PRO EUROPE
Packaging Recovery Organisation Europe s.p.r.l.

Fact sheet on bioplastics

March 2009

Bioplastics are increasingly in the news in the packaging sphere as they add new features to the diverse spectrum of plastics materials. Their development is linked to several factors such as the depletion of petroleum reserves, high oil prices and increased greenhouse gas emissions.

This fact sheet is meant to give clear and concise information related to bioplastics, the terminology used and management once they become waste, based on PRO EUROPE members' expertise in the matter.

Main conclusions:

- **Under the definition of bioplastics, different aspects are covered; their composition and end-of-life.**
- **Misconceptions about the properties, benefits and end-of-life process of bioplastics are widespread.**
- **Bioplastics are not currently proved to be more sustainable than petrol-based plastics.**
- **Technically, bioplastics could be recycled but would then require being part of a separate collection and having enough quantity of good quality recyclable waste, recycling infrastructure and sustainable outlet.**
- **Composting makes less sense from an environmental point of view than the incineration or gasification of bioplastics with energy recovery.**
- **Tax exemptions or incentives for bioplastics are not currently justified and would lead to distortions in the internal market.**
- **The promotion of biodegradable plastics among consumers should be avoided as it could lead to an increase of littering behaviours.**

About bioplastics

Differentiating bio-based plastics from biodegradable or compostable plastics

The term bioplastics is often used as a collective term for different plastic types. Two aspects of bioplastics are generally mixed up:

- Its composition: a plastic made of renewable resources.
- Its end-of-life: a biodegradable or compostable plastic

The composition and the end-of-life are independent aspects that should not be confused. The biodegradability of plastic is independent of its composition:

- Bio-based plastics are not always biodegradable.
- Biodegradable plastics are not always made of renewable resource. Traditional petroleum based plastics can be biodegradable.

A bio-based plastic is a plastic derived from a renewable source; biomass which is a material of biological origin excluding material embedded in geological formation or transformed into fossil fuels. According to the University of Hannover, there are more than 300 types of bioplastics. For example, bio-based plastics can be made from corn, sugar cane, starch. Many biobased plastics contain also a significant amount of petroleum, often 50% (for the bags) and sometimes up to 80%.

See ANNEX 1 on bioplastics definitions

Differentiating biodegradable and compostable plastics

It is also important to distinguish **biodegradable** plastics from **compostable** plastics:

- Biodegradable plastics are degradable due to the action of micro-organisms and enzymes (such as fungi or bacteria). The mineralisation of organic structures by micro-organisms converts the bioplastics into carbon dioxide, methane, water and biomass.
- Compostable plastics are degradable due to a biological process 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. They conform to an officially recognised standards EN 13432.[1]

Moreover, it should be noted that not all biodegradable materials are compostable.

Differentiating biodegradable and oxo-degradable plastics

There is a clear distinction between 'biodegradable' materials that undergo degradation by biological processes and water and 'degradable', often referred to as 'Oxo-degradable'. Those materials are made of traditional plastic with an additive that initiates degradation under the action of UV and oxygen. This kind of material could encourage littering, doesn't degrade in landfill, and is a real danger for marine life (particles are only degraded and will attract the toxins present in water and become real small bomb).

Differentiating in house and industrial compostability

A distinction needs to be made between plastics that can be composted at home and those which require an industrial process.

A certain level of temperature, heat, water and oxygen is required by active micro-organisms for efficient and effective biodegradation. A product is compostable according to the internationally recognized standard EN 13432 only when specific conditions (temperature, humidity level, time) are met in the composting system. These conditions are significantly different in home composting than in industrial facilities. Many products which meet EN13432 in industrial composting facilities will not do so in home composters.

Misconceptions and negative impacts

Sustainability

Bioplastics are often described as environmentally superior to traditional plastics although this assumption is not implicitly correct. Being biodegradable or biomass based is not synonymous with being environmentally friendly or sustainable.

Solution to the litter problem

The biodegradability does not resolve the litter issue. Biological degradation without the required conditions (micro-organism, temperature and humidity) is very slow and can last several years.

Moreover, bioplastics can potentially add on to the litter problem as the consumer may believe that they just "break down and disappear" after disposal. Therefore one most be cautius in promoting biodegradability of a material among consumers.

[1] A European-accepted testing scheme (EN 13432) exists which defines the compostability of plastics. It describes test methods to determine the biodegradation of polymers in the timeframe of industrial composting systems.

Confusion among consumers

Consumers are confused with the different labels describing packaging as “biodegradable”, “home compostable”, “compostable”, “degradable” or even “biopackaging” printed on bags, pots, trays, films, bottles, etc. They rate them very favourable but mostly ignore their exact meaning, whether and how they should sort them and which are the most sustainable waste management options to treat them.

There is a clear need for a regulated communication on both the labels and sorting instructions as well as their sustainability. Material producers and retailers using these new materials have a responsibility for introducing them in a responsible and coordinated manner so that previous education efforts for waste prevention and recycling are not ruined.

End-of-life bioplastics

Once bioplastics become waste, the important question of their collection and recovery arises.

Collection of bioplastics

Bio-plastics can either be collected with **other packaging[2], residual waste**, **or with organic waste**. The impacts of these three different scenarios are as follows:

- **Scenario n°1**: If the bioplastic complies with the sorting instructions, it will be selectively collected. Then the possible end-of-life options are :
    - **Recycling:** possible if adapted sorting equipment, enough quantity of good quality homogenous material, existing sustainable recycling infrastructure and outlet. It is to mentioned that blend material cannot be sorted apart and that there is a high risk of contamination of the recycling process of the PET if only 0,1% of PLA enter the process (both materials have similar appearance).
    - **Gasification or incineration with energy recovery**: better options than composting. Note that not all bioplastics are biodegradable and that there is a need for gasification infrastructure in Europe.
    - **Composting**: A possible option if no existing recovery infrastructure. Not all bioplastics are compostable.
    - **Landfill**: least preferred option

- **Scenario n°2**: If bio-plastics are thrown in the residual waste bin, they will end their life in landfill (the less preferred option) or being incinerated with energy recovery (better option than composting). In some countries, residual waste is sorted (same issues as in scenario 1).

- **Scenario n°3**: Only a small minority of citizens have access to organic waste collection. For those who have access to it, they are often forbidden to throw plastic packaging in it since the public authorities fear mistakes and thus a rise of the residue and therefore a lower quality of the compost. Note that not all the bioplastics are compostable. Two end-of-life are possible for organic waste:

    - **Gasification**: very few existing infrastructure and not all are adapted to treat packaging
    - **Composting**: a less sustainable solution than recovery (gasification or incineration) and few infrastructures adapted to treat packaging (they are filtered at the entrance of the facility and end up in the residual fraction).

[2] Please note that in most of the countries, only bottles are collected separately and not all plastic packaging.

Home composting: only a few bioplastics are home compostable. Few consumers use this end-of-life option.

See a summary of the different scenarios in ANNEX 2

Impact on existing producer responsibility schemes

It is important to recall that the Green Dot fee is only linked to the end of life of materials and aims at financing the recovery and recycling of packaging waste in order to achieve the EU targets in an efficient way. The fee is therefore not meant to promote one type of material vis-à-vis another. A special treatment applied to bioplastics such as a reduced fee for recovery compared to other plastics is not justified and would be unfair since bioplastics are not the best technical solution to protect all product and are not proved to be environmentally superior compared to petroleum-based plastics.

Case studies

Austria

A recent report[3] (May 2008) prepared by the Higher Technical Education Institute (TGM) in Vienna draw a series of conclusions on the possibility to sort, recycle and compost biopolymers.

- In automatic sorting plants, bio-plastics can be detected as "Non-PET". However, in manual sorting plants this is not possible since PLA can not be differentiated visually from PET.
- Even a very small amount (0.1%) of PLA mixed with PET affects the quality of the recycled product and hence its value on the market.
- When home composting is compared to industrial composting, the degradation is slower when happening at all. For example, PLA (a biopolymer made from natural sugar sources) does not disintegrate at all in home-composting.

Belgium

Fost Plus (the Belgian member of PRO EUROPE) has made a study[4] to assess best waste management options for compostable packaging being industrially compostable in Belgium.

Main conclusion is that, when it comes to **industrially compostable packaging**, energy recovery is the most preferred option for the moment (from an environmental, logistical and economic point of view). Indeed,

- Industrial compostability is less sustainable than incineration with energy recovery.
- Not all the citizens have access to organic collection.
- Most of the composting facilities are not equipped to treat packaging.
- Studies have shown that when there is reference to compostability on the packaging, consumers tend to believe that they can compost it at home although it is the case only when it is clearly indicated that it is domestically compostable.
- Communication to the consumer about the compostability of a packaging should therefore be avoided unless the packaging is home compostable

[3] *Bericht Recycling und Kompostierung von Biopolymeren* Zusammenfassung zu den HTL Diplomarbeiten Recycling und Kompostierung von Biopolymeren im Auftrag von ÖKK GmbH – durchgeführt am TGM im Schuljahr 2007/08 by DI (FH) Klemens Reitinger MSc (May 2008)

[4] *Analyse des effets sur l'environnement des options de retraitement pour les matériaux : acide polylactique (pla)*. Rapport final, An Vercalsteren, Carolin Spirinckx, Ive Vanderreydt (VITO), Étude effectuée à la demande de Fost Plus Mai 2008

France

Eco-Emballages (the French member of PRO EUROPE) has carried out a study[5] in 2006 which had the objective to compare polymers from different origins and to assess the end-of-life of plastic packaging.

- Bio-based plastics present an interest in term of green house gas emissions and non renewable resources consumption. Water consumption appears as a large environmental stake for those plastics.
- The best end of life of bio-based polymers is incineration with energy recovery.
- In LCA (Life Cycle Assessment), the production stage of bio-based is so important that the end-of-life has no significant impact.
- Based on the technology currently in application and the end of life system in place, bio-based products do not present any environnemental interest.

[5] *Summary of environmental studies on plastics from renewable and fossil sources* Studies carried out by Bio Intelligence Service, December 2007

ANNEX 1

Biopackaging - Definitions

100.000 T / year (0,2% of all plastic

Made from renewable ressources

Issues :

- Not all are compostable
- Might contain a % of fossil resource
- No existing standard or certification

No link with the end of life

Biodegradable term might cause littering

Home compostable

Issues :

- Made from fossil or renewable resources
- Not a common habit in Europe
- No CEN norm (existing certification)
- Confusion with the

Industrial compostable

Issues :

- Made from fossil or renewable resources
- Existing CEN norm and certification
- Energy recovery is more environmentally friendly than composting as end-of-life treatment
- Very few organic collection and composting infrastructure for packaging
- Compostability interesting in some application (agricultural film, catering packaging, ...).

Not to be communicate to the

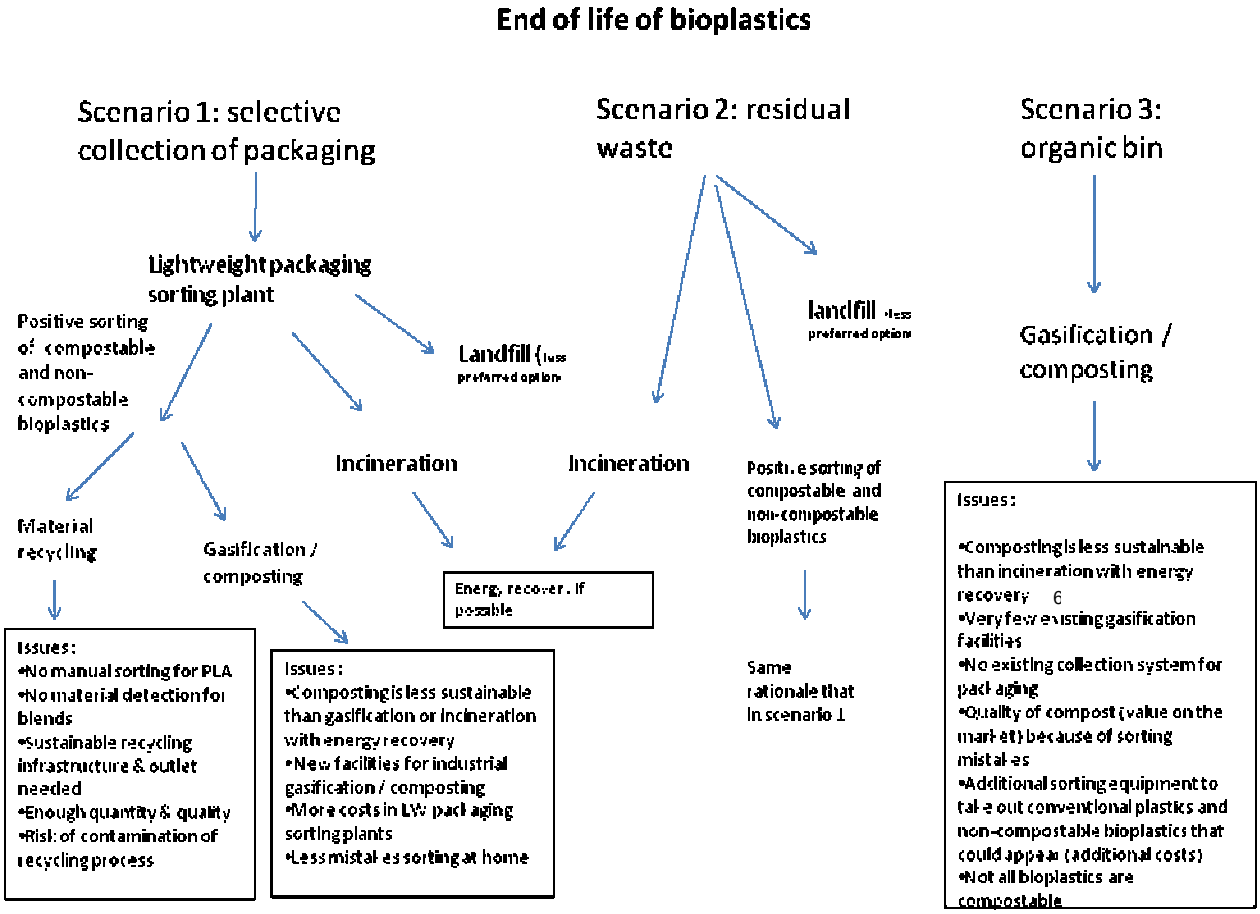
Oxodegrada

Issues :

- Made from PE with additives
- Degradable with UV & oxygen (not biodegradable)
- encourage litter
- Danger for marine life & human health
- Not degradable in landfill
- Greenwashing marketing

To avoid

ANNEX 2



6 Analyse des effets sur l'environnement des options de retraitement pour les matériaux : acide polylactique (pla). Rapport final, An Vercalsteren, Carolin Spirinckx, Ive Vanderreydt (VITO), Étude effectuée à la demande de Fost Plus Mai 2008