In This Issue

Green Plastic: The Garbage Dump Killer?

The Great Pacific Garbage Patch is a colossal floating garbage dump in the northern Pacific Ocean. Roughly the size of Texas, it lies between Hawaii and San Francisco. It contains about 3.5 million tons of trash, much of it plastic--shoes, toys, bags, pacifiers, wrappers, toothbrushes, and bottles are only part of what can be found in this dump. A similar dump exists in the Atlantic Ocean.

The global build up of plastic, both in the sea and along every shoreline, is an environmental nightmare. Most commercial plastics are produced from petroleum. These plastics degrade into small pieces so plastic waste builds up and can exist for many years. A great deal of research has taken place to develop biodegradable plastics that break down with exposure to sunlight, water or dampness, bacteria, enzymes, and so on. Instron customer Metabolix, Inc. has been researching for two decades to develop a commercially viable biodegradable plastic from corn sugar and has recently made the leap from research to commercial production with their product Mirel™.

Plastics produced from plant material are not new; they have been around for more than 150 years. First produced in 1845, polylactic acid (PLA), a thermoplastic polyester, was made by fermenting various agricultural products such as cornstarch. Dow Chemical revived PLA production in the 1950s, but high production costs precluded its widespread use.

In the 1980s, the British chemical company Imperial Chemical Industries (ICI) developed Biopol, a bioplastic produced through bacterial action. Polyhydroxyalkanoate (PHA) polymers are produced by most species of bacteria from food sources such as plant sugars and oils. One of these PHAs, known as polyhydroxybutyrate (PHB), has properties similar to those of polypropylene. But once more, ICI was unable to produce Biopol cheaply enough to compete with conventional plastics. Monsanto purchased Biopol from ICI in 1996. In 1998, Monsanto discontinued its bioplastics operations due to high costs and limited commercial opportunities. It sold its interests to the U.S. bioscience company Metabolix that began researching and developing a cost-effective process for manufacturing PHB-based plastics. In 2006, Metabolix formed a joint venture called Telles with the agricultural giant Archer Daniels Midland to commercialize a bioplastic under the name Mirel.

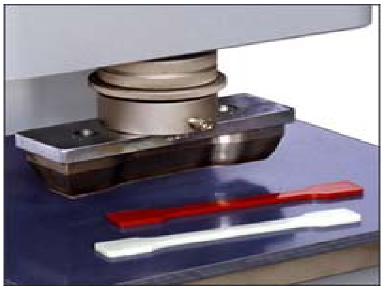
Mirel is designed as a suite of products, each of which can withstand heat and cold, is capable of containing food products, and biodegrades in natural soil and marine environments, home composting and industrial composting facilities, where these facilities are available. However, like nearly all bioplastics and organic matter, Mirel is not designed to biodegrade in conventional landfills. The rate and extent of Mirel’s biodegradability depends on the size and shape of the articles made from it. As with any new material, its testing requirements have been extensive. Its product data sheet gives mechanical test specifications for tensile strength, elongation at break, flexural modulus, flexural strength, notched IZOD impact values, and melt flow figures, using ASTM and ISO standards.

After initially producing Mirel bioplastics in a pilot plant, Telles opened a new production plant in Clinton, Iowa, USA, in December 2009 with a 50,000 ton/year capacity.

One of the first Mirel products is the injection molding grade used to make 60% of the pen components for the $1.25 Biodegradable Paper Mate® pen made by Newell Rubbermaid. The pen costs more to manufacture, but Paper Mate forecasts a strong demand. Other potential applications are cups, food containers, beverage cartons, razor handles, brushes, applicators, cell phones, erosion control netting, plant pots, and plant clips.

The success of the venture is partially linked to consumers’ continued and increasing demand for “green” products, though businesses also use the material as a cost savings measure, in applications where biodegradation saves time and labor. The market appears confident that the demand is there, with Metabolix more than doubling its share price since February despite a $38 million loss last year. It remains to be seen if the current enthusiasm to take care of the environment can eventually have the effect of shrinking or even eliminating the ocean garbage dumps.

Test Specimen Cutting and Stamping



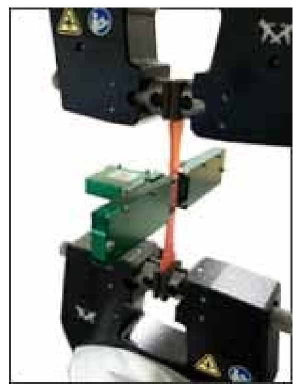
It's no secret that careful test specimen preparation is vital to achieving consistent and accurate test results. Cutting or stamping rubber and elastomeric test specimens from sheet stock is a very common technique for producing a wide variety of specimen shapes. However, despite the best of intentions, its very commonality can result in lowered inspection standards over time and a consequent reduction in the quality of specimens.

It is vital that you keep the stamp die or cutter very sharp. Rubber will always deform under the pressure of the stamp die and even the sharpest die can cause the cut edge to be slightly concave. As the die edge becomes more blunt, this “dishing” effect becomes more pronounced, reducing the cross-sectional area of the specimen.

It is just as important to keep the edge free from any nicks, notches, or curled edges. Any imperfections of the cutter edge, particularly in the area of the parallel length of the specimen, will undoubtedly result in premature failure. The risk of damaging the edge is highest where there is no ejection system for the specimen and you have to remove it manually from the stamp die with a pointed tool such as a screwdriver.

Get into the habit of regularly checking the specimen edges for dishing and the stamp die blades for wear and damage. You will be rewarded with greater consistency of specimen dimensions and greater accuracy of results.

Q. We take great care to ensure our test setup is consistent and our test equipment is as good as it can be, but our Poisson’s ratio values still show too much variability. Is there anything else we can do?



A. Poisson’s Ratio is defined by the division of transverse strain by axial strain. Instron has carried out extensive reproducibility studies to investigate inconsistent results between labs, as well as within individual labs. Difficulty in calculating the ratio relates directly to the measurement of transverse and axial strain at very small strain ranges.

As you indicate, a consistent setup with accurate equipment is vital. For most plastics, the recommended extensometer is a high-resolution biaxial extensometer. It is equally important to use the appropriate grips. Pneumatic side acting grips are preferred since they are self-aligning and offer adjustable clamping pressures, which allows for consistent clamping forces on the specimen from one to the next.

You should try setting up a small preload value on all your future test methods for plastics. When specimens are initially placed into grips, they can be subjected to small compressive forces. These forces can cause specimens to bend imperceptibly, causing inaccurate and inconsistent results. We have shown that establishing a small preload as a part of the test method eliminates those compressive forces on specimens and improves the repeatability of results.

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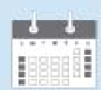

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Instron Worldwide Headquarters
825 University Ave
Norwood, MA 02062
www.instron.com