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Edible Food Wrappers: A Boon

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Abstract – Food packaging industry mainlyuses petroleum based packaging materials, which are non-biodegradable, even if they are bio degradable; they break down into smaller molecules, which are not harmless to the ecology. These packaging materials, once discarded, sit in the landfills for approximately 1000 years contributing to the harmful effects to plant and animal lives because chemicals leach into the soil. These chemicals ultimately seep into the ground water and effect health as agricultural and animal produce get affected. In addition to this, harmful chemicals leach into the food while the wrapper covers the fresh or hot food. Researchers are trying to produce zero waste packaging, since past many years. Animal produce based edible gelatin packaging and plant produce based rice paper packaging can be made at home, but the need of the times is mass production of both animals based and plant based packaging materials, which cause no pollution to the environment and ecosystem. The present paper discusses some progress made in this field recently.

Key Words - Edible, Wrapper, Protein, Gelatin, Plasticisers, Sustainable, Zero Waste, Biodegradable.

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THE PLASTIC PACKAGING MATERIAL

Food and pharmaceutical industry uses plastics, which are mostly petroleum based and are difficult to recycle or are non - biodegradable. The plastic food packaging material like styrofoam or the aluminium can lined with BPA (bisphenol A), packaging materials with fluorine compounds like PFAS, various synthetic chemical plastic additives, even some paper wrappers containing plastic additives are extremely harmful to human health and all life forms. In the case of humans, these additives and polymers or the degraded polymer compounds are, carcinogenic, hormone disrupting , obesity causing, disrupt the development and functions of liver, kidney and reproductive system, disrupt the immunity and cause metabolic disorders. The rate and extent of absorption of these chemicals by the contained food material depends on the temperature and duration of contact with the plastic packaging material. Moreover, high fat foods solvate harmful chemicals much faster and tend to get oxidise. In this list of plastic packaging materials, the plastic coatings of tablets and capsules are also to be included. Once discarded the residual chemicals go to landfills and harmful monomers, polymers, additives and stabilising chemicals contaminate the soil, water-bodies and groundwater, causing immense harm to the ecosystem and health of all living forms. This is a known fact that the biodegraded polymers produce smaller molecules which are again much easy to be leached in to the soil, contaminate water-bodies and are harmful. The need is to minimise the use of plastic material.

NEED TO USE ALTERNATE FOOD PACKAGING MATERIAL

In view of the severe harmful effects of the plastic based food packaging material, researchers started to look for alternate food packaging material , which may be edible. These edible food packaging material are not only to protect the food but also are to be eaten along with the food.

FORMS AND TYPES OF EDIBLE FOOD WRAPPERS

The edible wrappers may be in the form of, pouches, films, coatings and films. Most common compounds used to make edible wrappers are- animal and plant proteins, polysaccharides, lipids resins, seaweed packaging materials. At a smaller scale rice paper wrappers are made using rice flour, potato starch, salt and water and this is a vegetable based edible wrapper which is aceptable to vegetarians. Similarly gelatin edible wrappers are also made at a small scale by mixing gelatin, which is animal based product with glycerine. Nanocomposite edible wrappers materials are also made by mixing gelatin with nanocrystals. Glucanobacter xylinus is used to produce cellulose, which on acid hydrolysis produces rod shaped nanocrystals .

Milk protein caesin films are also used as edible wrappers to which various nutritious additives may be added to increase its mechanical strength, durability, flavour and crunchiness. Citrus pectin may be added to caesin to give it mechanical strength as well as to help increase the shelf life of packaged food.

Probiotics, antibacterials vitamins, and various flavours like strawberry, vanilla, apple are added to make it more palatable and nutritious. Such edible wrappers are used to pack pizza, nuts, snacks etc.

Soy protein, natural resins like edible shellac and gelatin are also used as food wrappers. Seaweed wrappers are vegetarian edible wrappers, which are made of those seaweeds which need only carbon dioxide to grow and therefore it also reduces greenhouse effects. These seaweed food wrappers don't need any chemicals to be manufactured. These are flavourless and are used to make tea -coffee pouches, sandwich wrappers and soup packs. Seaweed packages easily dissolve in hot water and don't change the flavour of tea, coffee or soup. These are costly but are zero waste.

As natural edible food wrappers need to improve their mechanical strength, elasticity, environment barrier properties, so many natural plasticisers are used to improve their properties. Some of the natural plasticisers, used for edible food wrappers are sorbitol, oleic and linolic acids, glycerol, saturated fatty acids,

DESIRABLE QUALITIES OF AN EDIBLE FOOD WRAPPER

1. **Shelf life** - The edible food wrappers must increase the shelf life of the packaged food during storage period, transport and distribution, till end use. Various edible wraps are added with natural plasticisers, and biomass chemical additives to make the films protect the food under various environmental conditions to which the packaged food might get exposed.

2. **Protecting from moisture** - Water vapour permeability of food wrappers is an important factor to decide the desirability of the food wrapper. Biopolymers which have hydrophilic groups at their surfaces will attract moisture and with increased pore size on the film or sheet, exchange of moisture between atmosphere and edible wrapper will take place easily due to which microbial activity will start in the food, its texture may alter, certain enzymatic activities may get initiated in the food, which will ultimately affect the quality, taste and shelf life of food. It implies that the moisture absorption by a food wrapper is an undesirable quality. Lipid based edible wrappers are less porous, low polar and more hydrophobic, which make them desirable as edible food wrappers. Edible Shellac is also a very good moisture barrier as food coating.

3. **Protection from aroma**- Protein and polysaccharide based edible wrappers are very less permeable to aroma molecules because the wrappers are polar and aromatic compounds are nonpolar. This causes the food to be protected from external aroma and at the same time the distinct aroma of the food is retained, which is a desirable quality of the food wrapper during distribution and storage. Edible Shellac coating is an excellent blocker of odour.

4. **Protection from oxygen** -Oxygen causes oxidation of food material leading to loss of characteristic aroma, taste and colour of the food. Hydrocolloid based films are good oxygen barriers in comparison to other food wrappers. Low oxygen permeability of food wrappers increases shelf life and reduces the use of plastic based food wrappers.

5. **Protection from oils** - Certain food need protection from oils. Protein and carbohydrate based films are hydrophilic and resist the permeability of lipids, which makes loss or gain of fat by the packaged food very less probable. Whey protein based wrappers are good fat and lipid barriers. Fried foods and snacks industry need such wrappers.

6. **Anti-microbial and antioxidant properties** - Natural or synthetic anti-microbial and anti-oxidants may be added to the wrappers to increase the shelf life and to preserve the original quality and freshness of the food material. Pigments, salts, flavours, plasticisers and nutrients may also be added to food and pharmaceutical products along with anti-microbial and anti-oxidants. The conditions of environment to which the food will be exposed during shelf life and transportation, decides the types of additives to be added to the wrapper.

7. **Protection from light** - Food may undergo chemical changes in the presence of light, which may alter the taste, texture and colour of food. Food films are also required to reduce interaction of packaged food with light to preserve its qualities till the food is consumed by the end user.

8. **Mechanical strength -** Fresh food may be fragile and delicate. The edible films and coatings are to protect the surface of the food and to prevent mechanical damage. Tensile strength; elasticity and elongation are the factors, which usually play important role in deciding the mechanical strength of an edible film or coating. The edible food wrapper must have enough mechanical strength to protect the structure of the food, facilitate handling during transportation and storage. The strength of the edible films depend on the process of making the film , its experimental conditions and the type and ratio of film making compound used. In general protein based films have lower mechanical strength than polysaccharide based films.

Environmental conditions, such as temperature and humidity affect the mechanical strength of the edible food wrappers.

9. **Gloss and shine**- Gloss and shine not only make the food look attractive which increase its marketability but it is also protective to the food. Whey protein. Shellac, zein, cellulose, pectin and dextrin coatings are used to provide gloss finish to fruits, nuts and chocolates. Glossy coatings without flavours or colours are preferred as edible food films.

10. **Easily digestible**- The edible food wrappers, films or coatings should be easily digestible which makes them favourable to be used as food coatings.

RECENT ADVANCES

Research is on-going to make such edible food wrappers which will be useful to both food and pharmaceutical industries. Attempts are being made to provide a stable, safe, convenient and at the same time appealing edible food packaging films for consumers. Studies are being carried out to look for seaweed alternatives to be used as food wrappers. Recently studies have been carried out to explore the feasibility of control- release active compounds added to biopolymer -based food packaging materials. Another line of attempt is to use various waste and by-products from the food industry to make edible packaging material, leading to minimize waste from food and horticulture industries. Nano composite and dry thermoplastic processes are also being explored to enhance the quality of edible food wrappers. In all, recent researches are in the direction to be able to produce zero waste edible food wrappers which can be designed according to desired specifications, regulatory requirements, consumer acceptance and commercial viability.

CONCLUSION

Lipids, polysaccharides, proteins and resins are the types of compounds, which can be obtained from biomass and may be used for making edible wrappers. Various food waste materials are being researched for making the wrappers, potato chips wastes, fish proteins, sea weeds, cheese proteins, fruit and vegetable wastes or their purees, mung bean starch are some of the many kinds of materials, being researched and tried to make edible food wrappers. These will not only reduce waste but will also protect the environment and lives. Protein based films, both of plant and animal origin, have good mechanical strength they are also act as a good barrier to oxygen, carbondioxide, lipid and odour. Although the edible food wrappers lack the type of environment barrier and mechanical strength offered by the synthetic and petroleum based polymer films and wrappers, but they are obtained from biomass and are zero waste materials. With the knowledge that synthetic polymeric food packaging materials are creating havoc with environment and all forms of lives, the reduction of use of these is a welcome move. In coming times we will be using more of these edible food wrappers, improvised by newer techniques and move towards more sustainable development.

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