Bioplastics

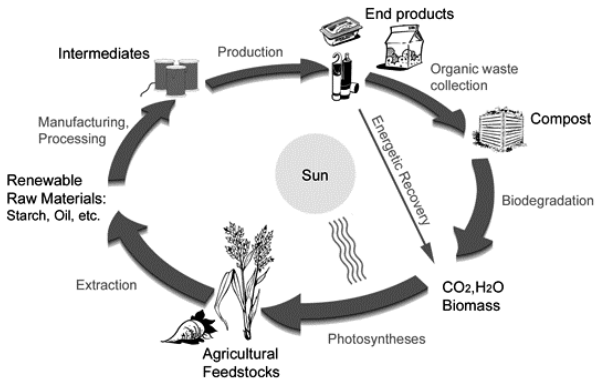
Bioplastics are generally considered to be a form of plastics derived from natural resources such as Wood (cellulose), vegetable oils, sugar or starch.
The collective term 'bioplastics' is used to describe two different concepts at the same time, often leading to confusion. These two concepts are:

- Functionality, i.e. plastics which are biodegradable/compostable;
- Material source, i.e. renewable resource-based or biomass based plastics.

Lately the term 'bioplastics' has almost replaced the term 'biodegradable plastics'. Bioplastics are now generally understood to be either:

- Plastics made from renewable raw materials (converted to biodegradable or non-biodegradable products) or
- Biodegradable plastics made of either renewable or fossil raw materials.

Their development follows nature's example: 100 billion tonnes of biomass are annually produced from plants, using sunlight and photosynthesis. The same amount biodegrades back into the source materials, carbon dioxide (CO_2) and water, together with small amounts of biomass and minerals. This occurs primarily through biological degradation via numerous microbes. The bioplastics industry's aim is to imitate this closed loop, as it represents the means by which environmentally-damaging CO_2 emissions can be reduced and fossil resources conserved for future generations.



The crucial point is the utilisation of renewable resources. Bioplastics' great advantage – the conservation of fossil resources and reduction in CO_2 emissions – make them one of the most important innovations for sustainable development. Plastics, with their current global consumption of more than 200 million tonnes and annual growth of approx. 5%, represent the largest field of application for crude oil outside the energy and transport sectors. This 5% crude oil consumption may appear comparatively small, however it does emphasise how dependent the plastics industry is on oil. Price increases in crude oil and natural gas caused by strong demand and political conflict also have a marked effect on the plastics market. It is becoming increasingly important and pressing for this significant industry branch to utilise alternative raw materials.

Currently available bioplastics types cover approx. 5-10% of the current plastics market. In addition there are completely new applications such as compostable film products. This technical potential is nowhere near fully utilised. Bioplastics development is just beginning. Their market share is currently well under one percent. The market is growing and in many application areas e.g. packaging or agricultural films, the number and quantity are increasing dramatically. Successful marketing strategies are based on clever utilisation of the materials' functionality and appealing to the consumer through the highly positive image. Labeling has been developed to assist the consumer in recognising the products and distinguishing them from conventional plastics. The labeling is based on scientific criteria for biodegradability and compostability.

The competitiveness of bioplastics has greatly improved in the past few years. This is not only due to the fact that conventional plastics have become expensive. The technical properties or simplified recovery following consumption can also represent an economic advantage. Most products remain more expensive than crude oil based plastics which have been on the market for many years. Bioplastics are currently produced mainly in small production plants (total production capacity approx. 300,000 t worldwide). Their development costs are high and they do not yet have the benefit of "economies of scale".

While most bioplastics are biodegradable, some are not, namely the so-called 'durables'. **A** traditional plastic based on fossil resources, such as polyethylene, is not biodegradable.
Some modified traditional plastics are sometimes called 'degradable'. For example, they may contain an additive which causes the plastic to degrade under conditions of ultraviolet light and oxygen. These are known as 'photodegradable plastics'. Others may contain an additive which initiates degradation under specific conditions of temperature and humidity. In this case, the plastic is referred to as 'oxo-degradable plastic' but the degradation process is not initiated by microbial action.

Biodegradable plastics degrade because of cell-mediated phenomena (micro-organisms, enzymes, fungi, bacteria). A material is biodegradable when the degradation is the result of the action of micro-organisms and the material is ultimately converted to water, carbon dioxide, methane and biomass.

Compostable plastics are degradable because of biological processes occurring during composting and are converted into carbon dioxide, water, and biomass. There are no toxic side effects like toxic residue for water, soil, plants or living organisms. Currently these plastics are based on renewable resources.

Please note that not all biodegradable materials are compostable.

What are the raw materials?

Biomass-based plastics are derived from renewable resources. Presently, the most common raw materials used in the production of biomass-based plastics are corn, starch and potatoes. But sugar cane or other types of renewable raw materials, including the biomass fraction present in waste (from households, municipal waste, dairy industry, paper mills, forestry, etc.) can be used. These raw materials are then converted into plastics in a production unit. But some specific types of plastics can even be produced directly by certain plants. Some bioplastics, e.g. those derived from corn grown in North America, are based on genetically modified raw materials. But others are not.

The most common market for bioplastics today is packaging. Existing applications include biodegradable plastic shopping bags, compostable waste collection bags and compostable or Biomass-based food trays and food service packaging. Various applications in other sectors are currently under development especially in the automotive and electronic sectors.

The plastics converting industry supports bioplastics innovation that offers to society and to the plastics value chain a range of additional opportunities including:

- Enlargement of the raw material base, at the right quality and price. This will improve competition;
- Use of existing processing technologies;
- New business fields, including niche products;
- Possible fossil carbon reduction over the life cycle of a product, even when recycling or reuse is not feasible;
- Additional benefits for the function of a product through biodegradability where this attribute is practicable;
- Sales promotion for certain products like organic food packed in compostable packaging.

Bioplastics will gradually find their place in the complex world of the plastics industry. Our industry is willing to work with different partners to make relevant progress on these new challenges. Innovation and diversity are our key strengths and bioplastics offer us new opportunities to demonstrate these to our customers.

Biodegradable plastics can be recycled but should not be mixed with traditional plastics. Incompatibility among various different types of bioplastics may require them to be sorted by type before being recycled. **T**hey can also be recycled through biological processes (e.g. composting).

Many studies show that under economic and ecological aspects, there is no general ‘best recycling process’ for plastics — the same applies to bioplastics as with traditional plastics.