Great advances in bioplastics

Sulzer Chemtech has developed an innovative process that allows the production of new grades of polylactic acid (PLA) with heat stability up to 180 °C. This advance makes the substitution of petrochemical plastics with PLA-based bioplastics possible in a broader range of areas.

Bioplastics, or organic plastics, are derived from renewable biomass sources, as opposed to conventional petroleum-based plastics, which are made from fossil feedstock. In certain applications, bioplastics already have a strong market position: for instance, in medical implants that dissolve in the body or compostable mulch films for agriculture use. There are new production technologies being introduced that make bioplastics available and affordable to the mass market.

PLA has very high potential for use in bioplastic applications because it resembles conventional petrochemical mass plastics in its characteristics and can be processed using existing standard equipment. PLA and PLA blends usually come as granulates with various properties, and they are used in the plastic processing industry for the production of foil, molds, cups, and bottles.

**Sulzer develops new process for PLA production**

For long-term success in the industry, it is crucial to improve the heat resistance of current bioplastics and to make them more competitive in price. Therefore, Sulzer Chemtech and Purac, a company of the Dutch CSM group, have jointly developed a new, cost-efficient polymerization process using lactide monomers to produce high-quality PLA. This process relies upon proprietary and jointly developed polymerization technology to efficiently make a range of PLA products from Purac’s specialty lactides. Purac produces D- and L-lactides (the monomers for PLA production, see box) in its Spanish production plant, which has a capacity of several thousands of tons. In March 2010, the construction started on a 75 000 t lactide plant at their production site in Thailand (Rayong Province).

**Improved heat resistance**

In contrast to commercial PLA, which contains a mixture of D- and L-lactides, Purac’s lactides allow the production of highly pure PLA types (based on L-L lactide or D-D lactide). This enables

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1. Sulzer delivered the modules of its new industrial-scale PLA polymerization pilot plant at the beginning of February 2012.
innovative PLA polymers with better properties, such as improved high-temperature stability.

The feedstock for this process is a lactide originating from cane sugar or Cassava starch. The PLA resulting from the Sulzer process does not require raw material that originates from genetically modified organisms (GMO) and can therefore be certified as a GMO-free product.

With its substantially improved heat resistance, the new PLA product endures temperatures of up to 180°C. This advance makes it possible to develop applications in the automotive, electronics, and textile industries using this new type of PLA.

Revolutionizing an industry

The new technology allows more efficient production of various PLA products and reduces processing and product-development times. In addition, it requires in total less financial investment and is therefore more profitable. The entry barriers to PLA production are significantly lowered.

The successful integration of three core competencies of Sulzer Chemtech has made this novel polymer production possible:

- Static mixing and reaction expertise
- Proven experience in piloting and scale-up
- Process and equipment engineering capabilities.

Successful startup of industrial PLA plant

In 2011, Synbra Technology, a Dutch chemical company, successfully put the first PLA plant with the innovative Sulzer technology into service [2]. The plant can produce up to 5000 t of PLA annually, which makes it the second largest plant of such a kind globally. The construction of the plant was completed in early 2011 at the Sulzer Chemtech location in Allschwil (CH), and it was followed by a commissioning and testing period.

The startup was successfully finalized, and Synbra Technology now produces various grades of high-quality PLA. The company intends to assume a leading position in Europe as a supplier of biodegradable polymers from renewable sources, and it plans to expand the annual PLA capacity significantly. Synbra also uses its own PLA production capacity to produce expanded PLA foam (E-PLA), an attractive biodegradable alternative to expanded polystyrene (EPS) foam in a variety of application areas. Customers of Synbra are manufacturers of packaging and insulation products, such as packaging boxes for food.

Sulzer builds a new PLA plant in 2012

Sulzer Chemtech demonstrated its dedication to bioplastics development through its recent decision to invest in its own 1000 t-per-year PLA pilot production plant [1]. This move will enable Sulzer to support its clients in the development of new PLA applications—both by providing samples in sizeable quantities and by demonstrating the feasibility of Sulzer’s PLA polymerization technology. It is planned that the plant, which will be located in Switzerland, will be operational in May 2012.

What is PLA?

PLA stands for polylactic acid. It is a bioplastic produced through the ring-opening polymerization of lactide monomers. The lactide monomers are based on lactic acid produced by the fermentation of sugar or starch (see also STR 1/2008, page 8). The characteristics of the polymer can be engineered through the selective mixing of lactides from counterclockwise D(−) and clockwise L(+) lactic-acid molecules.

In the near future, cellulosic material from wood, grass, or agricultural wastes could substitute for sugar as a raw material, thus avoiding competition with the food chain. This change could create synergies with other processes that use cellulose, such as those in the pulp and paper industry.

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