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A review on the role of packaging: materials and methods involved in the process of food preservation

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ABSTRACT

Food packaging is an essential part of food processing industries. It surrounds, enhances and helps in the protection of the food product from processing till it reaches the consumer. The packaging sector currentlyrepresents 2% of gross national product in developed countries. Efficient food packaging methods such as vacuum, modified atmosphere and active packaging helps in preventing deterioration. Oxygen scavengers,carbon dioxide absorbers, moisture controlling agents prevent oxidative reactions and excess moisture in food and extend shelf life of the product. The choice of packaging material such as glass, plastic, paper, cardboard and metals will determine changes that occur in food products and degree of protection depends on water vapor and oxygen transmission rates. It is necessary to test the packaging materials with respectto thickness, grease resistance, gas transmission rate to ensure safety and efficacy of the product. In order to safe guard the interest of consumer; government has introduced packaging laws and guidelines such as PFA Act (1954) that is to be followed by food processing industries. The historical development of packaging has led to discovery of novel packaging methods which help in long time preservation of food products. Novel packaging systems include the use of IOSP, TTI and antimicrobial packaging uses sensorsto detect and inform the stake holders about spoilage or temperature-time based changes in the food products in order to implement necessary action. Additional efforts are essential for promoting environmental sustainability, and to overcome problems like high cost associated with these packaging methods.

Keywords: *Food Packaging Materials and Methods, Food Spoilage, Preservation Methods, Functions and Types of Packaging, Packaging Testing and Laws, Novel Packaging Methods, Environmental Sustainability*

1. INTRODUCTION

The food industry is a diverse business which supplies most of the food which is consumed around the world. This industry covers a series of industrial activities which include processing, conversion, preparation, handling, preservation and packaging of food products. Often food products that are manufactured in industries undergo deterioration during storage. This spoilage occurs at any stage along the food chain. It occurs due to physical, chemical, microbiological changes which occur and render the food product unacceptable to the consumer. The following are mentioned below:

[1] Physical spoilage of food occurs due to moisture, temperature, pressure, bruising of fruits and vegetables, handling and transportation etc.

[2] Chemical spoilage results when different components of food react with each other or with an additional component that alters the sensory characteristics of the respective food product. This type of spoilage includes oxidation, enzymatic browning along with non-enzymatic browning.

[3] Microbial spoilage occurs due to the growth of microorganisms which produce enzymes that lead to theproduction of many undesirable by-products in the food.

1.1 Food preservation

Food preservation can be defined as the technique which is used to prevent food spoilage, food poisoning and microbial contamination of food. These techniques also help to prevent the growth of microorganisms, reduces oxidation of fats that cause rancidity and also inhibit enzymatic browning. The oldest methods of preservation include drying, refrigeration and fermentation. Modern methods of preservation include pasteurization, freezing, irradiation, canning along with the use of chemicals. Advances in the packaging materials have also played a very important role in the modern method of food preservation.

2. FOOD PACKAGING

The Packaging institute international defines packaging as the enclosure of products, items or packages which are wrapped in pouches, bag, box or other containers and perform one or more functions: containment, protection, preservation, communication, utility and performance. If a device or container performs one or more of these functions then it is considered as a package.

The primary goal of food packaging is to satisfy the industrial requirement along with the desires of the consumer, maintain food safety, cost effective and also reduce environmental impact. This is a critical stepin the food processing industry which assures the safety and quality of the food products. Food packaging protects the food from contamination, spoilage and also helps in transportation and storage. It also helps in uniform measurement of contents and allows brands to advertise, distribute and merchandise in large scale. Packaging increases the margin of safety and quality and inhibits microbial spoilage. The packaging technology could play a very important role in extending shelf-life of the food products and also reduces the potential risk of microbes. The selection of packaging material and technologies will help in maintaining the quality of the product along with freshness during the process of distribution and storage.

2.1 History

One of the earliest materials which were used for the purpose of packaging was leaves, skins, earthenware vessels and reed baskets. In the Mediterranean region large ceramic vessels and amphora's were used in order to ship wine and other products in 1500 BC. Glass was also used for the purpose of packaging around 1500 BC in Egypt. One of the oldest forms of flexible packaging material which was used was paper derived from the bark of mulberry tree which was used in the packaging of foods by Chinese. The United Kingdom used metal containers as packaging materials where in silver and gold were used. In the 19 th century plastics were discovered which were reserved for military and wartime use. During this period many components were discovered which include vinyl chloride, Styrene, cellophanes and polyethylene terephthalate which were used in packaging of foods.

2.2 Packaging industry

Packaging is very essential in most of the industries. The packaging sector represents about 2% of the gross national product in most of the developed countries of which half the portion is contributed by the food packaging industry. The growth rate of world packaging industry is 3 to 5% per annum. US alone accounts for 24% of the packaging industry. The Indian industries market for most of the packaging materials which is estimated to be rs280 to 300 billion per annum. The consumer packaging market in India itself is estimated around 148 billion. Flexible packaging material has replaced metal, glass and mostof the rigid packaging.

2.3 Functions of food packaging

The following are the important functions of food packaging:

[1] Food packaging prevents contamination caused by physical, chemical, biological and microbial factors.

[2] Packaging protects the food product from external environmental effects. It also prevents the mechanical damage which may occur during distribution.

[3] It also helps in preservation of food production and helps in extending the shelf-life of the product by inhibiting changes which occur due to microbial and biochemical factors.

[4] Packaging also displays information about the product which includes ingredients, nutritional labeling, expiry date etc and convenience features of packaging include easy handling, disposal and product visibility throughout packaging chain.

[5] Food packaging acts as a silent salesman by helping the consumer to instantly recognize a product through brands and labeling and hence helps in better communication. It also helps super markets to function as self-service brands

2.4 Types of food packaging

The packaging systems are basically categorized into four major groups and these are mentioned as follows:

[1] Primary packaging: This type of packaging is considered as the first level of packaging where in the product directly comes in contact with the product. For example Tea bag. It helps to preserve and maintainthe uniform quantity of the product. These packages should always be made with non-toxic materials which are compatible with the food product. It should also prevent changes in color, flavor and chemical reactions.

[2] Secondary packaging: This contains more than one type of packaging and it also helps in the protection from damage which may occur during storage and shipment of food products. It also increases efficiency in handling of products. One of the examples is the use of shrink wrap which holds two or more cans together during packaging processes.

[3] Tertiary packaging: One of the classic examples of tertiary packaging is shipping container as it helpsin protection of product during distribution and also provides efficient handling.

[4] Unit load: When a group of tertiary packages are assembled as a single unit then this is referred as unit load. One of the examples is the use of corrugated boxes which are stretch wrapped for handling, shipping and storage. A single unit is known as unit load. A fork lift truck is often used to transport unit load

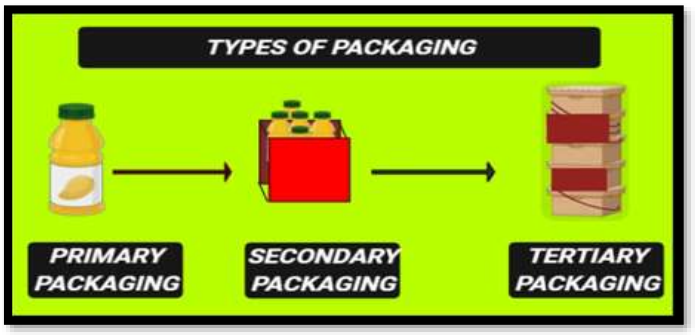

Image-1: Types of packaging

3. PACKAGING METHODS

Efficient food packaging helps to protect the food products from any form of deterioration and extends the shelf life of product. The main aim of these packaging methods is to enclose food products in a cost effective manner and to satisfy the industrial requirements along quality and safety. The following are some packaging methods mentioned which help in the process of preservation of food.

3.1 Aseptic packaging

Aseptic packaging is one of the most important processes in a food industry. It is a process by which a sterile product is packaged in a sterile container and maintained in aseptic conditions throughout the processes. Sterility is maintained by flash-heating process which involve maintain the product at 91 to 146 degrees. This technique uses less energy when compared to the tradition sterilization methods and retains the nutritional value of the product. It does not involve the usage of preservatives yet achieves long term preservation. Aseptic packages generally include paper, polyethylene, aluminum etc.

3.2 Vacuum packaging

This method involves the storage of the product in air tight packs where the air is sucked out and the package is sealed. This method of packaging helps in extending the shelf life of the product as the levels of oxygen inside the package reduces inhibiting the growth of microorganisms. It also inhibits oxidation and prevents evaporation of volatile compounds. Vacuum packaging is mostly used for the storage of dry foods which include nuts, cereals, cured meat, smoked fish etc. In this process, the food product that needs to be vacuum packed is stored in a vacuum bag which is made up of hermetic fills and then it is evacuated in a vacuum chamber and sealed hermetically as a barrier against air and moisture. Sometimes these bags are pumped with inert gases like nitrogen and carbon dioxide in order to avoid deterioration of foods due to pressure inside the vacuum chamber. One of the major disadvantage of this packaging is anaerobic bacteria can proliferate and cause food spoilage.

3.3 Controlled atmosphere packaging:

This involves the enclosure of food inside a gas impermeable package in which CO_2, O_2 are selectively controlled in order to increase the shelf life of the product. This system consists of an air tight storage chambers, O_2 regulatory unit, CO_2 absorbing unit for the purpose of controlling and monitoring the level of gases present inside the chamber. The temperature is stored inside the chamber with the help of refrigeration. By employing this technique the storage life of fruits and vegetables can be increased by 2 to4 times but one of the major disadvantages is that it reduces the post storage life of the product.

3.4 Modified atmosphere packaging:

Food products which are stored in high barrier packages are subjected to an optimal blend of oxygen, carbon dioxide along with nitrogen. One of the advantages of this packaging is that it initially modifies the atmospheric composition in the airtight storage room that could further cause change in the respiration activity of the food along with the growth of microbes. This blend of gases helps to meet the respiration needs for each and every packed food. It does not affect the texture and nutritional property of food. Modified packaging is of two types:

[1] Active modification: This involves the displacement of air in a controlled manner using desired mixture of gases. This process is also referred to as gas flushing.

[2] Passive modification: This method involves the use of a polymeric film wherein the permeation of gases determines the composition of the atmosphere inside the package. The advantages are it increases the shelf life by 40 to 50%, Provides high quality product, No chemical preservatives added, Odorless and cost effective. The three main gases which are used in this technique and they can be used either as individual or combined gases.

A] Carbon dioxide: Carbon dioxide is bacteriostatic and antifungal in nature. This is effective against aerobic bacteria such as Pseudomonas species. The antimicrobial activity of carbon dioxide is greater at low temperatures as the solubility of this gas decreases with increase in temperature.

B] Oxygen: Oxygen causes deterioration of foods by browning reactions, fatty acid oxidation along with pigmentation. Hence O_2 is excluded in order to prevent spoilage.

C]Nitrogen: N_2 is an inert gas that does not have any odor or taste Due to its low density and solubility it is often used as a filler gas in MAP to prevent the spoilage of foods.

3.5 Edible packaging

This involves a thin continuous layer of edible material present on the food material. The package is an integral part of the food which is edible as a part of the whole food product. This packaging acts as a mechanical barrier to moisture and gases, gives mechanical strength and is resistant to growth of microbes. The most common materials which are used for the purpose of edible

packaging include lipids, proteins and polysaccharides like waxes, gluten and cellulose respectively. The efficiency of food preservation can be improved by using primary edible packaging along with non-edible packaging as the secondary packaging that ensure protection from atmosphere and prevents contamination from microbes or foreign particles.

3.6 Active packaging

It refers to the incorporation of additives into the package which extends the shelf-life and enhances the quality of the product. This type of packaging changes the condition of the packaging which extends the shelf life and also assures safety and sensory properties while maintain the quality of the packaged foods. In order to enhance the shelf life of the product different strategies are employed which include temperature control, oxygen removal, moisture control and addition of chemicals such as salt, sugar, natural acids with effective packaging. Often oxygen scavengers, antimicrobial agents along with moisture absorbers, ethylene absorbers, and ethanol are used as active ingredients.

3.7 Oxygen scavengers as packaging material

These compounds are incorporated directly into the packaging material. Most of the oxygen scavengers include flexible films, rigid plastics and liners in closures. The presence of oxygen inside the container may cause oxidative reactions and result in deterioration of food. Oxygen accelerates the growth of aerobic microorganisms which causes off-flavor, off-odor and decrease in the nutritional quality of food. Oxygen scavenger is mainly used in order to eliminate oxygen and prevent undesirable changes in the food product. These are usually based on the principle of oxidation of iron powder or oxidation of ascorbic acid etc. Glucose oxidase along with catalase can help in elimination of oxygen from food for the purpose of preservation. Photosensitive dye irradiation is also one of the methods which can be used to remove oxygen for the preservation of meat and meat products.

3.8 Carbon dioxide absorbers and emitters:

Growth of microorganisms can be inhibited by using carbon dioxide in meat, poultry and baked food products. It reduces the rate of respiration and prevents the collapse of the package. Carbon dioxide can be used in various forms and this includes moisture and activated bicarbonate form. It is always used in less quantity as more quantity may cause oxidative changes in foods.

3.9 Moisture control agents:

The quality of a food product decrease as it comes in contact with excess moisture inside the food package. Moisture causes caking in case of powdered food products and softening of crispy foods. Hence, the use of moisture control agents is necessary in order to reduce the water activity and inhibit the growth of microorganisms. It also prevents condensation of fresh produce and reduces the rate of oxidation of lipids. Silica gel, natural clays and calcium oxide are often used in the packaging of meat, poultry, fruits and vegetables. Sometimes moisture control agents can be in sachet form.

3.10 Ethylene absorbers and absorbers

Ethylene is one of the most important plant hormones which are formed during the process of ripening and it is responsible for maturity, senescence of the product. In order to enhance the shelf-life of a product it is necessary to reduce of remove ethylene. Potassium permanganate oxidizes ethylene to acetate and ethanol and helps in the removal of ethylene. Activated carbon and zeolites are used for physical adsorption.

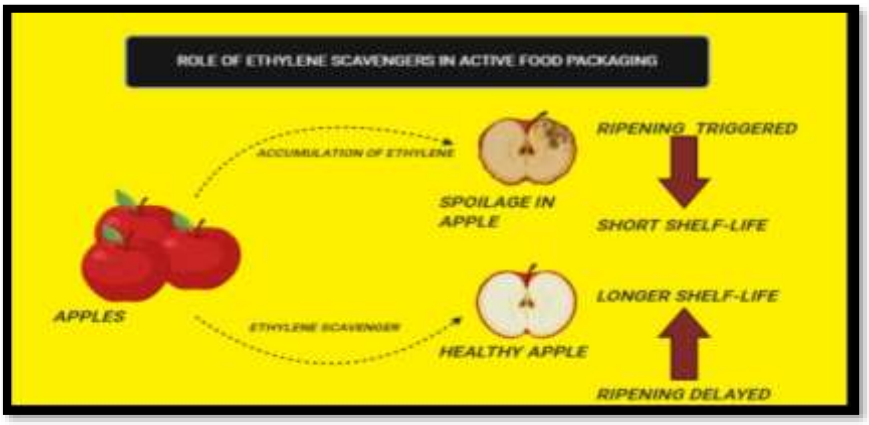

Image -2: Role of ethylene scavengers in food packaging

3.11 Temperature control: self-heating and cooling system

This involves the use of magnesium oxide and calcium oxide along with water in order to carry out exothermic reaction whereas self-cooling packaging involves the evaporation of external compounds which helps in elimination of heat from packaged contents.

4. DIFFERENT MATERIALS USED IN PACKAGING OF FOOD MATERIALS

The relation between food products with respect to its packaging material contributes to various changes which occur over a period of time. Hence, the choice of packaging material will depend on the type of food which is being consumed. Food industry involves the usage of wide scope of packaging materials and format which are used in processing of food industry in order to handle, store and distribute the food products. The selection of packaging material depends on acidic or alkaline, wet or dry, alcohol content and fat content. The role of a package is to protect the product against an agent that causes the degradation of a product and the degree of protection is often measured by two major factors which are water vapor transmission rate and oxygen transmission rate. They

help in detecting the level of moisture and oxygen sensitivity in foods.

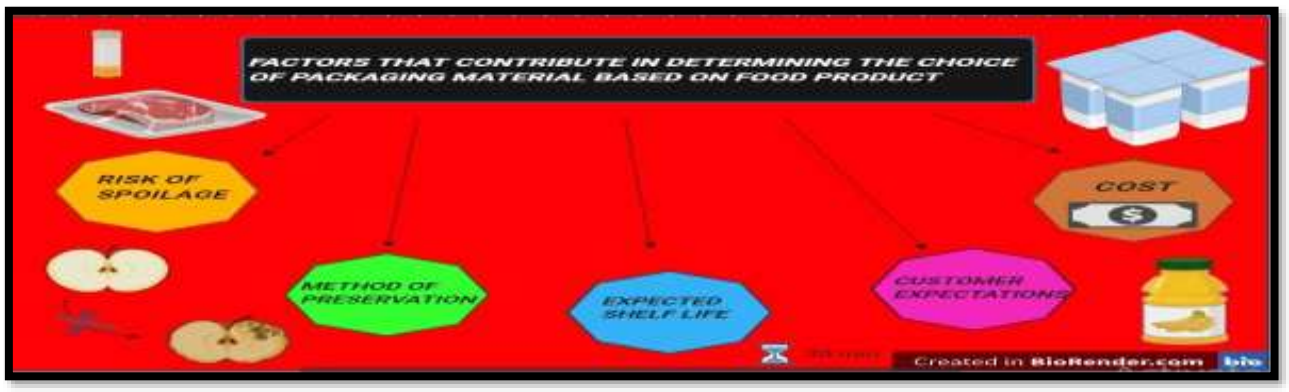

Image -3: Illustration of factors that contribute in determining the choice of packaging material based on food product

4.1 Glass

Most of the food packaging involves the usage of glass bottles or jars in case of packaging of those food products that need resistance towards moisture and oxygen. The major component of glass is silica which is derived from sand. Silica is often combined with other raw materials which include lime soda, soda ash, alumina and others for the purpose of food packaging. Glass confers many advantages like rigidity, pressure resistant, transparent and has excellent barrier properties. Glass also confers odorless and static chemical properties which does not impact the sensory characteristics of the food product. The usage of glass as a packaging material has declined over the years due to its fragile nature.

4.2 Plastics

Plastics are a group of polymer which can be molded into various shapes under controlled heat and pressure at relatively low temperatures when compared to glass and metals. The most widely used plastics in the packaging of food includes: Low density polyethylene, laminated aluminum foil, High density polyethylene, polypropylene, polyethylene along with nylon. The usage of plastic as packaging material gives an advantage of transparent film packaging for product visibility and resistance towards water. Many types of plastic materials are used for the purpose of food packaging which includes polyolefin, polyester, and polyamide, ethyl vinyl alcohol etc. Some of them are mentioned as follows:

[A] Polyolefin

Polyolefin category includes both polyethylene and polypropylene. These are of two major types:

[1]High density polyethylene: These are resistant to chemical and moisture and impermeable to gas. Often used in the packaging and preservation of milk, juice and cereals.

[2]Low density polyethylene: This material provides resistance to moisture and highly flexible in nature. It is often used to store bread and frozen foods.

[B] Polycarbonate

Polycarbonates are formed by polymerization of sodium salt of bisphenol acid along with carbonyl dichloride. It is heat resistant, durable and used as a replacement for glass. While cleaning polycarbonate packaging material harsh detergents such as sodium hypochlorite is not recommended as they catalyze the release of bisphenol and may contaminate food product.

[C] Polyethylene naphthalate

The packaging material is composed of a condensed polymer of dimethyl naphthalene dicarboxylate and ethylene glycol. This has a property of high glass transition temperature. It acts as a barrier for carbon dioxide, oxygen, and water vapor and shows resistance at high temperatures. Polyethylene naphthalate provides protection against transfer of flavors and odors and are used for manufacturing bottles for beverages such as beer.

[D] Ethylene vinyl alcohol

Ethylene vinyl alcohol is a copolymer of both ethylene and vinyl alcohol. It acts as a barrier to oil, fat, and oxygen. This packaging material is sensitive to moisture sensitive and used in multilayered co- extruded films.

4.3 Paper and cardboard

Paper and cardboard are made from cellulose fibers which are often derived from wood and other plant fibers using sulphate and sulphite. Pulping process can be done by using mechanical, chemical or combinational process. In case of mechanical pulping it produces papers which are relatively high bulk and low strength and cost effective. Chemical pulping produces stronger and higher quality paper and is more expensive. Cartons are often used for packaging in horticulture industry as it provides ventilation to fruits and vegetables during the process of storage in refrigerated conditions. The package design of these cartons helps in efficient handling and preservation of food product without any adverse effects.

4.4 Metals

Metals as a packaging material give good physical protection and recyclability and hence they are also preferred in food industry. Four types of metals are commonly used in food packaging process and this includes steel, aluminum, tin and chromium.

[1] Aluminum and steel

These are often used in the production of cans for drinks and processed foods such as beans, peas. These cans are durable and easy to store and ship food products as they have high mechanical strength and low weight in nature. The major disadvantage of steel is it tends to oxidize when it is exposed to moisture and oxygen producing rust. It acts as a good barrier towards moisture, air, odor and helps in the process of food preservation. Aluminum is also flexible and has good malleability and formability properties. It is used in packaging of soft drinks and sea foods. Aluminum foils are pure aluminum metal sheets acts as a good barrier to moisture, air and odor. This material is also inert to acidic foods and is easily recyclable.

[2] Tin plate and chromium

They are often used as protective layers for steel. They are resistant to corrosion. Tinplate which is the composition of tin and steel that is made by electrolytic coating of bare steel along with a thin layer of tin helps in minimizing corrosion. Electrolytic chromium coated steel has better heat resistance and is less expensive when compared to tin plate. Tin plate is produced from low carbon steel and has coating on both sides of black plate with thin layers of tin. This prevents the entry of microorganisms, water vapor and light and helps in preservation of food without spoilage. Tin plate is often heat treated and sealed to prevent contamination. This is used in the packaging of drinks, processed foods and powdered foods like sugar and flour based confections.

Image -4: Representation of time taken by a particular food package to undergo degradation

5. PACKAGE TESTING

Package testing is a very important step in the process of food preservation it must always be performed under standard conditions. The packages are often tested with respect to various factors:

5.1 Thickness

The thickness of the packages is defined as the perpendicular distance between two outer surfaces of the packaging material. Physical properties like water vapor transmission rate and gas transmission rate depend on the thickness of the packaging material.

5.2 Burst strength

Burst strength often tested for paper packaging it is defined as the ability of a paper to withstand hydraulic or pneumatic pressure. This test also helps in identifying tear and tensile properties of the package.

5.3 Grease resistance

This can be tested by exposing a test sample creased in order to grease that contains red dye. The time required for the red dye to appear on the unexposed side is measured. in case of plastic films this test is performed by using groundnut oil colored with sudan dye.

5.4 Gas transmission rate

This is determined by measuring the variation in pressure at constant volume. The normal temperature and pressure is calculated by the amount of gas flowing across the film. The efficiency of the material used for the packaging of foods is calculated by the amount of resistance the material provides for oxygen sensitive foods.

5.5 Water vapor transmission rate

It can be measured as the quantity of water vapor that will permeate into the film of 1 square meter in 24 hours and the relative humidity difference between the two sides is maintained at 38degrees. It helps in estimation of efficiency of the material to prevent the flow of water vapor which can act as a barrier for hygroscopic foods. it also helps in extending shelf life of the food product by reducing the moisture content and hence no food spoilage.

5.6 Impact strength and abrasion resistance

Impact strength can be estimated by the measurement of the strength of the packaging material to withstand damage by shock. Abrasion resistance measures the mechanical properties like hard resilience.

6. PACKAGING LAWS IN INDIA

A package attains the objective of delivering safe, wholesome, nutritious food to the consumer. In order to safeguard the interests

of the consumer packaging laws were introduced by the Government. The Prevention of Food Adulteration Act, 1954 (PFA) will prohibits manufacture, storage and sale of adulterated food. It also laid guidelines with respect to packaging of food products in order to maintain the safety and efficacy. packaging and Storage Requirements. The PFA act states that a container which is made of the following materials or metals, when used in the preparation, packaging and storing of food should be considered unfit for human consumption:

1. Containers which are rusty and containers of copper or brass which are not properly tinned.
2. Aluminum containers that don't specify chemical composition
3. Plastic packages that don't conform the materials according to Indian Standards Specification which are used for packing or storing of food products
4. Polyethylene, styrene polymers and Poly Vinyl Chloride that come in contact with food stuffs must be rejected
5. Tin and plastic containers should not be re-used for packaging of edible oil and fats.
6. According to PFA guidelines certain food items such as confectionery atta, maida, blended edible vegetable oil, colored and flavored table margarine shall be sold in packed condition only.
7. Dimensions of the carton jar or bottle should be specified on the package. Strength of the container with respect to stacking, freezing and microwaving must be tested. Labeling requirements along with the ability of package to restrict or allow, air, moisture and light must also be tested. Permeability, thickness, flexibility and resistance towards temperature must also be tested.

Other packaging requirements under PFA act include infant milk foods and processed should be packed other hermetically sealed, clean in flexible packs made of board paper, polyethylene to prevent deterioration. In case of meat and meat products should be packed in hermetically sealed containers followed by heat treatment and rapid cooling in order to ensure preservation for longer period of time. The containers which sealed should not show any change on incubation at 35℃ for 10 days and 55℃ for 5 days. All packaging materials of plastic origin should be with in color migration limits. Any packaged food which does not conform to these requirements under the PFA act , should be rejected .

7. FUTURE TRENDS IN FOOD PACKAGING

Innovations in food packaging systems are required to meet the needs of the market like healthy and high quality food products and also to reduce the negative environmental impacts of food packaging. Novel packaging methods involve the use of active and intelligent packaging which not only helps in prolonging the shelf-life of the product but also helps in improving the quality and safety of food products. New approaches also involve improving the characteristics of food packaging which include mechanical strength, barrier performance and thermal stability. Green packaging could be used to reduce various environmental impacts of food packaging through the use of biodegradable materials which mostly include the usage of plant extracts and nanomaterial.

IOSP system is one such novel packaging system which is capable of monitoring the conditions of various packaged foods by using sensors or indicators. The IOSP system can be used in order to monitor, sense, record, trace and deliver information regarding the quality of a food product inside the package. These systems have small tags which are incorporated into the food packaging systems in order to acquire the necessary information and transfer into to the stake holders. This device should be in direct contact with the food product and its atmosphere.

TTI system is also considered as a novel packaging method. The shelf life of various food products are sensitive to change in temperature and this causes deterioration and economic loss of most of the perishable food products. TTI systems are developed to monitor temperature and time dependent changes that occur in the quality of the food product. These are indirect indicator systems used in food industry because they are cost effective and user friendly. These systems are attached to individual consumer packages and are divided into 3 different types. One of the systems indicates the critical temperature which helps in determining whether the product has been exposed to temperature other than the reference temperature. The other kind indicates the cumulative effect of temperature and time dependent changes which affects the quality of the product. The third type is referred to as full history indicators which will continues monitoring the various in temperature throughout the products history Electronic based TTI system detect temperatures by using thermal sensors whereas, TTI systems based on nanoparticles and biological material show irreversible color change that determines the thermal history of the product.

Antimicrobial packaging is one of the most novel and essential form of packaging. The main reason for the deterioration of food products is due to microbial growth. Microorganisms cause food spoilage by developing off-flavor, changes in texture, discoloration and reducing the nutritive value. This increases the incidence of food borne illness. The principle in antimicrobial food packaging involves the extension of lag phase of bacteria which slows down the growth of microorganisms and this extends the shelf-life and helps in maintain the quality of the food product. There are two main types of antimicrobial food packaging. One type involves direct contact with food surface and here the antimicrobial agents are evaporated or incorporated into the food product. This packaging method is used along with vacuum packed foods. The other system does not involve direct contact with the food product. The implementation of antimicrobial packaging involves the right package for an antimicrobial agent along with the right environmental conditions subjected to preserve the food product.The most common antimicrobial agents which are used in the preservation of food products include benzoic acid and sodium benzoate.

These innovations in food packaging systems help in increasing the safety and quality of the food products. However, limitations must always be considered for maintain the safety of the product this may involve migration or leakage of active substances, Ingestion of unwanted substances, contamination etc.

8. CONCLUSION

Food packaging technologies are improving with respect to the lifestyle changes and increasing demand for high quality and safe foods. Packaging of food helps in extending the shelf life and maintains the quality, safety, and nutritional properties of food

products. Additional efforts are essential for promoting environmental sustainability, and to overcome problems like high cost associated with these packaging methods. To conclude food packaging indeed plays a very important role in the preservation of foods.

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