

# Biopolymers on the way up

There is no doubt that biopolymers offer numerous advantages over conventional plastics. But price isn't one of them... yet. Gunter Festel, Sarai Kölle and Dieter Sell report

BETWEEN 1999 and 2004, the worldwide production capacity for biopolymers grew significantly, to about 250 000 tonne/year. The rise in capacity clearly shows how they are emerging from being a niche market and moving to mass production scale.

Within Europe, recent figures indicate that consumption has increased from 20 000 tonne in 2001 to 50 000 tonne in 2004. By 2015, this consumption is expected to increase to about 1m tonne. Moreover, the long-term substitution potential of biopolymers is estimated at up to 15m tonne within the EU, a capacity that would meet about one-third of present plastic production.

## NUMEROUS TYPES

Today, there are numerous types of biopolymers based on different raw materials, and new products or processes are regularly appearing. For example, DuPont and Tate & Lyle have jointly developed a proprietary fermentation and purification process to produce bio-based 1,3-propanediol (PDO).

This will be manufactured by DuPont, which recently said it will spend \$100m constructing a plant in Loudon, Tennessee, US. It will produce PDO for the production of the polyester poly(trimethylene terephthalate), known under the tradename *Sorona*. DuPont aims to produce at least 25% of its products with bio-based resources by 2010.

Another example is Procter & Gamble, working together with Kaneka to produce poly-3-hydroxybutyrate-co-3-hydroxyhexanoate (PHBH) for the packaging industry. PHBH is expected to be commercially available on a large scale within the next two to three years, whereupon the price should fall below \$2.3/kg.

Prices for biopolymers vary: starch polymers cost from €1/kg; starch blends, €3-3.50/kg; cellulose polymers, €3.40-4.50/kg; and polylactic acid (PLA), €2.30-3.50/kg. But these figures are still much higher than those of petrochemicals-based polymers, such as polyethylene at €0.80-1.20/kg.

Innovative biopolymer-based products are stunted by higher costs, intense compe-

## HIGH PERFORMANCE POLYMER DEVELOPMENT

Polymer	Company (brand name)	Current production capacity, tonne/year
Starch polymers and blends	Biop ( <i>Biopar</i> )	-
	Bio tec ( <i>Bioplast</i> )	10 000
	FKuR Kunststoff	3500
	Novamont	35 000 (further 15 000-20 000 by 2006)
	Plantic	Several thousand
	Rodenburg Biopolymers ( <i>Solanyl</i> )	47 000
Polylactide acid (PLA)	NatureWorks (once Cargill Dow) ( <i>Nature Works</i> )	140 000
	Galactic	Still in pilot phase (several tonne/year)
	Hycail BV ( <i>Hycail</i> )	1000
Polyhydroxyalkanoates (PHAs: PHB, PHBH)	Biomer	Several tonne/month
	Procter & Gamble ( <i>Nodax</i> )	Still in pilot phase
Polymers based on bio-based PDO	DuPont ( <i>Sorona</i> ) [from 2006]	Still in pilot phase
Cellulose polymers	Innovia Films	-

tion with standard polymers, and lack of consumer knowledge of the product. Only recently, for example, with the amendment of the German Packaging Ordinance in December 2004, have the ecological advantages of bio-based plastics been recognised compared with conventional plastics.

## JOINT MARKETING ACTIVITIES

The current strategy of pushing the distribution of biopolymers through retail markets is a very slow process. However, joint marketing activities by manufacturers, the development of new biopolymer materials and products, and the increased availability of bio-based products will all help to promote awareness of their benefits among consumers.

Interest in biopolymers within Europe could also be improved by other general measures, such as an increase in home composting, the organised collection of biodegradable plastics, and by implementation of an own category for imports and exports. A stronger political message on the importance of sustainable development would also encourage the industry to increase investments in bioplastics which would lead to

higher innovation rates.

During the past 20 years, the quality of biopolymers has improved significantly. New technical properties have appeared that were not available in the past. A good example is starch polymers which show an unusual high moisture vapour permeability, thus assuring a longer lasting quality for food packed in such material.

Biopolymer prices are also expected to fall in coming years, as economies of scale, increased experience levels as well as technological innovations help to lower the costs of producing and processing them. The increase in prices for fossil resources will also help to reduce the price differentials.

Many of the insights reported in this article are based on a market study by Festel Capital in Summer 2005, on the potential of renewable resources with a special focus on biopolymers. ■

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