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Injection WORLD

BIOPLASTICS FOR THE LONG AND SHORT TERM

EXPANDING USES IN ADDITIVE MANUFACTURING

ATTENTION TO ENERGY USAGE REAPS REWARDS

AMI

Bringing the plastics industry together

IMAGE: SHUTTERSTOCK

Bioplastics for the long and short term

Diversification is now the watchword for bio-based polymers as applications spread from biodegradable packaging to durable uses in areas usually served by engineering compounds. Peter Mapleston finds out the latest

From compostable plant pots to highly durable car headlamp covers, plastics derived from renewables are moving into more and more applications across consumer and industrial sectors. Sometimes these biopolymers are biodegradable, even compostable – particularly important for products with short lifetimes, especially packaging – increasingly though, they are not. It is now possible to obtain durable high-performance polymers like polyamides of various types and thermoplastic polyesters, including polycarbonate, from renewable resources. Here is a look at a few of the latest developments.

Starting in Europe, but moving around the world, is legislation that bans non-biodegradable plastics from a range of single-use applications. In the EU Single-Use Plastics Directive, plastic is defined as a polymer obtained through chemical modification of raw material, with the exception of natural polymers. Strictly applied, this has implications that may not necessarily have been considered at the time of drafting the legislation.

At Italian compounder **MAIP**, which has developed a wide range of materials based on different bio-based and bio-degradable polymers, Managing Director Eligio Martini says this means that only plastic items made with natural, non-chemically modified polymers can be used for the listed single-use products. He highlights IamNature, based on polyhydroxyalkanoates, PHAs, produced by biosynthesis in bacteria (see also *Compounding World* March 2019) and biodegradable in all conditions, including seawater.

"Bio-based polymers that are obtained from biological-based monomers cannot be considered natural polymers," says Martini. "They are always synthesized by a polymerisation reaction outside the plant or microbial cell." He says this rules out not only polyethylene made from ethylene derived from sugar cane and plant-based polyesters, polyamides, and cellulosics, but also polylactic acid (PLA) and polymers starting from starch.

"The only natural polymers that can be considered to be exempt from the Directive are natural polymers produced by biosynthesis in animals,

Main image: Bioplastics producers are going for growth

Right: Pulverised oyster shells are used in one of MAIP's IAmNature compounds

IMAGE: MAIP

natural polymers produced by biosynthesis in plants and algae, natural polymers produced by biosynthesis in fungi and natural polymers produced by biosynthesis in bacteria."

MAIP has over 500 grades in its IamNature, with elastic moduli ranging from around 500 MPa to over 6,000 MPa, and comparable, depending on the grade, to polyolefins and styrenics. Unreinforced grades as well as grades containing various types of fillers and reinforcements are available. One formulation even contains pulverised oyster shells.

At least one grade has been developed for external applications, out-performing not only ABS but also ASA (the so-called outdoor ABS, in which butadiene rubber is replaced by acrylic rubber). Some formulations are also said to have considerable scratch and mar resistance.

Bio-Fed, a branch of **Akro-Plastic**, produces and markets biodegradable and/or biobased compounds under the M·Vera brand. It does not divulge the polymers used. The portfolio includes mostly film extrusion materials with good transparency as well as a variable bio content, but also injection moulding grades. These are certified according to OK compost HOME and OK biodegradable SOIL by TÜV Austria Belgium. A range of grades with different mechanical properties is available, suitable for applications such as coffee capsules, disposable cutlery, hygienic relevant products, food and cosmetics packaging.

Compounds with OK compost INDUSTRIAL certification are available for the same products. The M·Vera injection moulding portfolio is rounded off by a softer grade with properties comparable to LDPE (low-density polyethylene). This material is mainly biobased and fulfils the requirements of soil degradability certificatation. Engineering applications can be served by the M·Vera ECS range, based on partially bio-based polyamides.

All M·Vera materials can be coloured individually – for example with Bio-Fed's AF-Eco biopolymer-based masterbatches, which are certified in accordance with EN 13432. The AF-Eco range consists of colour and carbon black masterbatches as well as additive masterbatches.

Squeezable tube producer Tubettificio Favia has developed ToBeNaturAL, a line of cosmetic tubes that use aluminium for the tube itself and a closure injection moulded in IamNature from MAIP. The bioplastic has also proved to be particularly suitable for customisation through Favia's innovative digital printing technology, "ToBeUnique," which enables the tube and the closure to be printed at the same time.

From PLA

Nurel in Spain has developed a new range of Inzea renewable and compostable biopolymers (based on PLA and starch) for injection moulding and extrusion. The company claims to be the leader in Europe in the manufacture of compostable biopolymers.

Nurel says one of the main advantages of Inzea is that it can be processed in the same facilities as standard polymers with just small process adjustments. "With optimal mechanical properties and similar processing parameters, Inzea can replace most oil-based polymers with equivalent properties," it claims.

"Inzea products for injection moulding have been designed to improve the main drawback of PLA, its low thermal resistance and its fragility," says the company. Grades are suitable for processing in conventional equipment. Generally the recommended processing parameters are medium to high injection speed and a moderate backpressure. Grades range in flexibility from 1,000 MPa to 10,000 MPa.

Nurel offers a wide range of grades with thermal resistance up to 150°C with or without annealing to increase levels of crystallinity. Target applications for grades with higher heat resistance include microwave food containers, coffee capsules and hot food containers. Inzea biopolymers are