Biopackaging

Growing market share, refined offering

In this feature, biopackaging is defined as packaging made of renewable materials and/or which is compostable. The market share of bioplastics is presently about 1%. However, it is steadily growing because the offering is becoming larger and more varied. The recent trend has been for companies to rely on environmental gains at the source; degradability or compostability are not always a primary consideration. Yet functional requirements are becoming more numerous and packaging is becoming increasingly complex and ingenious. This feature provides an overview of the current situation.

prevent pack

What is **biopackaging** ?

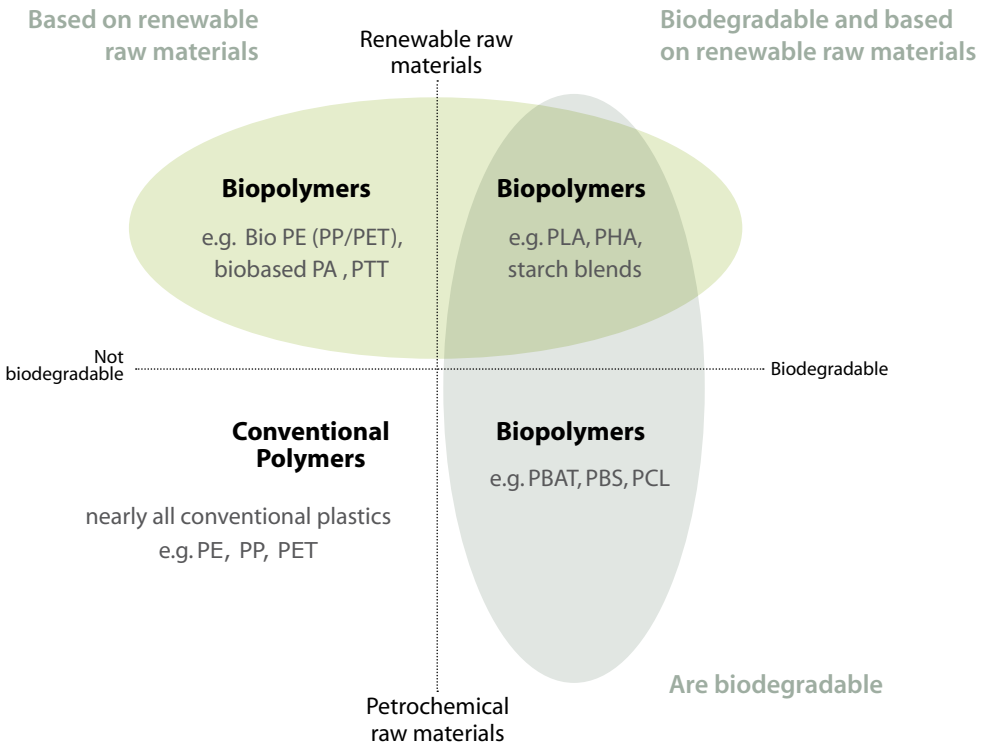
According to the man in the street, biopackaging is 'packaging that is good for the environment'. Joachim Quoden, Managing Director of Pro Europe, shares this opinion, but adds a precision: 'environmental gains can be achieved in a number of ways, for instance by making packaging lighter, by optimizing transport, by using less energy during manufacturing, by making packaging recyclable, or by using renewable materials. Professionals from this sector are sticking to only two aspects to define biopackaging: packaging that is made from renewable materials and/or that is compostable.'

In other words, for these professionals, biopackaging is a packaging that complies with at least one of the following conditions:

- **Its manufacturing** involves (virtually) no use of fossil materials or other raw materials in limited supply
- **After (final) use**, the packaging can be entirely composted

Quoden adds however that the environmental gain is not always obvious: 'Biopackaging is not automatically better for the environment; it depends on numerous factors.'

MATERIAL COORDINATE SYSTEM OF BIOPLASTICS



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Biopackaging

Classification based on raw material

Because paper and cardboard are made from wood fibre, which is a renewable material, cardboard packaging is considered the oldest and most important industrial biopackaging. There are also other types of packaging made from natural fibres. These include palm fibre or coconut fibre based packaging, as well as bagasse trays made from sugar cane fibres. Packaging made from bioplastics or biopolymers form an important group. Peter Ragaert of Pack4Food distinguishes three primary categories:

• Natural polymers based on cellulose or starch. Examples include the cellophane films of Innovia and the starch films and fillers of Novamont.

• Polymers obtained through the chemical synthesis of a natural monomer. These include the PLA (based on lactic acid) and the biological equivalents of fossil plastics such as bioPE, bioPP and bioPET.

• Polymers obtained through bacterial fermentation, such as PHAs (polyhydroxyalcanoates), including the well known PHB (polyhydroxybutyrate).

Bruno De Wilde, Lab Manager at Organic Waste Systems, adds a fourth category of bioplastics which are biodegradable: petrochemical polymers such as PBS, PBAT, PCL, and PVOH.

Growing attention to the flow of raw materials

The definition of biopackaging has not always been this broad. 'A decade or so ago, people focussed mainly on waste issues,' clarifies Ragaert. 'In order to be good for the environment, biopackaging had to be primarily compostable. That has gradually changed with the growing attention to the environmental footprint and greenhouse effect. It is now understood that there is at least as much environmental gain to be realized at the source. It is possible to reduce the burden on the environment by using natural, renewable raw materials.'

'OK biobased' illustrates the renewable source

The renewable source can easily be established in an objective manner. In addition, Ragaert notes that it is relatively simple to explain. 'In 2009, Vinçotte launched the internationally renowned 'OK biobased' logo. The label features four levels, each indicated by a star that represents 20% of renewable raw materials. Four stars therefore signify 80% biobased. That is crystal clear for consumers.'

However, Quoden remarks that 'it is also important to see that the manufacturing process is sustainable. Otherwise the potential environmental benefits of biopackaging are immediately counterbalanced.'

Competition with food products must be avoided

The flow of raw material for biopackaging is gradually becoming more diverse. This is necessary to avoid competition with food production. 'Some residual flows are already being looked into and actually used,' observes Ragaert. 'For instance, starch can be extracted from the juices obtained when cutting potato fries. That starch can then be used to produce bioplastics. For the production of PHA, we need a substrate on which the bacterial synthesis can take place. That substrate can also come from specific waste flows.'

However, many of these techniques are still in a research phase. At present, competition with food products therefore remains a threat.

good to remember

- Biopackaging is made of **renewable** and/or **biodegradable raw materials.**
- Pure waste streams are best **recycled** or **incinerated with energy recovery**. Composting is only useful if the packaging is contaminated with moisture or food.
- In order to meet market demand, biopackaging is becoming **increasingly innovative and complex**. Techniques and materialsare frequently being combined.
- The **development** of bioplastics is **gaining** momentum worldwide.

Biopackaging

End-of-life is more complex

The 'OK biobased' logo informs users about the raw materials that are used but does not say anything about the end-of-life of the packaging. Quoden says this depends upon numerous factors. 'Which materials are being used? Which processing infrastructure is present in a specific country? Some types of biopackaging are recycled, others composted or incinerated with energy recovery. Recycling also requires caution. Some polymers, such as PLA, are not compatible with the recycling of other types of plastics and can seriously contaminate the recycled material.'
'End-of-life is indeed more complex,' acknowledges De Wilde. 'A biobased packaging, for instance, does not automatically imply that it is compostable or degradable. Reciprocally, some petrochemical plastics are degradable. That complicates things for consumers: can the package be thrown on the compost heap or not, can it be put with the paper waste or in the blue PMD bag, or should it be thrown away with the residual waste?'

No erroneous claims

The use of claims such as 'compostable' or 'biodegradable' is strictly regulated. The Royal Decree of 9 September 2008 establishes the product norms for compostable and biodegradable materials. It refers to the European EN 13432 standard which defines the test programme and the evaluation criteria to which compostable products (including packaging) must comply. Meeting these requirements is essential to market reliable products and to rule out erroneous claims or 'green washing'.

Compostable but not on the compost heap

Not every biobased packaging complies with the compostability criteria outlined in EN 13432. Furthermore, even compostable types of packaging can not automatically be thrown on the compost heap. 'Bioplastics such as PLA only compost in a controlled environment and at a high temperature,' explains De Wilde. 'The degradation process is only initiated after heating to 60 °C for a week. This can not be done at home. A distinction is therefore made between packaging that is compostable in a controlled environment and packaging that is compostable at home. Various logos indicate this, such as those of Vinçotte and Din Certco.'

In addition, a packaging with a compostability logo may not be placed in the organic waste container. 'This is a precautionary measure,' says De Wilde. 'No packaging is allowed in the green waste container because this can easily lead to mistakes that are likely to contaminate the green waste flow; for instance with non compostable bioplastics. Some people within the sector are now requesting that green waste containers be opened for compostable packaging, on the condition that consumers are well informed.' '

At the moment, it is therefore of little use to put the 'OK Compost' logo on a packaging,' notes Quoden. 'That logo actually means that the package is only compostable industrially but it cannot be thrown with the green waste at home. It's very confusing for consumers.'

Abbreviations used

BioPE = Biopolyethylene
BioPP = Biopolypropylene
BioPET = Biopolyethylene terephtalate
MAP = Modified Atmosphere Packagingg
PBAT = Polybutylene adipateco terephtalate
PBS = Polybutylene succinate
PCL = Polycaprolactone
PET = Polyethylene terephtalate
PHA = Polyhydroxyalcanoates
PHB = Polyhydroxybutyrate
PLA = Polylactic acid
PVOH = Polyvinyl alcohol

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Looking for **suitable applications**

Compostability does not always entail added value. 'It is better if a non-contaminated flow of packaging waste is recycled, even if it bio-based,' says De Wilde (see also Coca-Cola testimonial). 'In some cases, incineration with energy recovery might even be the better option. We must judge this taking into account an overall lifecycle analysis.'

'Environmental studies indicate that incineration with energy recovery is better for the environment than composting,' endorses Quoden. 'Indeed, the latter leads to raw material losses, which goes against the European policy framework on Resource Efficiency.'

Bruno De Wilde notes that compostable packaging is interesting primarily when the waste flow is moist or inevitably mixed with food. Think of airline catering or fast food chains. Such packaging waste is too contaminated to be recycled well and too humid to be incinerated efficiently. In that case, composting the package and the food remains together is ideal. A distinct collection must then be organized. Other useful applications include body bags, starch-based garden, fruit and vegetable waste bags, and mulching films that are degradable on site for the agricultural sector.'

Creating clarity

It remains important to sensitize and inform. 'Biopackaging too must be managed in a responsible way,' says De Wilde. 'Logos and certificates should not be an excuse to just throw waste in the natural environment. That is why the Royal Decree of 9 September 2008 forbids the mention of the word 'biodegradable' on packaging. Whether degradable or not, packaging does not belong in the natural environment. And some claims require extra caution. This is the case with 'oxodegradable', for instance. This relates to films that degrade into microscopically small particles under the influence of light. These particles remain in the natural environment however and entail pollution, even though they cannot be seen with the naked eye.'

Functional requirements keep growing

In the mean time, packaging requirements—whether biobased or not—keep growing. 'Smart packaging, MAP, microwave resistant packaging, resealable packaging, et cetera, are in high demand today,' stresses Ragaert. 'Research is being carried out in each of these areas. As a result, biopackaging is also becoming more complex. Materials and techniques are increasingly being combined. In order to extend storage life, for instance, coatings and barrier materials are being added, whether biobased or not, compostable or not. Heat resistance is also a hot subject, for instance to enable pasteurization inside the packaging. In the case of PLA, research is examining what types of lactic acid are able to increase heat resistance. The impact on filling lines must also be considered. Everything is becoming technology intensive.'

1.7 million tons of bioplastics by 2015

The worldwide production of bioplastics is increasing rapidly. In 2009, a total of 318,000 tons were produced. One year later, this figure had already more than doubled to 724,000 tons. Expectations are that by 2015, approximately 1.7 million tons of bioplastics will be produced annually.

At the moment, however, their cost remains an obstacle. 'The manufacturing processes remain rather expensive,' explains Ragaert. 'This pushes the overall price upwards. As a comparison: PLA currently costs about 1.6 to 2 euros/kg, whereas petrochemical PE is 1.2 euros/kg. But of course, we know that petrol prices will rise in the future and that the production of bioplastics will in all likelihood become more efficient. In addition, virtually every industry supports bioplastics. Their use is certainly not limited to packaging. The automobile sector uses them, and gadgets and electronic devices are being designed using bioplastics. That is a big boost for further developments.'

For **additional information**

Pack4Food is a consortium of knowledge centres, network organizations, and companies concerned with the topics of 'innovating through the packaging of food products' and 'sustainable and functional packaging'. **www.pack4food.be**

Organic Waste Systems (OWS) is a spin-off of the University of Ghent that specializes in the biological treatment of organic waste flows. OWS is renowned worldwide as an independent lab that tests products on their biodegradability and compostability, among other things. **www.ows.be**

Pro Europe is the umbrella organization of producers responsible for the recycling of packaging. **www.pro-e.org**