



## Bioplastics: a promising material



BIOPLASTICS OFFERS MULTIPLE ADVANTAGES. HERE IS AN OVERVIEW OF THE SAME.



Currently, plastic is considered to be the main cause of the pollution and it is affecting the environment mainly due to littering; this has forced plastics to put under ban. But we can see, plastic has now become an intrinsic part of our day to day life and it will be difficult to completely remove or replace it. It has been reported in a survey that, India is one of largest plastic consumer in the world with a total consumption of plastics of about four million tons and a resulting waste production of about two million tons. So in such scenario, there is a need to develop and use an alternative material which can truly replace plastics, taking care of the plastic problem and provide a solution that will be environmentally friendly. With development in advance technology and the need for a sustainable solution, eco-friendly product, Bioplastics proves to be the best alternative.

One of the key benefits of using the Bioplastics is: they resemble to the conventional plastics, in term of properties, processing, and applications. Bioplastic resins are made from renewable agricultural feedstocks, such as corn sugar, hemp oil, and soybean oil. These feedstocks are then processed into high performance polymers. In contrast, conventional plastics are derived from pe-

troleum. Bioplastics resin can be used in making films for carry bags, shopping bags, garbage bags, nursery bags, mulch films, etc. They can be also used in making disposable injection moulded products like spoon, fork, knife, cups, plates, etc. Additionally, rigid packaging like small containers, bottles, caps and closures, flexible packaging films also can be made with bioplastics. Other advantages of Bioplastics resins are, they require low processing temperature and can be easily run on the existing processing machine with minimal or no change parts.

### Market statistics

In India, bioplastics are still in their nascent stages and have been faced with the challenges of availability, low consumption, education and awareness, pricing, government policies, etc. At present, Advance Bio Material Co. Pvt Ltd offers resins in the Indian market. These resins are 100% biodegradable and compostable within 180 days. They can be fully decomposed into CO<sub>2</sub>, water and minerals, which are good for crops and cause no harm and toxicity to farmland.

According to the Zion Market Research report, global bioplastics market was valued at USD 17.50 billion in 2016 and is expected to reach USD 35.47 billion in 2022, growing at a CAGR of 12.5% between 2017 and 2022. In terms of volume, global bio-plastics market stood at approximately 3,324.80 kilo tons in 2016. Globally, the production of Bioplastics is highest in Asia-Pacific, due to the increasing investments made by major market players, along with a large amount of feedstock. The growing packaging industry, both rigid and flexible packaging, in Asia-Pacific, which also accounts for more than 80% of Bioplastic market in Asia-pacific, is the reason for higher production. The Bioplastics market for Asia-Pacific was estimated at 489.36 kilo tons 2017, due to the growing demands from countries, like China, India, South Korea, and Japan.\*

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### Processing of bioplastics resins

Bioplastics resins can be easily processed using standard plastics processing technique like injection moulding, extrusion, thermoforming, etc. designed for processing thermoplastic resins. However, due to the different nature of the materials, the processing conditions need to be adjusted. Some of the guideline that needs to follow during processing is as follows:

- The processing of ADFLEX-FT-1TM (ADFLEX-FT-1 is Bioplastic resin grade from Advance Bio Material Co. Pvt. Ltd.) resin starts with the cleaning procedure of the production line. LDPE with MFR 4-5 g/10 min (190 °C, 2.16Kg) can be used to purge, with its minimum melting temperature ADFLEX-FT-1 resin can be used as the last cleaning step after processing temperature adjusted to correct settings.
- The processing temperature used during extrusion and film blowing is very crucial; the grooved feed section of the extruder should be kept as cold as possible. The temperature of the first extruder zone will be reduced to about 140°C. All other zone temperatures along the extruder line including the die should be set to achieve a melt temperature in the range of 150°C to 170 °C.
- The screw rotation speed should be slow at beginning and then speed up to match the haulage speed. As a precaution for a breakdown of the bubble, make a high film thickness during start-up. Because of the high elasticity of the bubble, it is suggested to position the sizing basket at a low height above the die depending on film thickness and output rate.
- The inside and outside aeration should be gradually changed from weak to strong. The preferred blowup ratio is 3:1 or 4:1. The heights from die orifice to the nip roll should be higher to ensure full cooling and prevent film blocking.
- ADFLEX-FT-1TM can be printed and welded on standard equipment, both alcohol and water based inks can be used after testing. The drying temperatures should be kept below LDPE conditions. As drying conditions depend very much on the machine design they need to be determined during the trial.
- ADFLEX-FT-1TM film edge trim and bag handle "punch outs" can be reprocessed and recycled as long as it is kept segregated (i.e. not mixed with polyethylene) and kept dry. The regrind pellets can be fed into the main film process at a ratio of 5:95 regrind / virgin resins.

The information provided above is general guideline and can vary from different machine manufacturer, kindly take advice before starting the trial.

### Standards & testing bioplastics resins

There are various standards available to know the biodegradable



and the composting ability of bioplastics resins. ASTM 6866 is used to determine bio-based content using radiocarbon analysis. ASTM D6400 is to set standard specification for compostable plastics. European standards EN-13432 is for packaging recoverable through composting and biodegradation, it requires at least 90% disintegration after twelve weeks, 90% biodegradation (CO<sub>2</sub> evolution) in six months, and includes tests on ecotoxicity and heavy metal content.

IS/ISO-17088:2012 test can be also used to determine the degree of degradability and degree of disintegration of compostable raw material. There are various other testing methods available for identifying whether the material is con-

ventional plastics or compostable plastics like FTIR spectroscopy. It is used extensively for material characterization in the plastics industry. FTIR spectroscopy provides valuable information about the base polymer and its morphology; it also helps in analysing the complex additive packages found in many plastics formulations. Polyolefin's dissolve in polar solvents (like chloroform) while starch will not. This could be a fast method to check the composition. Thermo analytical techniques (DSC, TGA) would also detect the presence of starch. Other general testing method that can be possibly used is burning test, density test, solubility test etc.

At present in India, Advance Bio Material Co. Pvt. Ltd. manufactures different grades of bioplastics resin suited for application in making films for carry bags, shopping bags, roll on bags, garbage bags, mulch films, multilayer film, injection moulded cups, plate, spoon, fork, knife and thermoforming. Heterogeneous non-recyclable multilayer flexible packaging is biggest threat to environment and government is planning to ban such packaging use, Advance Bio Material Co. Pvt. Ltd. has also developed and tested various structures using their Oriented Bioplastic Films and High Barrier Bioplastic Films for various applications. Advance Bio Material Co. Pvt. Ltd is working with processors to converting from conventional plastics to Bioplastics by providing right material and right processing guidance, machine modification, new machine selection, product development, testing, certification etc. They are dedicated to development of Bioplastics in India and is strongly believes that Bioplastics can grow, only when every processors process some quantity of Bioplastics and every consumers uses some quantity of Bioplastics. 📌

### Reference:

\*Ref: <https://www.mordorintelligence.com/industry-reports/global-market-for-bioplastics-industry>

Source: Advance Bio Material Co. Pvt. Ltd.