

Farming

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**ECO
FRIENDLY
PACKAGING**
REDUCE, REUSE, RECYCLE

BIODEGRADABLE PACKAGING: A FUTURE

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Food packaging is considered to be a vital domain in food technology that deals with the preservation and protection of all sorts of foods and their raw materials, as well as their protection from oxidative and microbiological deterioration. Packaging materials like polyolefins, polyesters, polyamides, and others have become increasingly popular as they are easily available in large quantities at low cost and have favorable functionality characteristics such as good tensile and tear strength, good barrier properties to oxygen and aroma compounds, low water vapour transmission rate. On the contrary, they are completely non-biodegradable, which results in pollution and serious ecological difficulties. Hence, the increase in environmental awareness leads to the change and therefore biodegradable films and techniques came into the frame. As a result, the concept of biodegradability benefits both users and the environment, and the raw materials are primarily derived from replenishable agricultural feedstocks or marine food processing industry wastes, allowing it to capitalize on natural resource conservation while maintaining an environmentally friendly and safe environment.

Ohoo is the start-up that has embraced algae for the manufacturing of plastic substitutes, offering edible bottles and capsules filled with water or fruit juice.

**INNOVATION
HUB**

Biodegradable packaging also acts as fertilizer and soil conditioner during biodegradation and composting leads to better agricultural yields. Food that is highly perishable in nature requires precise technical intervention for the preservation i.e., to increase the shelf life depending upon the water activity and storage temperature of the specific commodity. The preservation of high-quality food is a major challenge in present-day food processing operations. The post-harvest losses in our agricultural products are greater mainly in fruits and vegetables up to 20- 40%. These losses are mainly due to improper handling practices and inadequate post-harvest technologies that are being practised. Due to the highly perishable nature of food commodities, it is prone to microbial contamination by foodborne pathogens which can be overcome with the help of edible packaging because biopolymer has the properties of antimicrobial for various pathogens. Recently researchers are adding some other active ingredients in edible packaging such as extract and essential oil which contain a high amount of polyphenolics compound which play an excellent role in antimicrobial properties. We can also encapsulate the active compounds for enhancing their role for a long time. Scientists also do works on minimizing the size of edible packaging up to micro to nano which also plays a vital role in improving the properties of edible packaging as native starch has a weak mechanical property but it can get improved by reduction in size. There are also some companies which manufacture various edible packaging for food commodities such as Edipeel, Dow Dupont, etc. We can say that if we have to go for sustainability then edible packaging is the best option.

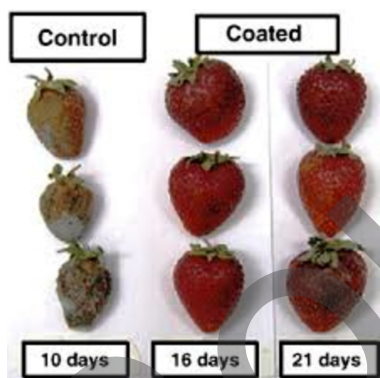
Biodegradable food packaging may be of two types
a) Films; b) Coatings.

Packaging Films

If the layer is formed separately and wrapped on the food surface later, it is termed film. The commonly used packaging materials are polyethylene, polyvinylidene, polyester, polyamide (Nylon), and cellophane. Biopolymers derived from agricultural feedstocks and other source materials have the potential to be used as packaging materials after processing. The functionality of the films can be better expressed by using them in combination with other ingredients such as plasticizers like glycerin, ethylene glycol, sorbitol, etc., and additives. Lipids and Hydrocolloids are the two types of biomolecules, that are commonly combined to make biodegradable packaging films or composites. For example, hydrocolloids are hydrophilic in nature and are poor moisture barriers, a property that can be compensated by adding lipids, which results in very good moisture barriers. In fact, Composite films are a mixture of these molecules and other ingredients to enhance their mechanical properties, fragrance chemicals, and lastly their barrier properties (to water, oxygen, carbon dioxide, and other gases). Usually, a film thickness of 2.5 mm (about 0.1 in) is employed.

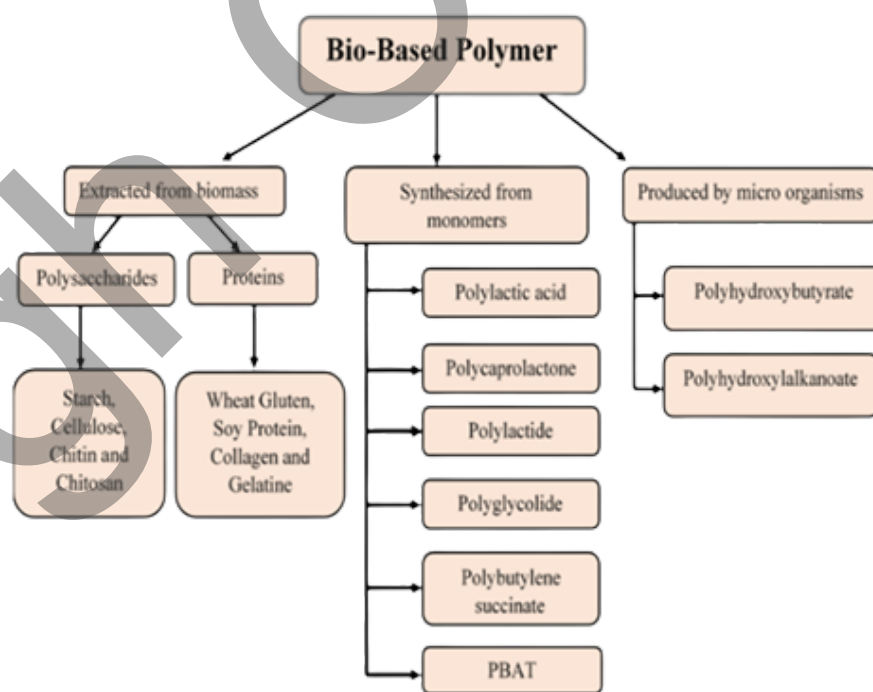
Edible Coatings

If the thin layer is formed directly on the food surface, it is termed a coating. Method of coating involves a) dipping, b) brushing, c) roll coating, d) spraying, e) spin coating, and f) flow coating. The most prevalent approach and used commonly is the dip method of Coating fruits, vegetables, and meat products. One of the popular age-old methods which were practised in China in the early 12th century was the application of a wax coating of fruits by dipping to retard the water transmission rate in citrus fruits.



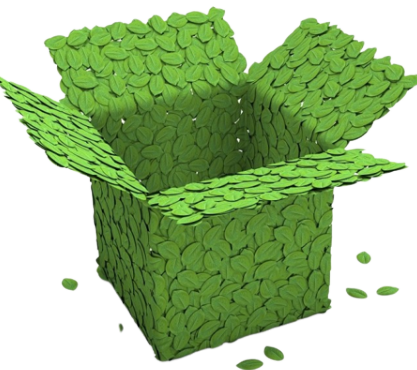
Bhavana (2018) Edible Films: Eat your food with the wrappers on!

The storage life of the products is increased by this coating, as they protect food from oxidation, microorganisms, and moisture. Properties like tensile properties and elongation at break are also considered edible coating properties which show their preventive nature. The stability of the food product depends on the edible coating requirement and its type, which may include the need to prevent oxidation degradation, control oxygen levels, and occasionally reduce oxygen consumption and ethylene output in different food. Ethylene is the major cause of fruit ripening which process gets reduced if we apply the edible coating. The coating can also be done by a foam application method; emulsions are the best example of the mentioned method. The various naturally occurring biopolymeric materials of use in composite film making and coating formulations are shown below:



These biomolecules are compatible amongst themselves and with other hydrocolloids, surfactants, and additives, and their aqueous solutions are usually stable at acidic and neutral pH.

Current Challenges in the Field of Food Packaging



Some commercial technologies claim to be sustainable, either in terms of biodegradable, but without a comprehensive and balanced assessment of their overall environmental value. A lot of research has gone into developing biodegradable packaging, which is bio-based packaging materials manufactured from renewable resources. Biodegradable packaging can be more sensitive to temperature and heat, a lot more care is needed during the shipping process, which may be costly for some businesses to maintain. There are various barriers to not purchasing a sustainable product such as higher process, perceived lower quality, and lack of availability. One of the main factors for the non-development market growth is the lack of recognition. Consumers identify these sustainable packaging through logos, labels, etc. According to some studies, attributes like price and product quality were more important than green packaging.

Future strategy



Biodegradable polymers help in reducing the environmental impact of plastic production and processing. Biodegradable packaging can be used for modified atmosphere packaging, active packaging system, and edible packaging for different high-quality food products to enhance their shelf-life. Biodegradable plastics are of essential relevance to the world economy in view of the urgent need for energy saving and emission reduction. Biodegradable polymers are made from renewable feedstocks and agricultural waste.



Ooho Biodegradable and edible water bottle

There is a terrific opportunity for research work in harnessing this economic opportunity. We can expect to see changes in a variety of industries with regards to not only edible packaging but sustainable packaging as a whole. The next generation of food packaging should significantly contribute to reduced waste in both food and packaging materials, and its negative impacts on the environment (e.g., resource utilization, greenhouse gas emissions, pollution). Consumers play a very crucial role in the success of environmentally friendly food packaging through their decisions of buying the product. The decision depends on many trade-off attributes like design, colour, and shape for example colour influences the taste of some products. Biodegradable polymers can help in overall environmental sustainability as they can be used for high-quality food products and to the enhancement of shelf life.