Modern Food Packaging Technologies: Regulatory Aspects and Global Trends

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Week – 02
Lecture – 10

Dear friends, welcome to the NPTEL online certification course on Modern Food Packaging Technologies, Regulatory Aspects and Global Trends. In the past lectures, we have seen the different methods of making paper and paperboards. In this lecture, we will be discussing about the testing methods of paper and paper boards. The topics which we will be discussing in this section is testing of paper and paper boards that will include abrasion testing, appearance testing, grams per square meter, tensile strength, tensile strength when wet, box board research and development association that is the BRDF plywood test. The thickness, concora corrugating medium test, then core compression side to side flat crust test, the curl test, edge crust test, flat crust or corrugated board, grease resistance, heat shield testing, moisture content, opacity, surface strength, tear resistance, stiffness and number of double force. To start with the in numerous home town applications, paper is broadly utilized, tissue moves, kitchen towels, paper cups, paper plates, scratch pad, modern pressings etc. Paper has endless applications in different enterprises.

However, how might you choose which paper is a reasonable for which application or then again on the alternate ways each paper picked by you is ideal for your industry. Quality examination is ideal answer of these enquiries. Industry standard association like ASTM, ISO and so on have turned out various testing strategies according to the mechanical prerequisites. According to the structure of crude materials, the paper properties of material fluctuate.

Consequently you can anticipate that it should be brilliant smooth surface, high bursting strength etc. Now, we shall put some focus on various tests that are performed to check quality of papers and what these tests tell. The first of this is abrasion testing. This method determines the resistance of surfaces of paper and paper board to the action of abrasion either wet or dry by measuring abrasion loss. Abrasion loss is quite complex and involves many factors including fiber type, mate structure and any additives or bonding agents used.

Surface sizing may increase abrasion resistance. By combining abrasion test results with actual end use results, it is possible to predict the usefulness and suitability of a product for a particular application. The instrument consists of a horizontal turnable with

a center clamp which revolves at 70 to 75 rpm and which holds the test specimen. Two weighted special abrasives embedded rubber wheels rotate freely on the surface of the specimen. The specifics of the abrasion test are given in TAPPI that is the Technical Association of Paper and Pulp Industry Test Model T476 or ASTM D3884.

The second is appearance testing. It measures the relative appearance of paper and board with the image expert system. Achieving a uniform surface appearance can be particularly difficult when manufacturing coated grades. The degree of non uniformity that is mortal present on the coated surface depends on coating coverage and the opacity of the applied coating or coatings. The data collected by our image analysis system correlates with well with the visual ranking of a variety of coated board samples.

The gram per square meter, the grams per square meter or GSM of paper are an important factor that has a decisive impact on the quality as well as the strength of the paper used in different applications. The GSM is the weight of the paper in a square meter material. This gives a lot of information about the molecular weight as well the strength and quality of the paper. In addition to that it helps the manufacturer in deciding the process for further processing of paper. The GSM is a decisive factor in estimating the cost of paper.

The GSM of paper is measured with the help of GSM cutter and GSM balance. The GSM cutter is used for cutting a small disc from the sample and then it is weighed on the GSM scale which gives the actual GSM of the paper. Now, the tensile strength tensile strength of the paper is determined by the strength of individual fibers and the links between them. During the testing process the sample is subjected to the action of an external load causing its breakage. We record breaking length elongation at break and tearing load that is the tearing point.

The breaking length it is measured in kilometer it is an imaginary length of the paper in which the free hanging strip of paper breaks at the point of suspension. The elongation at break it is the relative elongation of a sample during the tensile is test at the moment of breakage. The tensile loading the tensile strength is measured in units of force per cross sectional area when it breaks under specified conditions. Tensile strength when wet the destruction of the paper stability is caused when external mechanical forces exceed the maximum strength. The tensile strength of the paper is determined by the strength of individual fibers and the links between them.

A soaking of the paper decreases the strength to 10 percent of its original condition. Hydrogen bonds are disrupted with the effects of water wet tensile strength is important feature for example, in shopping bags and wallpapers. Now, BRDA ply bond this is a

rolling or peeling ply board test that is used exclusively for multi ply product. This test was developed years ago by BRDA that is the Box Board Research and Development Association which is nowadays it is known as RPTA that is Recycled Paper Board Technical Association. It is very good at detection poor bonding between plies in multi ply products, but at the same time it is not heavily influenced by the internal bonding of the individual ply.

This test has been used for multi ply coated and uncoated paper boards as well as coated and uncoated cylinder board. Thickness caliper is the thickness of a paper or board. Caliper is expressed as points in the English system with one point of caliper represented 0.001 inch in thickness. In the matrix system caliper is expressed in micron unless otherwise stated TAPPI test model T411 is the standard procedure used for measuring caliper.

The caliper of combined board is also measured using TAPPI test method that is T411 to measure the thickness of the combined product. Concora Corrugating Medium Test that is CMT. The Concora Corrugating Medium Test measures the crushing resistance of a laboratory fluted strip of corrugating medium and provides a means of estimating the potential flat crush resistance of a corrugated board. The method uses a laboratory fluter to prepare a fluted strip of board medium. The flutes of this strip are then held in position with a piece of adhesive tape.

The prepared fluted test piece is placed in the compression tester and the compressive force at failure is measured. Core compression that is side to side flat crush. Core compression measures the side to side crush resistance to composite tubes and cores by compressing them in failure according to CCTI that is the composite can and tube institute test method T108. Prior to testing measurements are recorded of the core diameter wall thickness and core length. The cores are then placed into a compression tester and crushed at a rate of 2.5 inch per minute. The maximum load is determined when the load becomes constant or falls off by 5 percent. The maximum load is divided by the core length and the crushing strength is reported pounds per inch. Now, the curl test the curl is the tendency of paper or paper board to curl and roll up. Generally in the crush machine direction due to changes in relative humidity this is often referred to as CD curl.

Machine direction curl is often called roll set curl. Curl tendency can be measured using a variety of sample sizes and sample orientations. We measure curl at various relative humidity, but normally samples are tested at 50 percent relative humidity and 20 percent relative humidity. Normal paper size is 1 inch into 6 inches with the long dimension in the cross direction for measuring CD curl. Edge curl test that is ECT.

The edge crush test is a traditional corrugated box test for compression strength. Normally measure ECT using the clamp method to hold the sample according to TAPPI test method T 839. Many corrugated boxes are specified in terms of ECT expressed in pounds per inch. The test is performed on combined board with the flutes in the vertical or crush machine orientation. There is another ECT method that is the TAPPI test method 811 that uses wax to reinforce the edges and generally used on request.

Flat crush of corrugated board. Flat crush is a measure of the flute rigidity of corrugated board as it is compressed between two ridge platens. This test can be conducted according to TAPPI test method T 825. It is largely a measure of the performance characteristics of the corrugating medium and is measured on a 4 into 4 inch sample of the combined board. The force to failure is reported in units of PSI or kilo Pascal.

The test is appropriate for single phase or single wall double phased board, but not for double wall or triple wall corrugated board. Now the Grease Resistance Test commonly known as the KIT test. This method describes a procedure for testing the degree of repellency and or the anti wicking characteristics of paper or paper board treated with fluoro chemical sizing agents. Fluoro chemical agents may impart both organophobic and hydrophobic characteristics to paper though a reduction in the surface energy of the sheet. This is often done by a surface treatment of the fibers without the formation of continuous films.

This test was originally developed to allow paper makers to know when the applied fluoro chemical was incorporated into the sheet and the approximate level of grease resistance important. Testing involves placing a series of numbered reagents varying in surface tension and viscosity or aggressiveness on to the surface of the sample. The solutions are numbered from 1 the least aggressive to 12 the most aggressive. The highest numbered solution that does not stain the surface is reported as the KIT rating. Heat Seal Testing Heat sealing has a number of different packaging applications.

The Sentinel Heat Sealer has two independently heated patterns and can test a variety of nip pressures and dwell times. Heat generally test paper board materials and determine the degree of heat sealability by measuring the percent fiber tear from the substrate. These test provide a means for screening various coatings and laminating materials for a given application. Moisture content this test measures the amount of moisture in pulp paper or paper board as received by the method TAPPI T412 or after conditioning at TAPPI laboratory conditions that is 73 degree Fahrenheit and 50 percent relative humidity per TAPPI T550. A representative sample of the material to be tested is placed in a sealed pre weighed weighing tin and the initial sample weight is determined.

The weighing tin is then opened in an oven environment of 105 degree Celsius until the weight of the same no longer changes with time. The dry weight of the sample is measured and the percent moisture of the original sample is calculated. Paper making fibers naturally absorbs moisture from the environment and the amount of moisture in paper or paper board significantly affects strength and elasticity affects the strength and elastic properties. Now, the opacity, Opacity is a measure of the ability of paper to obstruct the passage of light through the sheet. Paper opacity determines whether text or graphics are visible from the opposite side of the paper.

Opacity is influenced by basis weight and filter or coating materials that are added to the sheet. Percent opacity is the ratio of the reflectance of a single paper sheet bagged with a black backing to the reflectance of the same sheet bagged with a white backing. If the white backing is a stack of the same paper, the opacity value is referred to as printing opacity and if the white backing is a surface with a 0.89 reflectance, the opacity value is referred to as contrast ratio. Surface strength, surface strength is a measure of resistance of the paper surface against pulling of the fiber or coating force.

When the perpendicular action is applied to the surface, surface strength is an indicator of eligibility for printing as printing inks and rollers caused influenced by cohesion to the fiber on the surface of the paper. When insufficient strength occurs, fibers along with the bond are pulled from the surface. Now, the tear strength, it is an amount of strength and needed energy at pre cut tear sample under specified conditions. A significant drop in values may be due to over drying of the paper. Higher values can be achieved by increasing the pulp milling, but only up to the point when fibers become too short.

Now, the stiffness, stiffness of the paper is its resistance against deformation by external forces. What is important is the nature of the paper making furnish from which the paper is made. The rigidity is increased by using short fiber pulp or by adding the starch. The stiffness depends on the corresponding relative humidity and moisture content.

Number of double folds, the folding resistance required for securities which are in practical world constantly bent and crumpled. It determines a point of material disruption at which the paper breaks. The high number of double folds is the common with maps and bank notes. Thank you very much for today.