LECTURE 7

7.0 PLASTIC FILM CONTINUE

7.1 POLYVINYLIDENE CHLORIDE (SARAN FILMS)

Saran is a copolymer of POLYVINYLIDENE chloride and polyvinylchloride.

It is one of the best films for imperviousness to water vapour, gases and odour. This property together with its ability to shrink when treated by simple method has given it a wide scope for food package uses.

The form having the trade name of cryovac shrinks to the extent of 30% when immersed in water at 200 to 205^0F. The sarans are clear, have good mechanical resistance, low water vapoyr and gas transmission rates.

Uses for cheese, meats, sausages, dried fruits wrappers etc. saran films are highly resistant chemically and are varied in composition or given an appropriate coating to increases resistance to specific products. It takes printing and can be marked with a pen.

In heat sealing it tends to shrink away from sealing bars resulting in reduction of thickness and weakening of the film along the edge of the seal. In practice this effect is minimized by intensifying the application of heat and using very short heating period so as not to allow much time for shrinkage to take place. This produce is called impulses sealing. For heat sealing of sarans the heating bars are covered with TEFLON to prevent sticking on the bars.

STORAGE TEMPERATURE AFFECT THE PROPERTIES OF SARANS

1 year at 95^0F - lose 1/3 or shrinking ability

1 year at 115^0F - lose 1/2 or shrinking ability

At 40^0F - loss of shrinking ability

Stored below 40^0F SARAN loses pliability

The film is resistant to most solvent.

Saran was first produced in 1946. It was developed as a substitute for a natural rubber shrinkable film developed just before would War II when rubber had become scarce.

The Cryovac film is sxtruded by means of a special screw-type device.

A trapped gas bubble is employed to bring about the required orientation of molecules. Finely powered vinylidene-vinyl copolymer, mixed with plasticizers, stabilizers, dyes, pigments and other agents is fed in extruder is heated for the necessary time at accurately controlled temperature above the melting point.

The syrupy extrude passes through a circular die into COLD WATER, thus producing a super cooled tube of amorphous material using gas pressure, the tube is expanded to 4-times its super cooled diameter, causing the material to be strtched simultaneously in all directions. This orients the long chain lolecules bioxially to give the film its quality of uniform shrinkability.

(viii) Polyester

The ester polymer are films of unusual strength and of light weight they have various compositions, depending upon the identities of alcohols and acid from which they are formed. A popular type is polyethylene terephthalate, a polyester of ethylene glycol and TEREPHTHALIC ACID. This is called MYLAR. Mylar was first produced in 1954.

It has a geat tensile strength elasticity and STABILITY over a wide range of temperature (-80^0-300^0F).

Used in pouches for frozen food as well as other products which may be heated to boiling water temperature. For this application polyester is laminated with polyethylene. The laminate is used in most “heat in pouch” packaging of food.

Manufactured in thickness from 0.00025-0.0075 inches. They are much more expensive than polyethylene, cellophane or cellulose acetate.

Polyester films are made heat-sealable by treatment with certain subsrances. One of these substance is BENZYL ALCHHOL. Sealing Bars are covered with TEFLON.

POLYESTER comes nearer than any other film used today to having properties required of a film for packaging sterilized foods.

It has strength and stability but does not meet the requirements for imperviousness to gases and water vapour.

Its melting points is 482^{o}F and thus high temperature sterilization is possible.

It has clarity and has good printability.

It is used for vacuum packing of products.

POLYPROPYLENE

High potential use of this film is anticipated in the food industry. Presently used for bakery and confectionery goods. It has low density, excellent strength and stability with good shrinking properties. The film may develop into a real competitor of polyester film for “heat-in-the-pouch” packaging.

RUBBER HYDROCHLORIDE (Pliofilm)

Produced from Natural rubber by the addition of hydrochloric acid. It is stretchable, non toxic, good oil and greese resistance used for self service packages for meats, cheese. Bags lined with pliofilm are used for coffee, spices and cookie packaging.

The film has fairly good imperviousness to water vapour. But it is coated with other plastics to give it differing degrees of permeability. Has good film-to-film heat sealing properties. It is used in identical circumstances as polyethylene. It makes good laminates with a variety of other materials.

ALUMINUM FOIL

Advantages

1. Large covering area per pound of material
2. Opacity
3. Almost absolute imperviousness to water vapour and gas in higher gages and good imperviousness in low gages.

However, in thickness less than, 0015 in aluminum foil contains small perforations which makes it pervious to gases and vapours.

Aluminum foil is unaffected by sunlight, does not burn. It is non absorptive of water and thus does not exhibit dimensional change with variations in humidity. Intermetent contact with water has very little effect. But hygroscopic products packaged in thin foil may cause some reactions particularly if product contains salts and organic acids as do mayonnaise and cheese.

Use: candies, milk, unsalted meats, butter and Oleomargarine. Can be used safely with oils and greases. Commercially aluminium foils are not used with strong mineral acids which will cause severe corrosion but weak acids found in food products do not, have appreciable effects.

The only safe rule with new products is to make suitable tests. To protect aluminum foils against corrosive materials, protective coating may sometimes be applied.

Mechanical Properties of aluminum foil

Tensile strength of annealed foil = 8.5 Ibs/in of width/mil of thickness. Strain hardening increase tensile strength for bursting and tearing while the tensile strength is relatively high, advantage cannot always be taken of it in foil packages. Economic considerations may dictate the use of thinner gages with reliance on laminations with other materials e.g. plastic films or paper to increase strength.

One important property of aluminum foils is that they do not become brittle at low temperatures. Infact aluminum foil increases in strength and ductility as temperature is lowered down to 320^{o}F.

TESTS OF MEASURE CHEMICAL AND PHYSICAL PROPERTIES OF FLEXIBLE PACKAGING MATERIALS

BURSTING STRENGTH: (Mullen Burst Tester)

Increasing pressure of a rubber hydraulic bubble against sample of sheet or film, clamped between two jaws having coincident circular openings, bursts the sample which ahs closed the circular opening. Unit : (psi)

TENSILE STRENGTH AND ELONGATION (Baldwin Static – Weighing machine; Pendulum – Weighing machine)

Each end of a sample strip 1" wide is clamped between a pair of jaws. A load applied to one set of jaws, tending to stretch the sample is increased gradually until sample breaks in two.

Units: (enlongation (%)

Tensile strength (Ib/in-width/thickness)

GAS TRANSMISSION

Sample of sheet of film, sealed across an opening in wall of a vacuum chamber, transmits gas from outside to inside the chamber, causing pressure in chamber to increase

Unit: (cc/100 in^2/24 hours).

WATER VAPOUR TRANSMISSION

Sample of sheet or film, sealed across mouth of a cup containing a substance that absorbs water readily, transmits water vapour from atmosphere at 90% R.H. at 100^oF outside cup causing dessicant to increase in wt.

Unit: (grams/100 in^2/24 hours).

GREASE RESISTANCE

Sample of sheet or film of specified size (4" x 4") intimate contact with white paper is treated on the other surface with test reagent (grease or oil).

Unit: time (minutes or hours) required for first appearance of stain on the paper.

AGING

Sample of packaged product is alternately exposed to different aging conditions, such as wet and dry heat at 160^0F. extreme variations of temperature.

Extreme variations of R.H.

Various types of rays or extreme variations of free oz-concentration.

At proper intervals, sample is examined for product deterioration, changes in wt and dimensions, dulling, crazing (i.e. collapsing), warping and discoloration.

OTHER INSTRUMENTS

OTHER INSTRUMENTS ARE LISTED AS FOLLOWS

S/N	Instruments	Property Tested by Instrument
1	Tear Test (Elmendorf)	Tear resistance (gram/mil)
2	Folding Endurance or stiffness Tester (MIT)	Pliability or resistance to bending
3	HEAT SEALER	Temp. Required to seal (^{o}F)
4	Size Tester	Moisture absorptiveness (% increase in wt)
5	Climatizer or Testing Cabinet	Holds controlled conditions of R.H. and Temperature
6	SPI TESTER	Flammability