*Asian Sciences* (June & December, 2009) Vol. 4 Issue 1 & 2 : 102-103

# Bioplastics – A ecofriendly packaging technology

**SAKSHI ARORA, JANHAVI NIKAM, M.O. LOKHANDE AND B.A. AGLAVE***
Department of Biotechnology, H.P.T. Arts and R.Y.K. Science College, NASHIK (M.S.) INDIA

**Key words :** Materials, Soyprotein, Lactic acid

Bioplastics (also called organic plastics) are a form of plastics derived from renewable biomass sources, such as vegetable oil, corn starch, pea starch or microbiota, rather than fossil fuel plastics which are derived from petroleum.

***Bioplastics: PLA derived from corn-starch :***

Bioplastics are a new generation of biodegradable and compostable plastics. They are derived from renewable raw materials like starch (e.g. corn, potato, tapioca etc.), cellulose, soy protein, lactic acid etc., not hazardous in production and decompose back into carbon dioxide, water, biomass etc. when discarded. Corn starch is currently the main raw material being used in the manufacture of bioplastic resins. Mater-Bi (main component corn-starch), and PolyActide (PLA) (made from corn-starch as well) are currently the 2 main resins (raw materials), being used today in the production of compostable and biodegradable plastics and are certified for compostability under standards set by international organizations. However, other resins are coming into the market made from potato starch, soybean protein, cellulose etc. Most of these are currently not certified for compostability, though some are for biodegradability. The field of bioplastics is constantly evolving with new materials and technologies being worked on and being brought to market.

***Heat resistance*** :

– Corn-starch based products (bags, cutlery, cold cups, drinking straws): 120 degrees F

– Corn Starch Biodegradable Cutlery: 220 degreesF

Biodegradability and Compostability Bioplastics can take different length of times to totally compost, based on the material and are meant to be composted in a commercial composting facility, where higher composting temperatures can be reached and is between 90-180 days. Most existing international standards require biodegradation of 60% within 180 days along with certain other criteria for the resin or product to be called compostable.

The rate of biodegration for different biocompostables is dependent upon the composition and thickness of the material as well as composting conditions. Commercial composting facilities grind the materials, turn over the piles and reach high temperatures, thus reducing the amount of time it takes to compost and, is thus, the recommended method for composting these products. Home composting rates are slower and can vary, depending on how frequently the pile is turned over, the moisture and material content and the temperature.

***Applications :***

Because of their biological biodegradability, the use of bioplastics is especially popular for disposable items, such as packaging and catering items (crockery, cutlery, pots, bowls and straws). The use of bioplastics for shopping bags is already very common. After their initial use they can be reused as bags for organic waste and then be composted. Trays and containers for fruit, vegetables, eggs and meat, bottles for soft drinks and dairy products and blister foils for fruit and vegetables are also already widely manufactured from bioplastics.

Non-disposable applications include mobile phone casings, carpet fibers, and car interiors, fuel line and plastic pipe applications, and new electro-active bioplastics are being developed that can be used to carry electrical current. In these areas, the goal is not biodegradability, but to create items from sustainable resources.

***Performance and usage :***

Many bioplastics lack the performance and ease of processing of traditional materials. Polylactic acid plastic is being used by a handful of small companies for water bottles. But shelf life is limited because the plastic is permeable to water - the bottles lose their contents and slowly deform. However, bioplastics are seeing some use in Europe, where they account for 60% of the biodegradable materials market. The most common end use market is for packaging materials. Japan has also been

* Author for correspondence

| Estimated composting times | | | | | |
|---|---|---|---|---|---|
| Products | Sugarcane fiber/reed Grass: Plates takeout containers, bowls, cups and trays | PLA: Cold cups, daily containers and straws | Corn starch: Heat-resistant, non-GMO utensils | Trash / kitchen bags | PLA: Tasting spoons and utensils |
| Home composting | 2-4 Months | 6-12 Months | 12-24 Months | 3-6 Months | 12-24 Months |
| Commercial composting | 1-3 Months | 3-6 Months | 6-18 Months | 1-3 Months | 3-6 Months |

a pioneer in bioplastics, incorporating them into electronics and automobiles.

***Types of plastics :***

- Starch Based Plastics.
- Polyl Actide Acid (PLA) Plastics.
- Poly-3-hydroxybutyrate (PHB).
- Polyamide 11 (PA 11).
- Bio-derived polyethylene.
- Genetically modified bioplastics.

***Environmental impact :***

The production and use of bioplastics is generally regarded as a more sustainable activity when compared with plastic production from petroleum (petroplastic), because it relies less on fossil fuel as a carbon source and also introduces fewer, net-new greenhouse emissions if it biodegrades. They significantly reduce hazardous waste caused by oil-derived plastics, which remain solid for hundreds of years, and open a new era in packing technology and industry.

However, manufacturing of bioplastic materials is often still reliant upon petroleum as an energy and materials source. This comes in the form of energy required to power farm machinery and irrigate growing crops, to produce fertilisers and pesticides, to transport crops and crop products to processing plants, to process raw materials, and ultimately to produce the bioplastic, although renewable energy can be used to obtain petroleum independence.

Certain studies showed that bioplastics represent a 42% reduction in carbon footprint.

On the other hand, bioplastic can be made from agricultural byproducts and also from used plastic bottles and other containers using microorganisms.

***Recycling :***

There are also fears that bioplastics will damage existing recycling projects. Packaging such as HDPE milk bottles and PET water and soft drinks bottles is easily identified and hence setting up a recycling infrastructure has been quite successful in many parts of the world. Polylactic acid and PET do not mix - as bottles made from polylactic acid cannot be distinguished from PET bottles by the consumer there is a risk that recycled PET could be rendered unusable. This could be overcome by ensuring distinctive bottle types or by investing in suitable sorting technology. However, the first route is unreliable and the second costly.

***Cost :***

With the exception of cellulose, most bioplastic technology is relatively new and is currently not cost competitive with petroleum-based plastics (petroplastics). They do not reach the fossil fuel parity. Many bioplastics are reliant on fossil fuel-derived energy for their manufacturing, reducing the cost advantage over petroleum-based plastic.

*Accepted : September, 2009*