The Global Outlook for Biodegradable Packaging

Key trends and developments driving the global biodegradable packaging market

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Table of Contents

Table of figures

Table of tables

The Packaging (Essential Requirements) Regulations 2003, as amended by the Packaging (Essential Requirements Amendment) Regulations 2006

These regulations require companies to ensure that their packaging is 'fit for purpose' and is the minimum weight and volume needed for safety, hygiene, and consumer acceptability.

Packaging may be reusable (optional) but all packaging, including reusable packaging, must fulfill at least one of the following criteria:

- Packaging recoverable through material recycling.
- Packaging recoverable through energy recovery.
- Packaging recoverable through composting, in particular, "Packaging waste processed for the purpose of composting shall be of such a nature that it should not hinder the separate collection and the composting process or activity into which it is introduced".
- Biodegradable packaging: in particular, "Biodegradable packaging waste shall be of such a nature that it is capable of undergoing physical, chemical, thermal or biological decomposition such that most of the finished compost ultimately decomposes into carbon dioxide, biomass and water".

Belgium

The Belgian government primarily approaches the problem of packaging waste with taxation. The government attempted to introduce a carbon-based tax on all packaging materials, but this failed due to opposition from a coalition of environmentalists, industry, and consumers which viewed the plans for a general tax on packaging as a stealth tax that could not be justified on environmental grounds. From July 2007 a tax on selected types of packaging became effective, including EUR 3 per kg (approximately $4.30 per kg) on plastic carrier bags and EUR 2.70 per kg 0028 (approximately $3.80 per kg) on plastic films.

France

France is one of the leaders of biodegradable packaging regulation in Europe. A 2005 Law on Agricultural Policy outlined the country's obligation to promote biodegradable plastics, and in 2007 France submitted a proposal to the European Commission to require plastic used to produce small rubbish bags and cotton buds to contain a minimum of 40% material from vegetable origin (by weight). This proposal came into effect in 2009.

There are four main sources of biopolymer:

- *Biomass*: e.g. agro-polymers from agro-resources including starch and cellulose.
- *Microbial production*: e.g. polyhydroxyalkanoates.
- *Conventional chemical synthesis*, with base molecules derived from agro/renewable resources: e.g. polylactic acid.
- Polymers whose monomers and polymers are obtained conventionally *from petrochemicals through chemical synthesis*.

Biopolymers can be created using a number of methods, including the creation of a polymer structure from an original natural molecule using a process of chemical polymerization; and the chemical modification of a naturally occurring polymer. Chemical modification, however, can sometimes affect the biodegradability of the end product. As each biopolymer has its own unique set of properties (such as oxygen permeability), a compromise is often necessary between material properties and biodegradability.

There are currently two main production processes for the creation of biopolymers: fermentation and GM plants.

Fermentation

Fermentation is the use of micro-organisms to break down organic substances without the use of oxygen. Polymers created using fermentation usually use genetically engineered micro-organisms specifically designed for the appropriate substance.

There are two main methods of fermentation:

- Bacterial polyester fermentation: using bacteria called Ralstonia eutropha. These bacteria use the sugar of feed stocks such as corn to fuel their cellular processes, the by-product of which is a bacterial biopolymer which can then be separated from the bacterial cells.
- Lactic acid fermentation: using lactic acid fermented from sugar. In this process, the end-product is lactic acid, therefore an additional step is required to convert the lactic acid to polylactic acid (polymerization).

Table 4: Comparison of compostable and oxo-biodegradable plastics

Compostable plastic	Oxo-biodegradable plastic
Can be recycled as part of a normal plastic waste stream	Damages recycle stream unless extracted from feedstock
Can be made from recycled plastic	Cannot be made from recyclate
Emits CO_2 slowly while degrading and forms biomass Inert deep in landfill	Emits CO_2 rapidly while degrading
Can use same machinery as for conventional plastic	Needs special machinery
Can be compostable	Degrades only in high-microbial environment
Four or five times more expensive than conventional plastic	Little or no on-cost
Same strength as conventional plastic	Weaker than conventional plastic
Same weight as conventional plastic Leak-proof Degrades anywhere on land or sea	Weaker than conventional plastic
No PCB's, organo-chlorines, or "heavy metals" Can be incinerated with high energy-recovery	Can be incinerated, but lower calorific value
Production uses no fertilizers, pesticides or water	Production uses fertilizers, pesticides and water
Safe for food contact	Safe for food contact

Source: Business Insights

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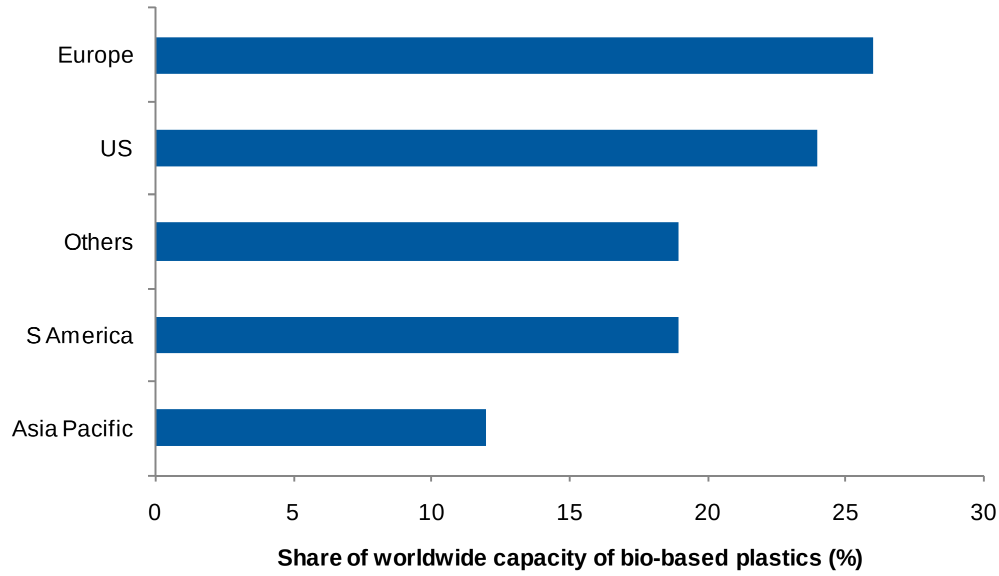
Market outlook

The global production capacity for bioplastics reached 400,000 tons in 2009, according to a study from the University of Utrecht, and is forecast to reach 3.5m tons by 2020, representing a Compound Annual Growth Rate (CAGR) of 21.8%. Europe currently leads the field in regulation and infrastructure for biodegradable packaging, and accounted for over 50% of world tonnage for bioplastic packaging consumption in 2010.

The US still dominates in terms of production capacity, but even here it is gradually losing its dominance. In 2003 the US accounted for 84% of global bioplastics production, compared to just 15% in Europe. However, by 2007 Europe had almost doubled its capacity to 33%, while the US share fell to 36%, and Asia accounted for 29% - a dramatic increase from just 1% in 2003. According to the European Bioplastics association, by 2020 Europe and the US are likely to each account for around a quarter of production capacity, while Asia, South America, and new players will provide the rest.

Figure 14: Share of worldwide capacity of bio-based plastics (%) by region in 2020



Note: Others = Africa, Middle East & Oceania

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Source: European Bioplastics Association