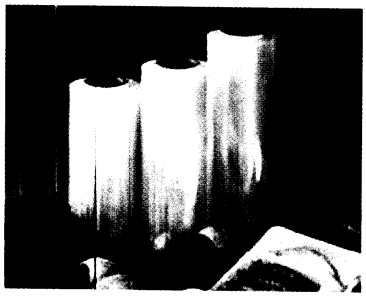
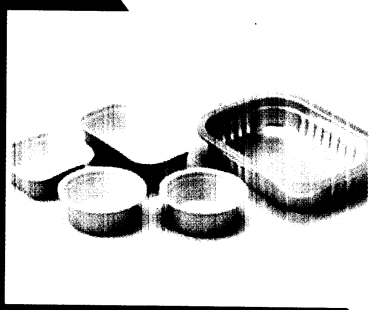
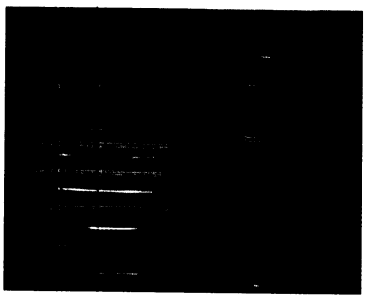
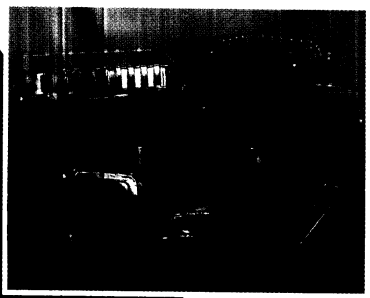
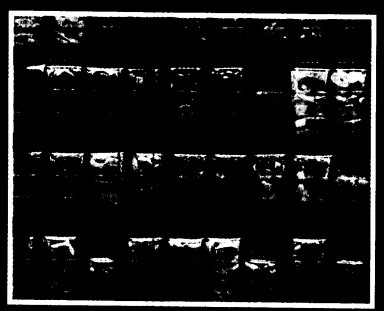
PRACTICAL MANUAL

Food Packaging Technology

B. Tech (Food Technology)

Course No.: FPT-121
Course Credit: 3 (2+1)

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Certificate

This is to certify that Shri/ku._____

Reg. No._____ has completed the practical read book of Course No. FPT-121(Food Packaging) as per the syllabus for B. Tech. (Food Tech.) first year II semester as prescribed by MCAER, Pune and his attendance is _____percent.

Date:

Course Teacher

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EXPERIMENT NO. 1

Measurement of thickness of paper and paper boards

Object: To measure the thickness of paper and paper boards

Theory-

The thickness as measured in this method is defined as the perpendicular distance between the plain surface of the paper or paper board.

For many purposes it is important that thickness of paper and paper board be held to a minimum variation. The operations such as printing, use on high speed packaging machines etc. demand that the variation in sheet thickness be held to a minimum since it is very difficult to maintain the same thickness of sheet across the entire width of a paper machine. It is necessary to measure thickness across the web of the paper and to take sufficient samples to get true average for that particular run of paper

Equipments –

1) Motor operated dial type micrometer
2) Spring loaded dial micrometer
3) Micrometer screw guage
4) Vernier caliper

Conditioning –

Sample under measurement is conditioned at 27^0C and 65% R.H. and all tests are performed.

Procedure -

Take the specimen paper/paper board and measure the thickness of the sample using all the micrometers. Show all readings and calculations

Observations

EXPERIMENT NO. 1

Sr. No.	Sample	Micrometer reading	Spring micrometer	Screw guage	Vernier caliper

Results _____

Report:

a) Corrected values of average, maximum and minimum obtained on each specimen
b) Paper results should be reported to be nearest value of 0.0025 mm and paper board results to 0.025 mm.

Note:

1) Any large difference in readings on the sample.
2) Any differences in the average thickness of the sample measured with dirrerent micrometers.
3) Thickness measured are affected by
4) Thickness of paper and paper board is measured is mms. of miles or points (1 mil=1point=1/1000 inch) for flexible film the unit of measurement is gauge. (100 gauge=1mil=0.001 inch = 0.025 mm)
   The distinction between paper and paper board is usually made on the basis of thickness. In general all fibrous materials of 0.012 inch (0.3mm) and thinner are called as paper
   Anything of 0.012 inch and above is called paper board.

EXPERIMENT NO. 2

Measurement of basis weight of the paper and paper board

Object: To measure basis weight of paper and paper board

Theory

Since the paper and paper boards are generally bought and sold on a weight basis but used on area basis. It is important that the material should be of specified weight per unit area. Any divergence from the proper weight will result in more of less square footage than is desired. It may also result in a material that is too heavy or too light for the intended use.

Apparatus –

Balance with a sensitivity of 0.001 mg or better. A balance may be a specially constructed sheet weighing device that indicate that basis weight in gram per square meter when are sheet of a given size is weighted. For small sample, an analytical balance is essential to obtain the required accuracy.

Equipments

Analytical balance
Graduated steel rule
Paper cutter

Procedure –

1) From each test unit of the sample of paper, not less than two representative sheets each at least 500 sq c.m. in area shall be selected.
2) From each test unit of the sample of paper board not less than five representative sheets each at least 1 sq ft. in area shall be selected.
3) Cut a piece of paper or paper board of 10 cm x 10 cm size exactly.
4) Weight the representative sample accurately on five digit balance in grams.
5) Multiply the obtained weight with 100 to get the basis weight of a given paper.

Observations

Sr.No.	Sample/paper board	Weight of 10x10 cm	Basis wt

Results

Basis weight of given

1) Paper is _____
2) Paper board is _____

EXPERIMENT NO. 3

Measurement of water absorption of paper and paper board.

Object: To measure water absorption capacity of paper

Theory-

This test is intended to find the penetration of aqueous liquids in to paper and paper boards. This test will help in guessing the extent of sizing materials added in paper during manufacture. The test is particularly useful in assessing the suitability of corrugated and solid fiber boards to be used for shipping containers. Which are likely to be exposed to water sprays.

Equipments

Cob test apparatus
Measuring cylinder
Stop watch
Blotter, soft absorbent cloth, or bottling paper

Procedure

The specimen holder consist of metal cylinder of 10 cm inside diameter. The cylinder is clamped tightly over the specimen paper, which in turn is supported underneath by a rubber mat placed over a flat metal base. With this set up, by making use of measuring cylinder, a water column of 0.5 to 1 cm height is allowed to stand on a specimen for a pre set time (2 minutes generally). The weight of the water absorbed is found out by weighing the wet sample, from this reading weight of water in grams that will be absorbed by one square meter of the specimen sample is computed.

Instruction

1) In this weighing should be made to an accuracy of 0.01 gm.
2) During selection of specimen for test printed area should be avoided as also deformed or racked surface.
3) The weigh mentioned above should be performed quickly since evaporation of water from the specimer may cause serious errors is test result.

EXPERIMENT NO. 3

Sr.No.	Sample No.	Initial wt.	Final wt.	Area of paper	Wt. of wat/sq meter

Result

Water absorptive capacity of a given paper is _____ gm/sq.m

Report

1) Give the test duration and number of tests conducted.
2) Report average weight of water absorbed in grams per square meter of the sample. If test is done on both sides of sample report the average cob values for two surfaces separately.

Note

1) In case of paper, the test is done on soft wire and felt side of paper.
2) In case of solid fibre board the test is done, only on the kraft pasted side of the board.
3) In case of corrugated boards, the test is performed on both the surfaces of the board the information as to which surface is going to be used as the outer surface in box.

EXPERIMENT NO. 4

Measurement of bursting strength of paper

Object: To measure bursting strength of paper

Theory-

The bursting strength test (Mullen test) gives an indication of tensile strength and stretch capacity of paper. It is one of the most widely used physical tests used in paper industry. It is simple and rapid. The bursting strength is resistance offered by paper to burst. The resistance or force applied is measured kg/cm^2 or $1b/cm^2$. It is also used to specify strength of components for corrugated board. The test is subject to serious error if equipment is not properly calibrated clamping pressure of the test specimen also influence the results to a marked degree.

Equipments

Specimen paper/board

Bursting strength machine

Procedure

Not less than ten specimens each at least 2.5x2.5 inch shall be obtained from each test unit sable. So as to be a representative sample.

Condition the sample according to IS:196/1950 and make all tests in the same standard temperature. Unless the approximate strength of the paper under test is known, make a preliminary test to determine the required capacity of the guage; to avoid overloading and possible damage to a guage.

Clamp the specimen paper property in position, apply hydrostatic of pneumatic pressure until the specimen raptures and record the maximum pressure registered in pressure guage. Watch carefully for any movement (buckling) of the clamp other specimen with increased pressure of clamp and repeat the test.

Make at least ten acceptable tests, applying on equal number of tests to each side of the paper.

Make no tests on areas containing water marks, creases, imperfection or visible damage.

After each test, return the indicator needle of the guage gently to zero.

Instructions

EXPERIMENT NO. 5

To measure the internal tearing resistance of a paper

Object: To measure the force required to continue the tear in paper.

Theory

This test is designed to determine the force (in grams centimeter) required to continue a tear already started, for a fixed distance. It does not give the force required to start a tear.

Internal tearing resistance of a paper is dependent upon grain direction, fibre length, degree of beating, density and surface treatment.

This property is important for all types of paper products which will be subjected to tearing strains in use. The test is used widely in the packaging industry, in use. The test is used widely in the packaging industry, and tearing strength frequently written in to specification.

Instructions

1) Test the samples supplied in accordance with the procedure. Try to distinguish wire and felt side.
2) Follows the procedure as per the instructions for use with the tear tester.
3) Condition the sample at 270C and 65% RH.
4) Use sufficient number of sheets in a specimen to get the readings between 25 and 75 on the tester.

Equipments The instrument used to carry the tour test is Elmendorf tearing tester.

Procedure – take a piece of paper of 64mmx74mm size. Cut the paper slightly at one corner and clamp the paper in two jaws of a machine. Apply force in opposite direction so that tear is propagated. Note the reading on dial at the point at which tear start propagating.

Report

1) For each principal direction the average, maximum and minimum of accepted test values of the force required to tear a single play.
2) Number of plies form at one time.
3) Make and model No.7 instrument used.

Sr.No.	Sample No.	Gram force

Results – Average grame force required to continue the tear is _____

EXPERIMENT NO. 6

To measure the resistance of a paper board and corrugated board to puncture.

Object: To measure puncture resistance of paper and paper board

Theory-

The resistance of paper board is one of the importance in manufacturing shipping containers and to a lesser extent in the manufacture of consumer package. The packages during transportation, storage and handling are bound to get exposed to various handling hazards. Therefore, puncture test gives an indication of the ability of container to resist the hazards during transportation. The puncture resistance is now gaining importance as a standard test for specification purpose (in particular for 7 ply corrugated boards) because of its relative advantages over burst. The puncture test gives much better assessment of the combined board strength than the burst strength and also appears to have better correlation with package performance against impact.

Conditioning

Condition the provided sample at 270C and RH 65% and then perform the tests in the same atmospheric condition.

Equipments -

TMI beach puncture tester.

Instruction and Procedure

1) The machine has four scales, which enable the operator to obtain values for a wide variety of materials. To scale 1 No. weights are used; the weight supporting stud is removed. To use scale 2 the stud and weight A is used. To use scale 3- weight A and B are used. To use scale 4- weights A-B and C are used
2) Never release the pendulum unless a sample is in place
3) Never test on unknown sample with the weights on.
4) Failure to observe 2 and 3may result in damage to the machine.
5) To test on unknown sample proceed as follows.

a) Raise pendium and lock in place by means of latch.
b) Place collar on puncture points.
c) Remove all weights and the stud.
d) Use always samples of size not less than 30 cmx 30 cm
e) Place the sample in clamping jaw.
f) Release the pendulum, if the pointer fails to go through the sample for enough to make clear torn, then add the stud and weight A continue this procedure until pointer produce a clear torn in sample.
g) Before each test, keep the pointer one inch away (on the positive side) from the expected reading.

Observations

Sr.No.	Sample No.	Weight added	Clear puncture noted Yes/No	Scale reading

Result- Puncture test for given sample is _____ in /sq inch.

Report

Puncture test results are reported as inch-ounces per inch of the tear as shown on the scale and also as joules per meter (1 in 02/in. tear=0.2785 J/m) the report for puncture test shall include the following

1) Test conditions.
2) Instruments scale used.
3) No. of tests made in each orientation.
4) Average result for test made in each orientation.
5) Over all average results and.
6) Maximum and minimum values obtained

EXPERIMENT NO. 7

To determine the static and dynamic tensile strength of paper

Object: To find resistance of paper offered to rupture under pulling force

I Static tensile strength

The tensile test gives an indication of the resistance of a paper to rupture when subjected to a puling force applied parallel to the plane of the sample. This property is important in case of many packaging materials which are subjected to direct tensile stresses, for ex. Tapes, wrapping paper, bags etc. It is important to consider in any operation where paper is being fed directly from the roll to some other equipment, such as, certain type of printing, coating, laminating etc.

The strength of paper (elongation) refers to increase in length parallel to the direction of force applied, when paper is subjected to tensile stresses.

Conditioning- Condition the sable at 27^0C and 65% RS and perform all the tests in the same atmosphere.

Equipments - Good brand tensile tester and Vender korpat barn tensile tester.

Procedure

1) For each principle direction to be tested, cut at least 10 specimens with clean and parallel edges to a width 15MMx15cm.
2) Avoid abnormalities, water marks and wrinkles.
3) Avoid touching the portion of the specimen that shall be clamped between jaws.
4) Tightly clamp one end of the specimen in the fixed jaw and other end in other jaw, after checking its alignment, tighten the latter and apply the load.
5) Reject the readings for individual specimen if the specimen slips, or breaks at the edge of the clamp.
6) Record the results of each individual breaking load to the nearest three significant figures.
7) Compute the average breaking load and preferably also the standard deviation for each direction tested.
8) Test at least 10 specimens, cut in both principal directions of paper, enters the strength in only one direction is required.

Observation

Sr. No.	Sample No.	Dial reading	Tensile strength

Report- Report the average of the breaking load calculated either in kg/15 mm of lbs/inch also record the % of elongation in each care.

Note –

1) Tensile strength is influenced by kind, quality and treatment of fibre constituents and also by the way the sheet of paper is formed as the paper machine.
2) The strength if influenced by A) Composition B) Formation on machine C) Moisture content D) other operations like coating, creping etc.
3) One advantage of tensile strength over burst test is that the tensile strength property can be measured in both the principle directions so that any abnormality can be easily located.

II Dynamic tensile test

This test measures the energy required to break a specimen of specified dimentsions by subjecting it to an impact strength. This test is useful for papers used in the construction of multi wall paper bags, at it gives an index to the capacity of the sample to absorb impact shocks.

Conditioning-Condition the paper as above

Equipments – Vender korput barn tensile tester.

Procedure –

1) This test is performed a pendulum type of tensile tester.
2) Specimens are prepared in the same way as for static tensile test and test length of sample should be preferably 18 cm.
3) Before commencement of the test, the instrument is corrected to zero error.
4) The pendulum is released to swing freely with the pointer on its initial mark. It the pointer does not come to zero, either friction on pointer or the position of appropriate nut on the pendulum is adjusted to attain the zero coincidence.

5) The sample specimen is then clamped between the grips.
6) Pendulum is raised and kept on its starting position.
7) The test sample now take a " shape"
8) On releasing the pendulum the sample breaks and the pointer registers the energy spent in breaking the sample. The procedure is repeated for other samples also.

Observations:

Sr. No.	Sample No.	Readings of dynamic tensile strength cm kg.

Report –

1) The test results in cm kg
2) Values are reported separately for two principal directions.
3) Maximum, minimum and average values in each care should be represented.
4) The conditions should be mentioned.

EXPERIMENT NO. 8

Determination of grease resistance of a paper

Object: To find the resistance of a paper and other packaging materials for its grease resistance.

This method covers the determination of the grease resistance of a paper by turpentine test. It gives accelerated comparison of the relative rates at which ordinary oils or greases such as commonly found in food stuffs may be expected to penetrate papers like uncoated or unimpregnated greaseproof, glassine and vegetable parchment paper.

Equipments –

1) Tube- A tube of metal or glass, 1" inside diameter and not less than 1: in length with smooth ends.
2) Pipette- A pipette calibrated to deliver 1.1ml solution.
3) Sand- A round grained, natural silica sand and graded to pan a No. 20 sieve.
4) Brook paper – Sheets of 80 lb paper.
5) Stop watch- Thirty samples which are representative of the specimen paper are to be tested. 15 papers on felt side up and 15 on the wire side up. The test specimen should be conditioned for 27^0C and 65% RH.

Procedure –

Determine the felt and wire side of the paper sample. Place each specimen on a sheet of the book paper which rests on a smooth plain glans surface, below which is an adjustable mirror is placed.

Place 1 tube on a specimen and put 5 gm of sand in the tube. The purpose of the tube is solely to assure a uniform area of the sand pile. Using the dropping pipette, pour 1.1 ml of the coloured turpentine (a suitable dye is sudan IV) to the sand note the time required and observe the coloured stain of turpentine on paper

Adjust the mirror and the eye level from which under layer (part) of the paper is clearly viewed.

As soon as the first stain appears on the book paper, work the time.

Record the elapsed time in seconds, between the application of the turpentine and the appearance of the first definite red stain, as the transudation time.

Sr.No.	Paper sample	Felt side	Wire side	Time in seconds

Report –

The report shall include the following

1) The number of specimen tested
2) The maximum, minimum and average time in seconds required to transudation of turpentine through paper.
3) All the reports over 1800 seconds should be reported as 1800+se

EXPERIMENT NO. 9

Determination of gas transmission rate of packaging films

Object: To find the gas transmission rate through package material.

Theory

The permeability of packaging materials to gases such as O_2, CO_2, N_2 etc an important parameter in deciding the suitability of the materials for a particular package. The self life of consumer package for frozen foods, instant coffee, fresh produce, fat and oily foods, meat and meat products, fish and fish products etc is dependent on the gas permeability rates of the package material used.

The gas transmission rate of a packaging material is defined as the volume of gas flowing through two parallel surfaces at a steady state condition, through unit area of the material in unit time under unit pressure, under the condition of the test. The gas transmission rate (GTR) is usually expressed as CC/24hrs/sq. meter/atmospheric pressure.

Procedure –

The permeability cell consist of two stainless steel discs and machined depression in each dish form a cylindrical cavity when the disc are superimposed. The packaging material to be tested is clamped tightly between two discs by means of fix equally spaced bolts. The bolts are tightened after placing three rubber gaskets (as a support and to prevent any gas leakage from other side). The cell also consists of a glass capillary connected is a vertical position to an opening in the centre of the upper disc. Suitable gas inlet and vent lines are also provided on both sides of the cell.

The gas is supplied at constant over a atmospheric pressure to the bottom of the cell and the permeated gas is allowed to expand on the opposite side against atmospheric pressure. A short plug of mercury contained in capillary is displaced upward by the permeating gas. The movement of this mercury plug offers a direct measure of the rate of permeation of the gas through the packaging material. To avoid friction to the movement of the plug, the capillary is vibrated during measurement by means of on electromechanical vibrator.

The change in volume of the permeate is measured as a function of time. Plot the displacement of mercury v/s the time on a graph and draw the line through the points obtained and measure the slope of line.

EXPERIMENT NO. 9

Observations

Sr. No.	Sample No.	Area	Displacement mercury	Time	Slope of graph

Calculations -

The gas transmission rate of the transmitted gas is calculated from the formula

$GTR = \frac{Vx6.566x10^{10}}{AP}$ CC/24hr/m^2/atmosphere

Where A- Area of the specimen is cm^2 (9cm fixed diameter of the equipment)

P- Test gas pressure differential com. Hg

V- Volume of gas transmitted through specimen = slpoe x a.

Slope = rate of rise of capilaly plug cm/second

A= Cross sectional area of capillary cm^2 (capillary dia meter is 0.12cm)

EXPERIMENT NO. 10

Determination of water vapour permeability (water vapour transmission rate) of packaging material

Object: To find the WVTR of a package film

Theory –

The permeability of a packaging materials to water vapour is an important property to decide is suitability for food packaging. The self life of consumer packages for frozen foods, baked goods, instant coffee, dehydrated foods, and fresh produce etc is dependent directly on the moisture permeability rate of the material used. Also the ability of many military packages to protect their contents from yeast and mold is directly dependant on the ability of package to keep water vapour out side the package.

Method –

Certain quantity of desiccant enclosed in a aluminium dish sealed by specimen of the material is placed under constant temperature and humidity condition and rate of water vapour transmission is computer from the rate of increase in weight of the dish assembly.

Procedure

Fill the aluminum dish with desiccant to within 6 mm of the specimen. Leave enough space, so that shaking of the dish which must be done at each weighing of the dish in the upright position, is to be carried out.

Seal the specimen film to the opening of the dish in such a manner the leakage of water vapour at and through the edges is prevented.

Weight the assembly on analytical balance. Then place the assembly on a rack in a test chamber maintained at 37.8^{0}C and 92% relative humidity.

The specimen may be placed in either the upright position or inverted position so that the desiccant is in direct contact with specimen. This latter position is preferred for specimens having a high rate of water vapour transmission, but care must be taken to ensure that the seal is not broken of the surface the specimen is not damaged.

Make successive weighing of the assembly at suitable intervals until a constant rate of gain is attained.

Weighting should be accomplished without removal of test dishes from the controlled atmosphere, it removal is necessary, the specimen must be tightly covered and weighting should be made immediately after removal of the assembly and then returned to the test chamber immediately after each weighing.

Plot the results against time, terminate the rest of change the desiccant before the moisture pickup by the desiccant exceeds 10% of its starting weight.

Instructions –

Test shall be made on the given material following the above procedure with the details given below.

a) When all dishes are ready, weight to four decimal places on electric balance.
b) All dishes must be weighed periodically during the next few days. At least three additional weighing must be taken, space weighing interval as evenly as possible.
c) Plot the graph in weight gain (gm) V/s time (days) and calculate WVTR from the slope of graph, as grams per sq.m per 24 hrs.

Sr. No.	Sample No.	Weight gain (gm)	Time (Days)	Slope of graph

EXPERIMENT NO. 11

Determination of tin coating by clarke's test

Object: To find the amount of coating on a tin plate.

Clark's test has been slightly modified to determine the thickness of tin coating on a tin plate. Tin coating weight on both sides can be determined separately by this method.

Procedure –

Tin plate specimen with suitable area of 35 cm^2 to 100 cm^2 is first degreased with carbon tetra chloride dried and weighed accurately on a sensitive balance.

One surface for the specimen is coated with bees wax. The firs coating is applied at about 90^0C both vertically and horizontally to ensure perfect coating an second coating is applied at 75^0C in the same way with the help of cotton swab.

The other surface of the specimen is degreased with a piece of cotton deeped in carbon tetrachloride.

The specimen is immersed in antimony tri chloride solution in such a way that the wax coated surface is at the bottom and tin surface facing upwards until about 1 minute. After all gas evaluation has ceased

The specimen is then removed from solution, washed immediately in running water and loosely adhering deposit of antimony removed by soft cotton wool swab.

The was coating is removed by melting and rubbing with cotton and thoroughly degreased with carbon tetrachloride

The specimen is dried and weighed again. The difference in weight of initial and final is calculated and expressed as g/m^2 or 1bs/bax.

A correlation is made for the amount of iron tin alloy layer. The correlation is minus 0.35g/m^2 or 0.0156 lbs/base box on each side.

To find coating thickness on other side of box wax is coated to the surface on which tin coating has been removed and above procedure is repeated and weight of tin on other side is also expressed as g/m^2 or lbs/bas box.

It the tin can is lithographed or lacquered, the tin coating weight is determined on the plane surface by coating wax to the lithographed of lacquered side first. Subsequently the lithograph or

lacquer is removed by following procedure and tin coating weight on that surface is determined in similar way.

Removal of lithograph or lacquer my quickly be done by dipping and shaking in the boiling solution of a mixture of 1 part of aniline and 10 parts of 12% ammonia for 1 to 2 minutes.

Observations

Sr.No.	Tin plate No.	Area of plate	Initial weight	Final weight	Different in weight	Gm Tin/m^2

Results:- The amount of tin on each side is _____ gm/m^2

EXPERIMENT NO. 12

Identification of plastic films

Object: To find the origine of a package material

Purpose –

To familiar with characteristics of various packaging films and to provide a method of identification.

Equipments

Tong, Bunsen burner, small beakers, solvents like, acetone, toulene ethyl alcohol, water, carbon tetrachloride etc. copper wire, (preferably with wooden handle) and various types of plastic filmes.

Procedure -- There are several methods to identify the plastic film of unknown origine.

1) **By visual examination** – By using the sense of touch, smell and hearing the noice of film one can identify the film to some extent. But this type of test require great knowledge of sense of experience. However these tests can narrow the further tests.

a. **By folding the film-** By the film in to several folds make a number of layers and observe the colour and clarity of the film whether it is crystal clear, hazy of yellowish in nature accordingly by referring to the table film can be categorized in one of the group. (refer table 1)

b. **By tearing the film-** The toughness of the film and the way in which the film tear propagate is to be carefully observed. Then fold the film, make a crease on film and try to tear the film on fold. This may be difficult for the films having high tensile strength. Some films may tear on nick very easily, some films may be difficult to tear initially but once the tear propogate then they tear very easily. This is a characteristics of some film, accordingly classify the film in accordance with table (refer table No.1)

c. **Burning the film** – Then burn the film, the way in which it burns will give the clue to its origine observe very carefully whether the film burns rapidly like a paper, burns poorly, or do not burn at all. Then also observe the edge of the film as it burns whether formation of bad at the edge is there or not. Then sniff the vapours carefully and also notice the colour of the smoke. Each type of the plastic will burn with different smell. (refer to the table 1) and classify the film accordingly.

d. Copper wire test- Some films particularly venyl and rubber films give characterstic green colour with copper wire. A clean copper wire is heated red hot and touched to the unknown film and then again put the copper wire on flame. A green shooty flame indicate the positive test to venyl or rubber hydrochloride (refer table 1)

2) **By finding specific gravity of the film -** A more precise method for identifying an unknown film, but require some equipment and little more time is the measurement of specific gravity of the film several techniques can be used, but the simplest is to weigh a small amount of the material and put it in to a narrow neck flask. If necessary, cut is to small pieces. Add water up to the mark on the neck. Make sure that there are no air bubbles, trapped with the film. Use vacuum to draw air bubbles form bottle, if they are present. Weigh the filled flask, then weigh it filled only with water at the same temperature. If it is done very carefully, the difference in weight can be converted to specific gravity and compared with standard table to identify the film. (refer table no.2). A 25 cc pycnometer is designed for this type of work and is much more accurate than flask. Other methods of determining the specific gravity include floating the film in various liquids of different densities, until it sinks. For example, 50% methyl alcohol has a specific gravity of 0.92;44% is 0.93;38% is 0.94 and so an.

3) **By finding solubility of the film in different chemicals -** Another method requiring still more elaborate preparation, but yielding more accurate results is a chemical analysis based on solubility's of various film materials. Some care is necessary to avoid the hazards of fire, explosion and toxicity associated with solvents. The film is cut in to small strips of 1.5x6 cm size. The amount of solvent should be at least 10 times the volume of the material. The different solvents such as acetone, amyformamate, carbon tetra chloride, cresylic acid, cyclohexantone, diethyl formamlde, ethyl alcohol, formic cid, methyl alcohol, water and toluene are taken separately in small bakers and the separate strip is dipped in each respective solvent for few seconds. Remove the test strip from the solvent and observed the immersed portion whether the film is soluble or insoluble. (refer table 3).

Note –

- Thicker film may take longer time to dissolve.
- Do not use any one strip for successive testing.

4) **Identification by infra-red spectroscopy** – Probably the most sophisticated technique for identifying the plastic films is with infrared spectroscopy. This permits an examination of the molecular structure by means of light absorption at various wave lengths. The resulting curve can be compared with the charts of known material and in case of pure form of plastic, it will give reasonably accurate identification. The results can be however, confused by any additive, waiting, or blending materials that might have used during orienting the film.

Table-I Identification tests for plastic films

Types of films	Visual			Tear test			Burning test								
											Burns slows with a bead at the edge				
	Crystal clean	Yellowish clear	Hazy	Easy to tear (notified)	Stretches before tearing	Resist s tearing	Burns exploides	Burns the papers	Burns like wash drip wash odor	Burns like wash without dripping white smoke	Vinegar odor	Odor	Marigold odor like smoke	Sweet odor	Burn
Cellophone	X			X				X							
Cellulose acetate	X			X							X				
Cellulose acetate-butyrate	X			X								X			
Cellulose nitrate	X			X			X								
Nylon	X					X									
Polyester	X					X								X	
Polyethylene			X		X				X						
Polypropylene			X		X					X					
Polysryrene	X			X	-								X		
Polyvinyl chloride	X				X										
Rubber hydrochloride		X			X										
Saran	X														X

Table –II Solubilities of plastic films for identification

Films	Acetone	Amyl formate	Carbon tetrachloride	Cresylic acid	Cryclohexanone	Dimethyl formamide	Ethyl acetate	Ethyl alcohol	Formic acid	Methyl alcohol	Water	Toluene (boiling)
Acrylic			I				S			I		
Cellophane	I											
Cellulose acetate	S											
Cellulose butyrate	S											
Cellulose nitrate	S	S					S	I				
Cellulose propionate	S											
Nylon			I	S	I		I		S			I
Polycarbonate			S				I					I
Polyester	I											
Polyethylene	I		I				I			I		S
Polypropylene	I		I				I			I		S
Polystyrene	S		S				S			I		S
Polyvinyl alcohol											S	
Polyvinyl chloride	S		I		S	S	I					I
Rubber hydrochloride			S				I			I		S
Saran	S		I		S	S	I					I

Table- III Densities of plastic films

Film	Density	Film	Density
Polypropylene	0.90	Cellulose propionate	1.21
Polyethylene	0.93	Polyurethane	1.24
Polystyrene	1.07	Polyvinyl alcohol	1.25
Rubber hydrochloride	1.11	Cellulose acetate	1.30
Nylon 6/6	1.14	Cellulose nitrate	1.38
Polyester	1.15	Polyvinyl chloride	1.40.
Cellulose butyrate	1.18	Cellophane	1.44
Acrylic	1.19	Saran	1.68
Polycarbonate	1.20		

EXPERIMENT NO. 13

To find the chemical resistance of the package films

Object: (1) To find chemical resistance of a package film

(2) To a quant the student with the behavior of the selected packaging material in presence of some of the food simulating solutions

(3) A secondary purpose is to a quant the compatibility of different packaging material with food

Material Required

30 test tubes with cork	Various plastic films such as
Sample stand	
Cutting knife	Polyethylene
1% soap solution	Polyvinyl chloride
10% citric acid	Saran (PVDC)
10% sodium hydroxide	Cellophane
Vegetable oil	Carboxyl methylcellulose
Hydrogen peroxide	

Procedure -

Cut 6 identical 1.5 x 10 cm strips of plastic film of each specimen.

Place these samples in position on the sample holder after making the materials designation.

Keep the sample holders in conditioning room and weigh each specimen precisely on the gramatic balance. Record the weight and return the specimen to its proper position in the holder. The weight recorded is called as original weight.

Leave the materials completely immersed in above solutions unit proper time say 30 min. 1 hr, 11/2 hr, 5 hr. 10 hr, 20 hr, 24 hr. etc. Then remove the specimen from the reagents one by one at a time.

Very carefully dry each specimen, with a filter paper, see carefully that all liquid and greasy material is completely removed from the surface of each specimen. Specimen taken from volatile solvents need not be rinsed. Specimens taken from soap solution, citric acid and sodium hydroxide should be thoroughly rinsed in water before drying.

Specimens taken from non volatile oils should be rinsed in a solvent such as ethanol before drying.

When all specimens have been properly dried, weight them precisely on the balance and record the final weights.

After weighing note carefully any signs of deterioration which the specimen amy exhibit.

Make following observations in each care.

1) Original weight of the film
2) The final weight of film after drying
3) The weight loss of gain
4) The % weight loss of gain
5) Any deterioration, spots, or breakage in the film.
6) Infer from the above observations the suitability of the film for packaging suitable type of product.

Observations

Sr. No.	Film No.	Chemical	Initial weight	Final weight	Weight gain/loss	Any deterioration

EXPERIMENT NO. 14

Pre packaging of fruits and vegetables

Object: To study the effect of pre packaging on quality of fruits and vegetables.

Theory-

For selecting the proper packaging material for packaging, the following things should be considered.

1) Oxygen and carbon dioxide permeability – The selected material should be sufficient enough to allow the respiration process to continue to keep the produce alive. It should not creat the conditions for an aerobiosis.
2) Water vapour transmission rate to check the transmission losses to minimize the wilting loss of bloom etc.
3) Transparency is necessary to increase consumer appeal.
4) The package should have good impact resistancy to with stand the abuses of transportation and handling.
5) Many of the commercially plastic films have got loss permeability to oxygen than required – hence to avoid anaerobic conditions aeration ventilations should be provided.

Procedure--

1) 100 guage and 200 guage low density polyethylene bags of the size 25x30 cmare selected for the experiment
2) 10 aeration vents are provided to give about 0.3% aeration to one set of low density polyethylene (100 guage bags – 6 numbers)
3) Select good quality brinjal, snap beans and carrots for the prepackaging study.
4) What the vegetables under tap water and spread in tray and keep under fantoremove excess of water.
5) Take 6 bags of ventilated low density poly ethylene (100gm) and 6 bags of ventilated (200 gm) bags.
6) Weigh about 0.5 kg of vegetable to each bag
7) Tie the bags tightly with twin and keep the bags at room temperature and at refrigerated conditions.

8) Weigh each bag after 2 days also observe the bloom, wilting, microbial infection, or any other defects and record it.
9) Continue the observations at every alternate day till the product is no more acceptable.
10) Take 6 bags each of unventilated LDPE 100 guage and 200guage bags.
11) Tie the neck of the bag along with rubber tubing tightly with a twin.
12) Weigh the content every alternate day and record the observations as above and also measure CO_2 built up inside the bag using Hartman and Brown CO_2 meter.
13) Continue the records until any spoilage, off flavour is observed inside the bag.
14) Calculate the % physiological loss of weight (PLW) at each weighing and plot PLW v/s time in day and CO_2 concentration v/s time in days and indicate the shelf life at two storage conditions.

Sample name	Storage (days)	100 guage		200 guage		Any other observation
		CO_2	PLW	CO_2	PLW	