25 years of bioplastics degradation testing
A journey

OWS (Organic Waste Systems) is one of the world’s leading experts in biodegradability, compostability and eco-toxicity testing of different types of materials, including bioplastics. The Belgium-based company, with some 80 employees and various laboratories, is housed in a beautifully restored building in the old harbour of Gent. The journey started in 1990 - right around the time when the first modern bioplastics entered the market.

Slow but steady start

Novon Polymers, Procter & Gamble and Novamont were OWS’s very first customers. Testing was performed at two laboratories compliant with the principles of Good Laboratory Practice (GLP), one at the head office in Gent, Belgium, the other located in Dayton, Ohio in the United States.

As a result, OWS became one of the pioneers of the bioplastics industry. The company’s intensive participation in a number of standardization organizations, both at the national (ASTM and DIN) and international (CEN and ISO) level, led to the co-development over the past 25 years of several test methods and standard specifications on biodegradability and compostability. This resulted, among other things, in the publication of ISO 14855 and ISO 16929: test methods to determine the biodegradation and disintegration respectively under industrial composting conditions.

Even though no specific standard specification on industrial compostability had yet been finalized at the time, Vinçotte, the Belgium-based certification institute, had already certified the first compostable material in 1995 under their OK Compost certification program. Two years later, European Bioplastics (then IBAW) and DIN CERTCO jointly introduced the Seedling logo. The Biodegradable Plastics Institute (BPI), the US counterpart of Vinçotte and DIN CERTCO, introduced its logo in 1999. Certification bureaus in Japan, Australia, Korea, Canada, etc. soon followed suit; OWS has been recognized by all certification bureaus worldwide now for many years.

Early on, the focus was mainly on niche markets for which biodegradability and/or compostability was an asset, such as biowaste collection bags. This would rapidly change with the introduction of EN 13432.

Significant growth

It had taken several years and a substantial amount of time and the combined efforts of a number of parties, but in
February 2001, the European standard EN 13432 on industrial compostability was published. The US equivalents ASTM D6400 and ASTM D6868 were introduced in, respectively, 1999 and 2003. This resulted in a significant growth of the bioplastics industry, which ultimately led to OWS’s decision to concentrate its knowhow at a single site. The company closed down the laboratory in the US, invested in the laboratory in Gent and switched from GLP compliance to ISO 17025 accreditation.

With the expansion of the industry came also the next step in the market development. Biodegradable and compostable materials were now also being used for organic food packaging, matching the image of organic farming. Shortly after, bioplastics producers also began to target fast food restaurants, festivals, sport events, etc. as potential customers.

At the same time, simple products like bags and single layer packaging were further optimized, resulting in more complex structures. Compostable materials started being used for pizza boxes, frozen food packaging and yoghurt cups; today, all kinds of short-life packaging are produced from compostable materials. Yet this also served to raise new issues. While EN 13432 perfectly prescribes what compostability entails, it no longer provided answers to questions such as: Do blends of already certified components need to undergo full testing? What to do with multi-layered structures? And what about inks, additives and adhesives? As a result, certification committees were introduced during which experts, including OWS, discuss how these new complex products needed to be tested to comply with EN 13432. These are the so-called by-laws.

Today OWS has a team of 16 people working exclusively on biodegradability, compostability and ecotoxicity testing.

Biodegradation in other environments

However, in addition to compostability tests, OWS performed other kinds of tests as well. One of the first applications tackled by the industry was mulching films. A test method to quantify soil biodegradation had been developed in 1996 at ASTM level (ASTM D5988). Although it subsequently took until 2003 for the international equivalent, ISO 17556, to be published, the first certificates for soil biodegradable products were granted in 2000 by Vincotte under their OK Biodegradable Soil certification program. Today, DIN CERTCO also has a similar certification scheme and accompanying certificate and logo.

Similarly, certification schemes were also developed for materials and products that are home compostable or biodegradable in fresh water (for example, wet tissues and wrappers of dishwasher tablets). In recent years, however, marine degradation has received the most attention. Even though the only available test method (ASTM D7081) has been withdrawn, companies continue to work on developments in this field.

What to expect in the next years

Short-life packaging and consumer goods will further drive the compostable plastic industry in the coming years. Coffee capsules, for instance, are a very hot product nowadays and OWS has tested several tens of different coffee capsules from different companies in the past two to three years. Other products generating interest include multi-layered stand-
up pouches, fruit stickers and agricultural products used for tree and root protection.

Legislation is another very important driver. In March 2016, France introduced national legislation requiring home compostability for all single use plastic bags (< 50μm). Food service ware has since been included in this legislation, and is required to be home compostable as of 2020. As a result, OWS has seen an exponential growth in home compostability testing requests, specifically for the French market.

Also, at the European level, discussions are ongoing to incorporate specific requirements on soil biodegradation in the updated Soil Fertilizer Regulation. For instance, all major producers of controlled-release fertilizer coatings must therefore start investing in the development of soil biodegradable coatings. Today, OWS has already started working for some of the largest producers of controlled-release coatings in the world, and is in contact with several other producers as well.

Things are also changing in the US. Transparent certification schemes and by-laws have been in place in Europe for many years, but are unknown in the US. At the end of 2016, BPI established a Standards and Procedures Committee, with as first priority: the development of a certification scheme and set of by-laws. OWS is a member of this committee.

**Shift to “AD-able” plastics?**

Compostable products and their end-of-life characteristics perfectly match the European (bio)waste management scene. For many years, source-separated biowaste has been treated via industrial composting. EN 13432 compliant products can be processed by these systems and do not hinder the composting process. Furthermore, the separate collection of municipal biowaste is also expected to develop further.

However, there is a clear shift in Europe from industrial composting to anaerobic digestion when it comes to the biological treatment of organic household waste. Anaerobic digestion is a form of organic recycling, just like industrial composting. Yet, with the production of biogas, which can be converted to electricity, it is also a form of energy recycling. As a result, more and more industrial composting plants are looking at the possibility of expanding their capacity with an anaerobic digestion plant, both in Europe and in the US, where they seem to switch directly from landfilling to anaerobic digestion.

While industrial composting is a fairly simple and robust treatment, anaerobic digestion is complex and has several varying parameters which can influence the conditions (wet vs. dry, mesophilic vs. thermophilic temperature, one stage vs. two stages, etc.). For instance, OWS’s patented ORANCO technology is a dry, thermophilic one stage process. As a result, not all compostable plastics (biodegrade under these conditions. This could be a problem. Therefore, as part of the European FP7 project Open-Bio (see link below), OWS co-developed a test method and standard specification for so-called “AD-able” plastics. A representative test method has been defined, and criteria have been set. Both documents have been transferred to CEN, and, once validated, could add an extra driver to this already rapidly growing industry.

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