Madam Farhat Rashid
Food Packaging (FST-610)

NOVEL FOOD PACKAGING TECHNIQUES

Packaging has been defined as a socioscientific discipline which operates in society to ensure delivery of goods to the ultimate consumer of those goods in the best condition intended for their use.

The Packaging Institute International **(PII)** defines packaging as the enclosure of products, items or packages in a wrapped pouch, bag, box, cup, tray, can, tube, bottle or other container form to perform one or more of the following functions: containment, protection, preservation, communication, utility and performance. If the device or container performs one or more of these functions, it is considered a package. Innovative methods of Food packaging includes,

1. **Modified Atmosphere Packaging (MAP)**
2. **Biodegradable Packaging**
3. **Active Packaging**
    a. **Oxygen scavengers**
    b. **Carbon dioxide scavenger**
    c. **Ethylene Scavengers**
4. **Edible Packaging**
5. **Intelligent or Smart Packaging**
6. **Nano Packaging**

1. MODIFIED ATMOSPHERE PACKAGING (MAP)

Modified Atmosphere Packaging (MAP) can be defined as the enclosure of food in a package in which the atmosphere inside the package is modified or altered to provide an optimum atmosphere for increasing shelf life and maintaining quality of the food.

In modified atmosphere packaging (MAP) air is replace inside a package with a predetermined mixture of gases prior to sealing it. The gases involved in modified atmosphere packaging, as applied commercially today, are carbon dioxide, nitrogen and oxygen.

GASES USED IN MAP

The three main gases used in MAP are CO_2, O_2, and N_2, either singly or in combination.

i. Carbon dioxide reacts with water in the product to form carbonic acid which lowers the pH of the food. It also inhibits the growth of certain microorganisms, mainly moulds and some aerobic bacteria.

ii. Nitrogen is an inert gas with no odor or taste. It has no direct effect on microorganisms or foods, other than to replace oxygen, which can inhibit the oxidation of fats.

iii. Oxygen promotes several types of deteriorative reactions in foods including fat oxidation, browning reactions and pigment oxidation. Most of the common spoilage bacteria and fungi require O_2 for growth. For these reasons, O_2 is either excluded or the level set as low as possible. Exceptions occur where O_2 is needed for fruit and vegetable respiration or the retention of color in red meat.

ADVANTAGES OF MODIFIED ATMOSPHERE PACKAGING

1. Increased shelf life.

2. Reduced economic losses due to longer shelf life.

3. Provides a high quality product.

5. Improved presentation – clear view of product and all –around visibility.

6. Little or no need for chemical preservatives.

7. Sealed packages are barriers against product recontamination.

8. Odorless and convenient packages.

DISADVANTAGES OF MODIFIED ATMOSPHERE PACKAGING:

1. Added costs for gases, packaging materials and machinery.

2. Temperature control necessary.

3. Different gas formulations for each product type.

4. Special equipment and training required.

5. Increased pack volume adversely affects transport costs and retail display space.

6. Loss benefits once the pack is opened or leaks.

7. CO_2 dissolving into the food could lead to pack collapse and increased drip.

2. BIODEGRADABLE PACKAGING

The present global concern about petrochemical – based plastic materials has generated much interest in biodegradable, or " green" packaging materials.

According to the American Society for Testing and Materials (ASTM) guidelines, a "biodegradable plastic" is defined as a degradable plastic in which the degradation results from the action of naturally occurring microorganisms such as bacteria, fungi and algae.

Biodegradable or green packaging must satisfy some basic requirements to be an ideal candidate for food packaging.

1. These requirements include barrier properties (to water vapor, gases, light and aromas), optical properties (transparency), strength, welding and molding properties, printing properties, migration resistance, chemical and temperature resistance, the ability to satisfy disposal requirements and the ability to retain sensory properties.
2. Bio-based polymers, or biopolymers, are obtained from renewable resources.
3. These renewable resources consist of proteins (whey protein, soy protein, collagen, gelatin, wheat protein etc.), polysaccharides (starch, alginates, pectin and chitosan/chitin) and lipids (fats, waxes and oils).

3. ACTIVE PACKAGING

1. Active packaging is an innovative concept that can be defined as a mode of packaging in which the package, the product and the environment interact to prolong shelf-life or enhance safety or sensory properties, while maintaining the quality of the product.
2. It allows the active preservation of foods, according to their needs, by modification of the environment inside the package by removing undesired gases or by regulating the composition of the gas in the package headspace.
3. Active systems can be classified according to their functionality as scavengers, regulators and emitters, and their action can be specific for several substances (O_2, CO_2 , ethylene etc.).
4. The internal atmosphere may be regulated by substances that absorb (scavenge) or release (emit) gases or vapors.

4. EDIBLE PACKAGING

1. An edible film or coating is simply defined as a thin continuous layer of edible material formed on, placed on, or between the foods or food components to extend shelf life of the product that may be eaten together with food with or without further removal.
2. Edible films provide replacement and/or fortification of natural layers to prevent moisture losses, while selectively allowing for controlled exchange of important gases, such as oxygen, carbon dioxide, and ethylene, which are involved in respiration processes.
3. A film or coating can also provide surface sterility and prevent loss of other important components. Generally its thickness is less than 0.3 mm.
4. Requirements to consideration edible coatings should have an acceptable colour, odour, taste, flavor & texture. Edible coatings should be undetectable It must adhere to the food, but not stick to the packaging materials. It should melt in mouth, but not in hands.
5. Safety & Health issues an edible film to be used in food should be generally recognized as safe (GRAS) by the FDA. If the material cannot be demonstrated to be GRAS, then manufacturer must submit a food additive petition to the FDA. There should be a declaration about the type of edible materials some individuals are allergic to certain polymers.

COMPONENTS OF EDIBLE COATINGS

Polymers are the main ingredients of many edible coatings. Many edible polymers are nontoxic, simple derivatives of cellulose, one of the most abundant natural polymers in nature, being a component of plant structure. The coatings made from polymeric edible films are generally designed to be flexible and tough. Components of edible coating includes,

Polysaccharides

Polysaccharides coatings are hydrophilic and intermediate among coatings materials in gas exchange properties but are poor barriers to moisture. These include cellulose derivatives, starch derivatives, chitosan, pectin, alginates and gums.

Proteins

Proteins are similar in properties, being also hydrophilic, and include wheat gluten, peanut, soy, collagen, gelatin, egg, whey and casein.

Lipids

Lipids and waxes tend to be more permeable to gasses but present a better barrier to water vapour and includes beeswax ,petroleum based waxes, vegetable oils etc.

Resins

Resins are the least permeable to gases and intermediate in resistance to water vapor and include shellac, wood rosin, and coumarone indene resin.

APPLICATION OF EDIBLE FILMS AND COATINGS

Edible coatings have been successfully applied in processed foods such as meat, cereals, confectionaries, dried fruits, nuts and fresh and fresh-cut fruits and vegetables. These coating improves the quality and shelf life of foods. These films act as novel packaging system and control the release of active compounds such as antioxidants, flavours, and antimicrobial agents.

1. Meat films and coatings

2. Cereal coatings

3. Raisin and Nut coatings

4. Confectionary coatings

ADVANTAGES OF EDIBLE FILMS AND COATING

The potential benefits of using edible coatings on fresh and processed food products are:

1. Reduce water loss.
2. Reduce gas diffusion.
3. Reduce movement of oils and fats.
4. Reduce movement of solutes
5. Reduce loss of volatile flavors & aromas.
6. Improve structural properties (hold it together).
7. Incorporate pigments, flavoring, & food additives
8. Improve appearance (e.g., gloss).
9. Inhibit transfer of moisture and oxygen.
10. Reduced mold growth.
11. Reduce adhesion to cooking surface.
12. Edible films Environment friendly, as fully consumed or biodegradable, recyclable. Reduce the waste & solid disposal problem.
13. Enhances organoleptic properties like color, sweetness etc
14. Enhances nutritional values by supplementation
15. Film can work as carrier anti microbial or antioxidant agents
16. Film can be used as micro encapsulation of flavoring agents
17. Coating protect produce from physical damage caused by mechanical impact, pressure, vibrations and other factors

DISADVNTAGES OF EDIBLE FILMS AND COATING

The edible wraps would not be used alone where unsanitary conditions during food handling can occur

1. They would be used to wrap foods inside a secondary synthetic package during food distribution and storage
2. Poor mechanical properties. "Each coin have two sides"
3. The high cost of film-forming biopolymers (with the exemption of starch and certain starch derivatives) compared to synthetic packaging materials
4. The need for effective, economical, and microbiologically safe methods for applying edible coatings on food products on an industrial scale.
5. The poor barrier properties of most polysaccharide- and protein-based edible films at high relative humidity environments.
6. The possibility for adverse organoleptic effects introduced by edible coatings.
7. The dietary allergies and intolerances associated with various protein film-formers.

5. NANO PACKAGING

1. Nanoscale innovation could potentially introduce many amazing improvements to food packaging in the form of barrier and mechanical properties, detection of pathogens, and smart and active packaging with food safety and quality benefits.
2. Nanotechnology enables designers to alter the structure of packaging materials on the molecular scale, in order to give the material the desired properties.
3. With different nanostructures, plastics can be given various gas and water vapor permeabilities to fit the requirements of various foods.
4. By adding nanoparticles, one can achieve packages with more resistance to light and fire, better mechanical and thermal performance, and less gas absorption.
5. These properties can significantly increase the shelf - life and sensory characteristics of food products, and facilitate transportation and usage.
6. The addition of nanosensors to food packages could be used to detect chemicals, pathogens and toxins in foods.