at break, bond strength, bursting strength, heat seal strength, water vapour transmission rate and oxygen transmission rate. The overall migration studies indicated that the pouches are within the limits prescribed for food contact applications and they are suitable for processing freshwater fish. The indigenous pouches were found to be as good as the imported pouches. It has been found that the curry processed in indigenous retort pouch could be kept for more than one year at room temperature.

Key words : Retort pouch packing, thermal processing, freshwater fish.

A retortable pouch is a flexible laminated pack having sufficient strength and heat resistance to allow it to be used in place of a metal can for heat processing and storage of food product. The retort pouch has been widely recognized as an economic alternative to metal can for producing thermally processed shelf stable foods. The majority of the pouches now produced are composed of 3 layer films, polyester film on the outer layer, a core of aluminium foil and an inner layer of polypropylene copolymer. The core of aluminium foil is used to give the laminate the necessary water, gas, odour and other barrier properties. The primary function of polypropylene inner ply is to give good heat seal and product resistance. The polypropylene ply on the inside also protects the aluminium foil and contributes to overall strength. Some manufacturers incorporate nylon film, which reduces the gas transmission rate and contributes to the strength of the packaging materials.

Most of the laminates previously available in the country are based on low-density polyethylene (LDPE). These materials suffered distinct thermal damage and had poor sealing characteristics. Laminates with high density

polythethylene (HDPE) even though had higher softening temperature, did not prove to be reliable, due to its weak sealing characteristics. Even though polypropylene is suitable for heat processing, the shelf life of food products is limited to 3-6 months (Subramanian *et al.*, 1986; Antony, 1985). This is due to poor barrier properties of polypropylene. In India indigenous manufacturers have come out with a retort pouch, a flexible laminated food package having the configuration polyester/aluminium foil/cast polypropylene that can withstand thermal processing. The physical properties of the pouches were studied after collecting different types of indigenous and imported flexible pouches, analyzing their composition and conducting detailed studies on their physical and food contact application properties. This paper reports on the properties of indigenous and imported retort pouch for the thermal processing of freshwater fish and their suitability for food contact applications.

Materials and Methods

Retort pouches obtained from four indigenous and two imported laminators were assessed for quality requirements. The layers of the pouches were identified by Fourier Transform Infrared Spectroscopy. Heat seal strength was determined as per ASTM (1973). Internal burst strength for seal integrity was determined by the method described by Duxbury *et al.* (1970). The suitability of the laminate for product resistance and process resistance of the pouches were determined as per the method described by Gopakumar (1993). The water extractives were determined by the methods of FDA (1983). Bond strength (peel strength) was determined as per ASTM (1972), water vapour transmission rate, as per IS:1060 (1960) and oxygen transmission rate, as per ASTM (1975). The suitability of the laminate for product resistance and process resistances were determined as per the method described by Gopakumar (1993).

Results and Discussion

The composition of the indigenous and imported pouches are given in Table 1. All the retort pouches were found to be made up of an outer layer of polyester, middle layer of aluminium foil and an inner layer of cast polypropylene. The polyester thickness varied from 10 to 17.5 μ in case of indigenous pouches and was 12.5 μ in case of imported pouches. The aluminium foil thickness varied from 12.5 to 15 μ, except in one case wherein the thickness used was 25 μ, in indigenous pouches.

The physical properties of the imported and indigenous pouches are presented in Table 2. The bursting

Table 1. Thickness of indigenous and imported pouches

Source	Outer polyester layer (μ)	Middle aluminium foil (μ)	Inner poly propylene layer (μ)
Indigenous	12.5	12.5	80.0
	17.5	25.0	75.0
	10.0	15.0	65.0
	12.5	13.8	82.5
Imported	12.5	15.0	75.0
	12.5	15.0	80.0

Table 2 : Physical properties of indigenous and imported pouches.

Source	Bursting strength (psig)	Heat seal strength-25mm width (N)		Bond strength-10mm width (g)		Tensile strength ($kg.cm^{-2}$)	
		Machine Direction	Cross Direction	Inner layer	Outer layer	Machine Direction	Cross Direction
Indigenous	21	70.25	60.75	110	184	451.5	425.4
	18	72.5	70	304	480	401.7	381.8
	21	92.0	75.5	140	210	466.7	456.3
	20	79.7	73.0	300	340	436.5	422.9
Imported	30	98.0	81	247	220	506.6	498.4
	26	88.0	87.0	225	147	481.4	475.2

strength of the indigenous pouches varied from 18 to 21 psig for 30 seconds and imported pouches from 26 to 30 psig. The heat seal strength of the indigenous material (25 mm width) varied from 70.25 to 92 N and the imported pouches varied from 87 to 113.5 N. The minimum requirement of heat seal strength (25 mm width) is 75 N, bursting strength is 20-30 psig (Lampi, 1980). The overall migration limit expressed as water extractives is below the limits of 10 $mg.dm^{-2}$ indicating the suitability of the retort pouches for food contact applications. The bond strength of the indigenous pouches varied from 110 g (10mm width) to 300 g in the case of outer layer and in the case of inner layer it is 184 to 340 g. The minimum requirement of bond strength is 150 to 500 g. The result of the tensile strength indicates that all the retort pouches have good strength to hold the contents and is suitable to work on automatic lines. Water Vapour Transmission Rate (WVTR) and Oxygen Transmission Rate (OTR) of the retort pouch films should be nil. In the present studies most of the laminates have a WVTR of 0.1860 to 0.1865 $g.m^{-2}.24h^{-1}$ at 37°C at 90 % RH and OTR of 1.75 to 2.6 $ml.m^{-2}.24\ h^{-1}$, at 1 atmospheric pressure. Even though there are transmisson of water vapour and oxygen, curry processed in indigenous retort pouch could be kept in good condtion for 24 months at room temperature (Vijayan *et al.*, 1998). Flex cracks development was more prominent in the three indigenous pouches, while others in this cateory were free from it. Although flex cracks were seen on the layer of aluminium foil, the structure represents no microbiological hazard unless the crack is accompanied by cracks in the plastic components of the laminate. The above results indicate the integrity of the indigenous pouch from sources 3 and 4 (Table 2), for its use as a container for heat processed fish products.

References:

Antony, K.P., Srinivasa Gopal, T.K., Perigreen, P.A., Arul James, M., & Govindan, T.K. (1985) *Journal of Popular Plastics* Vol. XXX (c), 33.

ASTM (1972) *Standard Method of Test for Peel or Stripping Strength of Adhesive Boards*, D 90349, American Society for Testing and Materials, Philadelphia.

ASTM (1973) *Standard Methods of Test for Seal Strength of Flexible Barrier Films*, 6888, American Society for Testing and Materials, Philadelphia, Philadelphia.

ASTM (1975) *Standard Method of Test for Gas Transmission Rate of Plastic Film Sheeting*, D14345, American Society for Testing and Materials, Philadelphia.

Duxbury, D.D., Sames, P.F., Howeler, W.F., Gee, T.H. & Miller, W.N. (1970) *Reliability of Flexible packaging for Thermo processed Foods Under Production Conditions*, Phase I: Feasibility Tech. Report 72-77, GP, US Army Natick Development Center, Natick, Mass., USA.

FDA (1983) *Code of Federal Regulations: Foods and Drugs* 21 Parts 170-199, Office of the Federal Register, National and Records Office, Washington DC.

Gopakumar, K. (1993) in *Fish Packaging Technology: Materials and Methods*, Concept Publishing Company, New Delhi.

IS 1060 (1960) *Methods of Sampling and Test for Paper and Allied Products*, Part II Bureau of Indian Standards, New Delhi.

Lampi, R.A. (1980) *J. Food Proc. Eng.* **4**, 1

Subramaniam,V., Srivastava, A.N., Nirmala, N. & Sharma, T.R. (1986) in *Recent Developments in Food Packaging*, p. 57-58, Association of Food Scientists and Technologists (India).

Vijayan, P.K., Gopal, T.K.S., Balachandran, K.K. & Madhavan, P. (1998) in *Advances and Priorities in Fishery Technology*, (Balachandran, K.K., Iyer, T.S.G., Madhavan, P., Joseph, J., Perigreen, P.A., Raghunath, M.R. & Varghese, M.D., Eds.), p. 232-235, SOFT(I), Cochin.