PACKAGING OF EDIBLE OIL AND FAT

Oils and fat form an important constituent of human food. In India, the fats used as cooking media are generally vegetable oil, vanaspati and ghee.

Vegetable oil is derived from seeds of plants. Among the oilseeds cultivated in India, from which edible oil is obtained, are groundnut, rapeseed, mustard, sesame, safflower, sunflower, niger, soyabean, linseed and castor. The other sources of vegetable oil are palm, cottonseed, coconut and rice bran. Generally the two methods employed for obtaining edible oil are pressing and solvent extraction. The crude oil thus obtained may be refined, bleached and de-odourised to remove pigments, objectionable odours and flavours and non-triglyceride material. Oil is liquid at room temperature and contains a large proportion of unsaturated fatty acids.

Plastic Packages for Edible Oil and Fat

Vanaspati is refined hydrogenated vegetable oil. It is solid at room temperature, as during hydrogenation, the fatty acids get saturated.

Ghee is pure clarified fat with especially developed characteristic physical structure and flavour. Ghee is exclusively obtained from milk, cream or butter from various animal sources by means of processes, which results in almost the total removal of moisture and solid-non-fat contents.

In India, different varieties of edible oil are consumed, generally depending on the regional preferences and availability.

India is one of the largest producers and consumers of edible oil in the world. Indian Vegetable Oil Industry comprises around 1,50,000 oilseed crushing units with a total capacity of 425 lakh tonnes, 800 solvent extraction units with capacity of 345 lakh tonnes of the oil-bearing material, about 300 refineries with capacity of 50 lakh tonnes and 205 vanaspati units with annual capacity of 32 lakh tonnes.

The domestic availability of vegetable oil during 2002-2003 season is given in Table 1.

TABLE 1
Domestic Availability of Vegetable Oil
During 2002 – 2003 Season

(lakh tonnes)

Oilseeds/ S.E. Oil	Oil Recovery %	2002 – 2003 SEASON					2001 – 2002 SEASON				
		Oilseed Production	Marketable Surplus for Crushing & Oil Availability			Total Oil Availability	Oilseed Production	Marketable Surplus for crushing & Oil availability			Total Oil Availability
			Kharif	Rabi	Total			Kharif	Rabi	Total	
OILSEEDS											
Groundnut	40	46.0	10.9	7.3	18.2	**7.3**	70.7	25.6	9.4	35.0	**14.0**
Soya	17	43.0	37.0	0.0	37.0	**6.3**	54.0	48.0	0.0	48.0	**8.2**
Rape/	33	43.0	1.5	40.0	41.5	**13.7**	48.5	1.5	45.5	47.0	**15.5**
Mustard/Toria Sunflower	35	13.2	2.8	10.4	13.2	**4.6**	8.7	1.5	7.2	8.7	**3.0**
Sesame	45	6.2	1.8	2.0	3.8	**1.7**	7.9	3.5	2.2	5.7	**2.6**
Castor	42	5.1	5.1	0.0	5.1	**2.1**	6.0	6.0	0.0	6.0	**2.5**
Niger	30	0.8	0.5	0.0	0.5	**0.2**	1.3	1.0	0.0	1.0	**0.3**
Safflower	30	2.0	0.0	2.0	2.0	**0.6**	2.9	0.0	2.9	2.9	**0.9**
Linseed	43	2.0	0.0	2.0	2.0	**0.9**	2.4	0.0	2.4	2.4	**1.0**
Sub Total		**161.3**	**59.6**	**63.7**	**123.3**	**37.4**	**202.4**	**87.1**	**69.6**	**156.7**	**48.0**
Other Oilseeds											
Cottonseed	11	45.9	35.4	0.0	35.4	**3.9**	51.4	40.4	0.0	40.4	**4.4**
Copra	65	6.5	6.5	0.0	6.5	**4.2**	8.5	8.5	0.0	8.5	**5.5**
Sub Total		**52.4**	**41.9**	**0.0**	**41.9**	**8.1**	**59.9**	**48.9**	**0.0**	**48.9**	**9.9**
Secondary Source											
Rice Bran	15					**6.0**					**5.5**
Rapeseed Cake	9					**0.8**					**1.1**
Sunflower Cake	12					**1.0**					**0.4**
Groundnut Cake	7					**0.6**					**0.8**
Cottonseed & Others	7					**0.5**					**0.5**
Minor Oilseeds (TBO)						**0.5**					**0.5**
Local Palm Oil						**0.5**					**0.5**
Sub Total						**9.9**					**9.3**
Grand Total		**213.7**	**101.5**	**63.7**	**165.2**	**55.4**	**262.3**	**136.0**	**69.6**	**205.6**	**67.2**

According to projections made by the National Council of Applied Economic Research (NCAER), the country's demand for edible oil is expected to be more than double by 2015 from the levels in 2000.

The NCAER scholars have projected aggregate edible oil demand to go up as shown in Table 2.

TABLE 2
Edible Oil Demand

	1999-2000	2004-05	2009-10	2014-15
Per Capita*				
Low estimate	9.81	11.55	13.95	16.00
Medium estimate	9.89	11.63	14.83	18.16
High estimate	9.97	12.10	16.17	22.60
Total Demand**				
Low estimate	10.10	13.30	17.40	22.80
Medium estimate	10.20	13.90	19.00	25.90
High estimate	10.30	14.60	20.70	29.40

* In kg per annum

** In million tonnes

The projected demand growth is on account of both, increase in population as well as higher per capita income.

To deliver the huge quantum of edible oil to the consumer in a safe and hygienic condition, packaging provides an easy solution. Inculcating the habit of buying and selling of this commodity in packaged form becomes a strong case.

Composition of Edible Oil and Fat

The composition of fatty acids in each variety of oil/fat varies considerably. Table 3 gives the percentage levels of saturated, mono – unsaturated and polyunsaturated fats with respect to different oil, vanaspati and ghee.

TABLE 3
Fatty Acid Composition of Oil and Fat

Particulars	Saturated Fatty Acids (Mufa) (%)	Mono-unsaturated Fatty Acids (Pufa) (%)	Poly-unsaturated Acids (%)
Coconut	90	8	2
Palm	50	39	9
Cottonseed	28	22	50
Groundnut	20	50	30
Rice bran	18	45	37
Sesame	18	43	39
Niger	12	36	52
Safflower	10	15	75
Butter	63	33	3
Soyabean	16	24	60
Sunflower	12	21	67
Mustard/rapeseed	6	67	27
Corn Oil	16	29	55
Vanaspati	61	36	3
Ghee	64	33	3

[Source : Science Reporter, September 1991, 43 - 45]

Spoilage Factors

Oil and fat are subject to spoilage due to effect of environmental factors that can affect their stability. These factors are mainly oxygen, moisture, heat and light.

Oxygen is the most critical factor affecting stability. The presence of oxygen leads to oxidation and formation of hydroperoxides and peroxides and then aldehydes and ketones resulting in off-odours due to oxidative rancidity. These reactions increase in rate and intensity in the presence of light and heat. Each oil or fat has a different degree of susceptibility to oxidation. This depends upon the fatty acids composition of each oil and fat. Oil containing high degree of unsaturated fatty acids such as safflower, soya and sunflower are highly prone to oxidative rancidity whereas oil with high degree of saturated fatty acids are less susceptible.

In unrefined oil, natural antioxidants are present and, therefore, these are less prone to rancidity than refined oil, where the antioxidants get removed during the process of refining. Very often, the oil manufacturers add antioxidants to refined oil in order to extend the shelf-life of the product. In vanaspati and ghee, oxygen sensitivity is low as compared to oil.

Oxygen may gain access to the fat/oil in several ways. Atmospheric oxygen may be present in the oil, it may also be present in the headspace of the package, or may enter the package through the body or the seals.

Another important factor, which contributes to the deterioration of oil is moisture. Very small amount of moisture can be detrimental. Hydrolysis of triglycerides result in formation of glycerol and free fatty acids. Off-flavours occur due to hydrolytic rancidity.

This is more common in oil and fats with high levels of saturated fatty acids. Moisture may also gain entry through the body or seams by permeation.

Light and heat act as initiators of oxidation reactions, which ultimately lead to degradation and, therefore, control of these factors is also important.

Bureau of Indian Standards and Prevention of Food Adulteration Rules – 1955 (PFA), have laid down the specifications of different edible oil and vanaspati.

The PFA also lays down specifications for ghee. The list of standards (BIS) are given in Table 4.

TABLE 4

Indian Standards Pertaining to Edible Oil and Fat – Specifications

Number	Description
435 : 1973	Castor Oil (second revision)
542 : 1968	Coconut Oil (second revision)
543 : 1968	Cottonseed Oil (second revision)
546 : 1975	Mustard Oil (second revision)
547 : 1968	Sesame Oil (second revision)
548 (Pt 1) : 1964	Methods of sampling and test for oil and fat: Part 1. Methods of sampling Physical and chemical tests (revised)
548 (Pt 2) : 1976	Methods and chemical test for oil and fats: Part 2. Purity test (third revision)
548 (Pt 3) : 1976	Methods of sampling and test for oil and fat: Part 3. Analysis by gas liquid chromatography
1780 : 1961	Vegetable Oil
3448 : 1984	Rice Bran Oil (second revision)
3490 : 1965	Nigerseed Oil
3491 : 1965	Safflower Oil
4055 : 1977	Maize (com) Oil
4276 : 1977	Soyabean Oil (first revision)
4277 : 1975	Sunflower Oil (first revision)
8323 : 1977	Palm Oil
8361 : 1977	Palmolein
10633 : 1986	Vanaspati (first revision)
10634 : 1986	Bakery shortening (first revision)
11068 : 1984	Criteria for edibility of oil and fats
11069 : 1984	Refined, bleached, hydrogenated and deodorized and winterized (RBHWD) soyabean oil
11476 : 1985	Glossary of terms relating to oil and fats
12457 : 1988	Margarine

The above standards specify requirements of each oil/grade of oil with respect to characteristics such as:

- Moisture and insoluble impurities
- Colour
- Refractive Index
- Specific Gravity
- Saponification value
- Iodine value
- Acid value
- Unsaponifiable matter
- Flash Point

The most significant and critical parameters considered for assessing the storing quality of edible oil are:

- Percentage moisture content
- Percentage free fatty acid
- Peroxide value
- Change in colour/odour

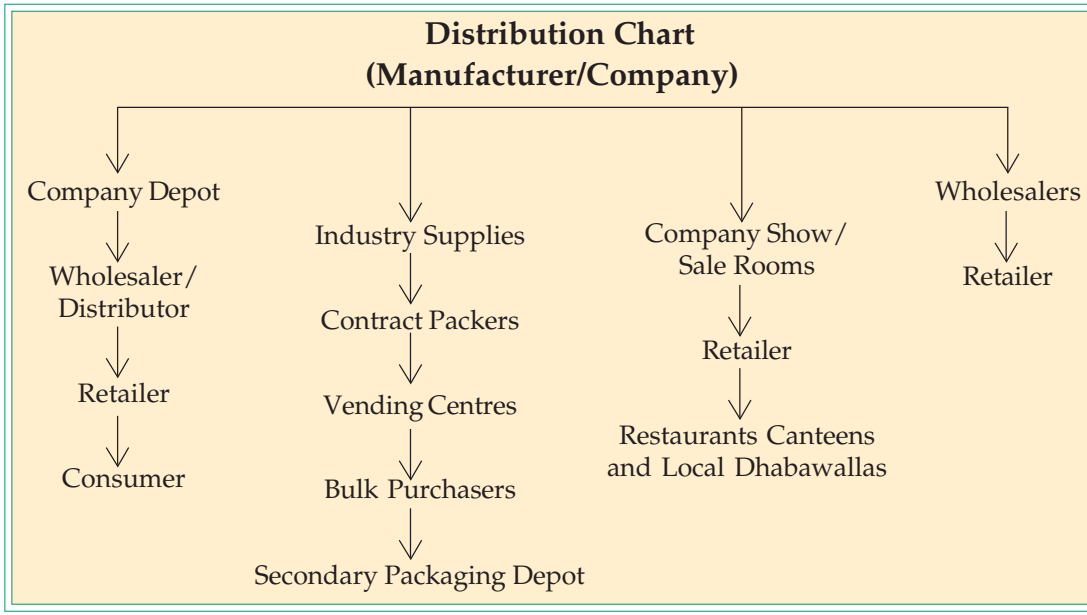
The BIS and PFA standards, specify only the upper values for the critical spoilage factors, and nowhere mention of lower values (which should be the base/initial value) are made. It is very important for the industry to decide on lower or base value. This is of significance as the shelf-life factor is inter-related to the product quality when ready to pack.

It should be noted that:

Critical Parameters	**Shelf-life & Specifications**
Lower the initial value of critical parameters	Higher the shelf-life
Lower the initial value of critical parameters	More economical would be packaging material
Higher the initial value of critical parameters	Higher the specification of the packaging material and, therefore, higher the packaging cost
Higher the shelf-life requirements	Higher the packaging specification and, therefore, higher the packaging cost

Distribution Pattern

The general distribution pattern followed for these products is shown in the distribution chart given below:



The above distribution pattern indicates that the product passes through a number of hands before it reaches the consumer and therefore it would be ideal to pack the oil at the manufacturer's end itself. This would result in a safe and wholesome product to the consumer.

Packaging Systems/Types of Pack

Traditionally, oil and fats have been packed in 15kg square tinplate containers. The other types of packages like plastic containers, lined cartons and flexible pouches have been recently introduced. Even though packaging has witnessed many changes, till today about 52% of oil and fats continue to be traded in loose/unpacked form. This includes retail selling of loose oil from 15kg tins as well. This allows a lot of scope to pursue the dangerous practice of adulterating the oil with less expensive and unhygienic varieties.

Due to adulteration of oil, deaths have been reported in Spain, Phillipines and India. Consequently, the governments in these countries have taken a step forward to encourage use of inexpensive safe and hygienic plastics packaging for edible oil. Plastic packaging provides safe hygienically packed oil at competitive cost to consumers.

It is extremely important that, whatever the packaging material used, it should be food grade and non-toxic. The product package compatibility is the starting point and shelf-life follows compatibility.

Packaged oil and fats offer various advantages such as:

- Ease in quick disposal at retail points
- Ease of identification

- Tamper evident and therefore chances of mixing or adulteration minimised
- Quality is guaranteed
- No need for consumer to carry own container
- Convenience in storage and use by the consumer
- No wastage due to spillage at retail shops/containers
- Brand identification can be established

Packaged oil, vanaspati and ghee are well accepted and the quantity in packed form is growing steadily.

The array and availability of packaging materials, sizes and shapes of package construction are unlimited. In the present day, consumer is willing to try and use new materials. Modern packaging technology provides many opportunities to maintain product protection while reducing the cost.

The main requirements for a packaging system for edible oil, vanaspati and ghee should be:

- Non – toxic and compatible
- Protect against environmental factors
- Machineable
- Leak-proof and transport-worthy
- Easy to store, use and handle
- Printable

Package Types

Tinplate Containers

Tinplate containers are widely used for packaging of edible oil. They ensure a long shelf-life and are sturdy. They are also suitable for high filling and packaging operations. However, the disadvantages of using a tinplate container are its high cost and uncertainty about availability.

15 kg HDPE and Tin-plate Containers for Edible Oil

Edible oil are packed in tinplate containers of different capacities – 500g, 1kg, 2kg, 5kg and 15kg. The shape of the container may be round or square.

IS – 10339 : 1988 gives the specification for ghee and edible oil tins (500g, 1kg, and 5kg), whereas IS: 10325 – 1989 gives the specification for 15kg square tins for vanaspati and edible oil and ghee.

Of late, tinplate containers of 1 kg, 2 kg and 5 kg capacities are being replaced by plastic containers for edible oil and vanaspati, but are still in use for ghee packaging.

It is most unfortunate that reuse of tinplate containers is prevalent even though banned under GSR 575 (E) dated 4/8/95. 15kg tinplate containers used for packaging of edible oil, use not only seconds but also printed sheets, where inks could cause a major health hazard.

Glass Bottles

Though glass bottles provide excellent protection and can also be used for high-speed operation, they are not commonly used for edible oil packaging because of their fragility and high tare weight.

Semi – Rigid Containers

These are mainly plastic containers made from HDPE (High Density Polyethylene), PET (Polyethylene Terephthalate) and PVC (Poly Vinyl Chloride). The advantage of using these

HDPE Jerry Cans for Edible Oils

Plastic Container for 15 kg Edible Oil

containers is that they provide a moderately long shelf-life, are light in weight and are transport-worthy. Although they do not provide as long a shelf-life as the tinplate container, they are economical as compared to a tinplate container, and therefore, suitable for use where very long shelf-life is not required.

HDPE Container for Vanaspati

HDPE (High Density Polyethylene) Containers

Blow moulded HDPE containers in the form of bottles (200g, 400g), jars (1kg and 2kg) and jerry cans (2kg, 5kg and 15kg) are widely used for packaging of vanaspati and edible oil. IS: 10840 – 1994 gives specifications for blow moulded HDPE containers for packaging of vanaspati.

PET Bottles for Edible Oil

PET (Polyethylene Terephthalate) Bottles

With the introduction of PET bottles in the country, edible oil is one of the commodities being packed in 1 kg stretch blow moulded PET bottles. PET bottles have excellent clarity, are odour–free and have good gas barrier

properties. **PET bottles are also accepted internationally for edible oil packaging.** IS: 12887 – 1989 gives specifications for PET bottles for edible oil packaging.

PVC (Poly Vinyl Chloride) Bottles

Recently, food grade stretch blow moulded PVC bottles have been introduced for packaging of edible oil in the country. PVC bottles have good clarity and excellent oil resistant properties. IS: 12883 –1989 gives specifications for PVC bottles for edible oil packaging.

Other Semi – Rigid Packs

Aseptic Packs for Edible Oil

The other forms of semi – rigid containers recently introduced in the market are the bag-in-box systems, lined cartons and the tetra packs, for marketing edible oil, vanaspati and ghee.

Flexible Plastic Pouches

Flexible pouches may be made from laminates or multi-layered films of different compositions. The pouches may be in the form of pillow or as stand-up-pouches.

Limited quantities of edible oil, vanaspati and ghee are packed today in flexible pouches of 1 kg, 500 g and 200 g capacity. The main advantage of packaging oil, vanaspati and ghee in flexible pouches is that they are more economical than any other packaging system available for packaging of these products. IS: 12724 – 1989 gives the requirements for flexible packaging materials for packaging refined edible oil.

Flexible Plastic Pouches for Edible Oils

The selection of a laminate or a multi-layer film is governed primarily by the compatibility of the contact layer, heat sealability, heat seal strength and shelf-life required, besides machineability and physical strength parameters. The shelf-life factor is interrelated to the product quality when ready to pack as well as to the market environment. It is of utmost importance that an economical optimum medium is chosen and this can only be done if the quality parameters are fixed for the products at the time of packing.

With the upper limits of the properties (spoilage levels) being known, lower the initial values and lower the shelf-life required,

more economical would be the packaging medium. If the oil properties at the point of packing are nearer the upper limits, higher is the packaging media specification requirement to achieve the given shelf-life period. Similarly, longer the shelf-life needed, higher would be the material specification. The task becomes more difficult when the above two factors play concurrently. Consequently, the cost of packaging also goes up. Thus, the primary factors that should be fixed are the shelf-life period, market conditions and initial values of critical parameters of edible oil. The upper limits of various edible oil, vanaspati and ghee in respect of critical factors as per the relevant standards are given in Table 5.

TABLE 5

Critical Factors: Upper Limits for Refined Edibls Oil/Ghee/Vanaspati as per BIS

Product	BIS No.	Percentage Moisture Content	Percentage Free Fatty Acid As Oleic Acid	Peroxide Value (Milliequivalent of Oxygen Per Kg)
Vanaspati	10633-1986	0.25	0.25	-
Sunflower Oil	4277-1975	0.10	0.25	-
Palm Oil	8323-1979	0.10	0.25	10
Coconut Oil	542-1968	0.10	0.25	-
Safflower Oil	3491-1965	0.10	0.25	-
Soyabean Oil	4276-1977	0.10	0.25	-
Maize Oil	4055-1966	0.15	0.25	-
Sesame Oil	547-1968	0.10	0.25	-
Groundnut Oil	544-1968	0.10	0.25	-
Mustard Oil	546-1975	0.10	0.25	-
Cottonseed Oil	543-1968	0.10	0.15	-
Palmolein	8361-1977	0.10	0.25	10
Nigerseed Oil	3490-1965	0.10	0.25	-
Ricebran Oil	3448-1984	0.10	0.25	-
Ghee	PFA Rules 1955	0.50	3.00	-

Analysis of Needs and Shifts

Analysis of results from some studies in flexible packaging materials carried out indicate that flexibles with appropriate thickness and specifications could be effectively deployed for edible oil, vanaspati and ghee packaging, for medium and even for long shelf-life periods. The criteria that need specific consideration are excellent barrier properties, good substrate bond and heat seal property. Amenability to machine run is yet another important criterion.

Flexible Plastic Pouches for Vanaspati

Currently, flexible packaging for edible oil and vanaspati is being used only for 1kg and less quantity. The common materials for producing composite film structures depend on the performance desired and include:

- High Density Polyethylene (HDPE)
- High Molecular High Density Polyethylene (HM-HDPE)
- Low Density Polyethylene (LDPE)
- Linear Low Density Polyethylene (LLDPE C_4/C_8)
- Nylon 6 (PA-6)
- Ethylene Vinyl Acetate Copolymer (EVA)
- Ethylene Acrylic Acid Copolymer (EAA)
- Polyester (PET)

These polymers are used either in co-extruded films or in laminates.

Structures and Critical Polymers

Structures

Based on the requirements, various laminated, 3 and 5 layer co-extruded structures have been developed. They include:

- Typical Laminate Structure-PET + Adhesive + 3 Layer co-extruded LD/LLD film with primacor (EAA) as sealant layer
- Typical 3 layer co-extruded film consists of LD+ LLD-HM HDPE-Primacor (EAA)
- Typical 5 layer co-extruded film consists of LD+LLD-Tie-Nylon 6-Tie-Primacor (EAA)

These structures have one common polymer, i.e. Ethylene Acrylic Acid Copolymer for the sealant layer, and it provides an excellent seal integrity through oil contamination, good hot tack and lower seal temperature. The EAA could also be replaced by octane based LLDPE.

Generally HDPE blends with LD/LLD provide low MVTR in the co-extruded film and also avoids excessive stiffness in the film which may result in failure during drop test.

For low OTR, either Nylon-6 or Polyester or other like polymers can be used depending on the structure and shelf-life required.

Critical Polymers

- PRIMACOR* (Registered trade mark of Dow Chemical Co., USA) Ethylene Acrylic Acid Copolymer (EAA)

  In general, the performance of ethylene acrylic acid copolymers improves with increased percentage of acid copolymers and its characteristics can be summarised as follows:
  - Seal integrity:
    - Excellent sealing through oil contamination
    - Minimum seal strength deterioration over the period of shelf-life
    - Withstands longer transportation

- Ease of processing
- Insensitivity to moisture under normal conditions
- Low sealing temperature
- Excellent Hot tack

- Linear Low Density Polyethylene (C_4 & C_8)

  The success of the flexible pouch for packaging of edible oil and vanaspati has to a large measure, been on account of the LLDPE content in the structure.

  LLDPE is a narrow molecular distribution copolymer having butene-1and octene 1. In film form they have:

  - Good impact strength
  - Tensile strength
  - Good puncture resistance
  - Excellent hot tack seal strength

  The blending of LLDPE with LDPE resin gives excellent hot tack and seal characteristics.

  LLDPE with octene copolymer provides superior performance with regard to tensile strength, toughness, impact strength, stress crack resistance and tear resistance, excellent hot tack and sealing through contamination etc.

- Metallocene Polyethylene

  As compared to polyethylene resins made by using standard catalyst, the metallocene technology claims to offer better strength characteristics, better oxygen and moisture barrier characteristics, high clarity and greater toughness.

- Ionomer (Surlyn)

  The ionomers are tough, transparent, having high tensile strength, low softening point, good abrasion resistance and good oil resistance. The most important properties of film are:

  - Heat sealability and hot tack strength
  - Excellent optical properties
  - Resistance to oil and co-extrusion with nylon with excellent adhesion.

- NYLON-6

  Nylon-6 based multi-layer film has unique combination of properties such as:

  - High barrier
  - Aroma retention
  - Puncture resistance
  - High burst strength

- Tie Layer

  In a 5 layer structure, the tie layer is being used for bonding two different polymers such as Nylon-6 and PE. Primacor can also be used as bonding layer since it offers good adhesion

to both Nylon-6 and PE. As Nylon-6 is sensitive to moisture and picks up moisture during processing and weakens bond strength, grafted copolymers are being used as tie layer in 5 layer structures, to overcome this.

- Polyester

  PET is being used for lamination with co-extruded film, which enhances properties such as:

  - MVTR/OTR
  - Excellent printing
  - Aroma retention
  - Excellent burst strength in the pouch

A shift to flexibles stands to offer many advantages, primarily in terms of cost to the consumer and overall economy. One should, however, not lose sight of the critical needs a flexible medium and pouch should satisfy. The other important aspect relates to secondary and tertiary packaging, as unlike the rigid tinplate or plastic containers, the pouch does not offer any contribution in the performance of the total system.

A Closer Look

The distribution of edible oil and vanaspati – common essential commodity for the masses, assumes greater significance as the days progress. The growing health and hygiene problems due to adulteration and increasing per capita consumption has increased the demand for safe delivery of the product to the consumer. What is, therefore needed, is packaging at its most economical level.

Flexible Plastics as Economical Media

If one compares the product sale cost v/s the packaging cost for various types of packages, the most economical pack would be a flexible pouch.

Flexible Plastics as Effective Solid Waste Reducing Media

While selecting a packaging medium, its effect on the environment needs to be considered, as solid wastes are causing problems. Flexible plastic pouches, in comparison to other packaging systems, stand to offer an advantage in reducing solid waste, as they are lighter in weight. Considering a pack of 1litre, the approximate tare weights of different packaging media would be:

Tinplate Container	: 63 grams
HDPE Container	: 40 grams
PVC/PET Container	: 22 – 28 grams
Tetra Pack/Lined Carton	: 30 – 35 grams
Flexible Plastic Pouch	: 9 – 13 grams

Moreover, flexible pouches can be recycled and reproduced for other non-food packaging applications or as building materials etc.

Indian Standards for Packaging of Edible Oil, Vanaspati and Ghee

A variety of packaging materials/package types are used by the oil, vanaspati and ghee industries. The Bureau of Indian Standards has drawn up specification details/ requirements, method of sampling, tests of different packaging materials/packages used by the industry. Table 6 gives a list of Indian Standards related to packaging of edible oil, vanaspati and ghee.

TABLE 6
Indian Standards Related to Packaging of Edible Oil, Vanaspati and Ghee

Number	Description
IS : 10325 – 1989	Square tins – 15kg/litre for ghee, vanaspati, edible oil and bakery shortenings – specifications
IS : 10339 – 1988	Specification for ghee, vanaspati and edible oil tins
IS : 10840 – 1994	Blow moulded HDPE containers for packing of vanaspati – specification
IS : 12887 – 1989	Polyethylene Terephthalate (PET) Bottles for Packaging of edible oil – specification
IS : 12883 – 1994	Poly Vinyl Chloride (PVC) bottles for edible oil specification
IS : 14129 – 1994	Flexible packaging materials for the packing of vanaspati in 10kg and 15kg packs – specification
IS : 11352 – 1994	Flexible packaging materials for the packing of vanaspati in 100g, 200g, 500g, 1kg, 2kg and 5kg packs – specification
IS : 12724 – 1989	Flexible packaging materials for packaging of refined edible oil – specification (Under Revision)

Legislations

On account of being essential commodities, the edible oil, vanaspati and ghee are subjected to the following regulatory legislations:

- Prevention of Food Adulteration Act
- Directorate of Vegetable Oil Products
- Bureau of Indian Standards
- Directorate of Agricultural Marketing and Inspection
- Food & Drug Administration & Rationing Offices of State Governments in Essential Commodities Act
- Ministry of Civil Supplies
- Package Commodities, Weights and Measures Act
- Occasional interstate transport restrictions imposed by State Government

Studies Conducted at IIP

Refined Groundnut Oil in Flexible Plastic Pouches

Shelf-life studies of refined groundnut oil was carried out in co-extruded films of three compositions at accelerated conditions of 38°C ±1°C, 90% ± 2% R.H. and at standard conditions of 27°C ± 2°C, 65% ± 2% R.H.

During the exposure period, samples were drawn at regular intervals of time to assess the keeping quality of oil. The observations/tests were carried out with respect to:

- Percentage moisture content
- Percentage free fatty acid (as oleic acid)
- Peroxide value
- Colour/clarity
- Odour

The shelf-life obtained in the three materials at both the sets of storage conditions is given in Table 7.

TABLE 7

Shelf-life of Refined Groundnut Oil in Co-extruded Flexible Plastic Pouches

Sr. No.	No. of Layers and Total Thickness	Material Composition	Shelf-life in Days	
			Acc ·	Std ··
1.	5 layers 95-100µ	28µ PE - 7.5µ TIE- 20µ PA 6 - 7.5µ TIE- 32µ EAA	30	90
2.	3 layers 95-100µ	PE – PE – 30µ EAA	22	48
3.	3 layers 105-110µ	HM + LLD – LLD – 35µ EAA	22	52

Film 1 is clear, films 2 & 3 are yellow pigmented.

. Accelerated conditions of 38°C ±1°C, 90% ± 2% RH.

.. Standard conditions of 27°C ± 2°C, 65% ± 2% RH.

Refined Bleached Deodourised Palmolein in Flexible Plastic Pouches

Shelf-life studies of RBD Palmolein were carried out in a similar manner as in the case of groundnut oil. However, the packaging material compositions were different. In all, seven materials were evaluated, of which three are laminates and four are co-extruded films.

The results of the studies are indicated in Table 8.

TABLE 8

Shelf-life of RBD Palmolein in Flexible Pouches

Sr. No.	Material Composition	Shelf-life in days	
		Acc*	Std**
1.	12µ Polyester/60µ LDPE/ 25µ Surlyn – (Laminate)	30	118
2.	12µ Polyester/60µ LDPE/ 25µ EAA – (Laminate)	32	125
3.	12µ metallised Polyester/ 120µ LD– HD– (Laminate)	>57	152
4.	25µ LLDPE-5µ Tie– 25µ Nylon-5µ Tie- 25µ EAA (co-extruded)	25	120
5.	20µ EAA –5µ Tie- 25µ nylon-5µ Tie – 20µ EAA (co-extruded)	28	122
6.	30µ LDPE-5µ Tie- 30µ Nylon- 5µ Tie- 30µ EAA (Co-extruded)	29	127
7.	40µ HM–MDPE–20µ LLDPE – 40µ EAA	40	138

Samples 1,2,4,5 and 6 are clear films, sample 3 is metallised and sample 7 is yellow pigmented.

* Accelerated Condition of 38°C ± 1°C, 90% ± 2% RH.

** Standard condition of 27°C ± 2°C, 65% ± 2% RH.

Conclusion

The family of edible oil, vanaspati and ghee is indeed a large one of a different product mix. The variations also make them differ in behavioural pattern to climatic and market environs, though rancidification is the major quality degradation parameter. The consumption pattern of these products is also linked to the demography and age old culture of the people settled in different regions of the country. However, the range finds market outlets in the major cities, where the population is heterogeneous in character.

Thus, the proportionate quantity wise consumption is also staggered. The regional based oil and fats require a lower chain of network whereas the metros and popular brands require a relatively longer chain of network. The family practices and joint family has an influence on the mode of buying in institutional type packs.

Over the years, the purchase of these products in loose form is the practice. This could be attributed to many reasons, a major factor being a very high percentage of consumers belong to daily wage earning group. The other interesting argument is that many outlets have their own crushing units and therefore the oil sold is fresh.

A high percentage probably over 52% is moved in institutional and higher bulks. Loose sale has been predominant with less attention paid to the associated problems depriving the consumers the real value in terms of quality and quantity. The consequent effect on health and hygiene is often overlooked. The use of reconditioned and reprocessed packaging media add to the evil.

With the gradually increasing per capita consumption and growing consumer awareness as well as increased capability to pay, the marketing of oil and fats is set to take a turn of change. The concept that the product in a pack gives more assurance and psychological advantage overrides that little extra cost. A package thus becomes the vehicle to ensure quality and quantity and the brand assumes relevance and significance.

The availability of variety of packaging media has lightened the marketing efforts providing a choice of selection to suit product range, market size, distribution pattern, display features, socio-cultural perceptions, etc. The country has witnessed the introduction of a large number of brands and surely many more will follow. A product of this nature for daily needs, demands a priority in terms of availability and safety.

A cross section of retail packs of the type of co-extruded and laminated structures, HDPE bottles, stretch blow moulded containers, bag-in-box systems and the aseptic tetra packs speak volumes for the industry and consumer realisation. With the pattern set in the right direction, it has now to take off. The processing centre has a key role to play, and as a beginning, should shift to retail packs at their plants itself and move towards consumer value based products with the technology back-up of a good quality product.

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