



## **Biodegradable Packaging – An Eco-Friendly Approach**

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### **Article History**

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Packaging plays a major role in the protection and shelf life extension in the supply chain of a food product. Plastic based packaging has been widely used since decades. These materials made from petroleum based derivatives are expensive, takes many years for decomposing thereby polluting the environment. According to the report by Central Pollution Control Board of India (2013), about 15342 tons of plastic waste is generated every day across the country. Less than 5 % of the plastics are recyclable and the rest pollute the land and water bodies thus, affecting the fauna and flora. Dumping plastic wastes makes the harmful chemicals to leach down in the soil affecting the soil fertility and incinerating these wastes emits toxic gases, which are harmful to the environment. Recycling of plastic waste is not a permanent solution because of the additives and colour present. Hence, alternative packaging, which are eco-friendly, with a major emphasis to safe guard our environment is the needed measure to combat this issue. Such a packaging must be easily degradable. The term biodegradable refers to those materials that could be easily decomposed by the enzymatic action of the microbes within a short period of time. Polymers used conventionally as packaging materials, are not biodegradable because of the long chain molecules, which make the break down by the microorganisms difficult.<sup>1</sup> Hence, they are considered as environmental waste. Contrary natural polymers have molecules easily degraded by the microorganisms.

Considering the adverse effect of petroleum based plastics causing environmental pollution, demand has risen for biodegradable packaging in the food sector. Biopolymers are molecules present in cellulose and proteins. They are produced from renewable sources such as plant based materials like starch, cellulose, plant oil, sugar, reed etc.


Based on the origin and production method, bio-polymers are classified as below:

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**Polymers Produced from Biomass**

Polymers of this class are extracted from plants, marine and animal sources. Among the plant category, polymers extracted from starch obtained from corn and potato is widely accepted taking into consideration cost and availability etc. Fresh commodities like potatoes, corn, rice are heated to extract the starch molecules. The extracted starch polymers are further processed to arrive at the final package shape. This starch based plastics are completely biodegradable and could be made into sacks, bags and other packages. Because of their easy availability and low cost, starch based biopolymers are produced in large quantities in the world. Polymers can also be extracted from vegetable proteins like chick pea and soya beans.<sup>1</sup> Bamboo is one of the fastest growing plants on the earth making it an excellent alternative to paper and plastic. Cellulose from plant matter is extensively being used for manufacturing biodegradable packaging. Wood pulp is used to create paper and can be recycled into other paper products. Cellulose based film that is similar to plastic can be prepared from wood pulp. Mycelium of mushroom can be combined with seed husks for use as an alternative to polystyrene/styrofoam packaging. Chitin is another polymer obtained from the shells of prawn. It has good antimicrobial properties.<sup>1</sup>

**Polymers Produced by Chemical Synthesis**

Poly Lactic Acid, commonly referred as PLA is a biodegradable polymer or resin, obtained by fermentation of corn,<sup>2</sup> whey or molasses. It has an excellent permeability to water vapour and is made into thermoformed pads and containers, transparent bottles etc. used for packaging food. PLA containers have a great demand in the world market.

**Polymers from Natural Organism**

Polyhydroxy alkanooates and bacterial cellulose belong to this group.

**Forms of Biodegradable Packaging**

Based on the need of packaging different products, biodegradable packaging is produced in various forms viz., gels, film, bag and box.<sup>1</sup> Gel as hydrogel applied as a coating on fruits and vegetables, helps prevent microbial contamination. Biodegradable films are made from renewable biomaterial like corn dextrose. Biodegradable films are resistant to moisture and are easy to compost. They act as oxygen barriers for food packaging; used to wrap perishables and to seal containers. Biodegradable bags are also made from biomaterials. They are strong and resistant to breakage and considered safe for packaging food materials. Bio-oriented polystyrene from corn is used for producing biodegradable boxes with lid.

**Merits and De-merits of Biodegradable Packaging**

Biodegradable packaging is made from eco-friendly materials. Hence, it is easier to recycle. They require less energy to produce. They are non-toxic<sup>3</sup> with reduced carbon emission and help to reduce climate change. Though, biodegradable packaging has many advantages over plastics, they have their own limitations. Long term usage of biodegradable packaging from plant source may lead to more requirement of plant matter for their production. They may also require special facility for composting<sup>3</sup> due to the fact that certain single use plastics derived from thermoplastic starch is obtained by mixing with small amounts of petroleum based polyester, which is hard to be broken down by certain bacteria. Landfilling is another issue emerging due to biodegradation.

Biodegradable packaging can be a best alternative to plastics when used in conjunction with metal containers. They offer best packaging solution for perishables against microbes. The dependence on fossil fuel is reduced due to possible shift from plastics. Even if biodegradable packaging has not reached its full bloom to save our eco system, judicious use of this alternative packaging is advisable.

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