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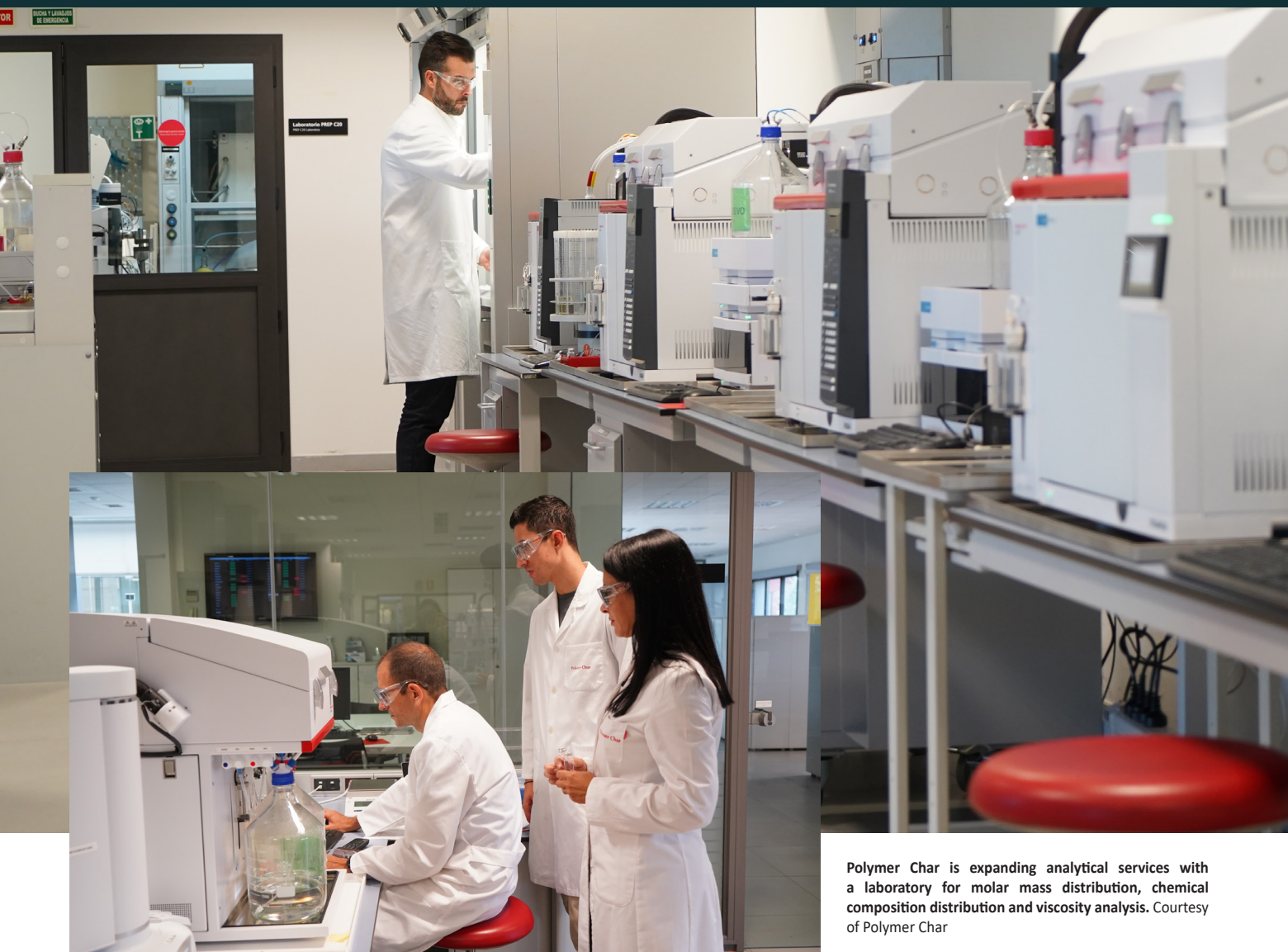
RECYCLED PLASTICS BOOST
CONSTRUCTION PERFORMANCE

 **INSPIRING
PLASTICS
PROFESSIONALS**

BRABENDER
Marks 100 Years
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Leadership

SUSTAINABILITY CHALLENGES

BY NANCY D. LAMONTAGNE



Polymer Char is expanding analytical services with a laboratory for molar mass distribution, chemical composition distribution and viscosity analysis. Courtesy of Polymer Char

Each batch of recycled plastic is different, so testing and analysis are critical for processing and quality

The focus on sustainability means that companies are working to incorporate more recycled materials into their plastic products. However, recycled materials come with high levels of variability that affect not just how machines run but also the quality of finished products. This challenge is leading

to new approaches in both online and offline testing and analysis that address variations as they arise.

Polyolefin Analysis

Polymer Char, of Valencia, Spain, develops and commercializes instrumentation

for measuring molar mass and chemical composition distributions in polyolefins, including recycled polyolefins. “Chemical composition distribution properties are important, especially for linear low-density polyethylene, high-impact polypropylene or any industrial copolymer obtained with two reactors or two catalysts,” says Benjamin Monrabal, R&D director. “We have been so specialized in this that we are the only supplier of this type of instrumentation to the polyolefins industry.”

Alberto Ortin, a scientist at Polymer Char,



points out that all the company's instruments are automated, which is important for polyolefins. "Polyolefins are analyzed at elevated temperatures, using chlorinated solvents for dissolution, which entail many inconveniences," he remarks. "Thus, it's key to automate the processes, including sample preparation, so the analysts don't need to handle solvents or wear protective equipment."

Recently, the company has expanded to offer simpler instrumentation for processor quality control labs. "We came up with the idea to develop separation techniques and instruments that are particularly designed for quality control purposes," says Monrabal. "Processors who don't want to spend a lot of money or purchase sophisticated instrumentation can use these quality

control devices to measure the molar mass distribution, soluble fraction percentage or intrinsic viscosity. This QC line of instruments is now one of our most popular."

These instruments are also used for process control in manufacturing facilities and help companies more quickly change grades in the reactor and let them see earlier whether adjustments in reactor conditions are helping move the polymer toward a desired microstructure. Monrabal says that measuring the intrinsic viscosity of PET is one of the most requested applications. In response to this need, the company developed the Intrinsic Viscosity Analyzer (IVA), which provides a reliable and automatic viscosity meter for intrinsic viscosity analysis of polymeric materials in solution.

and characterization at Fraunhofer LBF Institute in Germany, has been developing an analytical toolbox for qualifying and comparing recyclates. He is presenting this topic at the Eighth International Conference on Polyolefins Characterization, which is organized by Polymer Char and takes place on May 22 to 24, in Valencia.

As a research and technology organization, Fraunhofer LBF develops analytical methods and works with hundreds of different clients all over the world. The institute's foray into recycle analysis began with a request from a packaging company wanting to know how much recycle was in an unknown sample. This information was critical because the company could be held liable if its package didn't have the amount of recycle that the

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We are on the way to a circular economy, and by supplying our partners with analyses and helping them with the interpretation of data, we can help show that plastic is not bad, it's part of a solution.

The company is also growing its analytical services by opening a Polymer Analytical Laboratory (PAL) for molar mass distribution, chemical composition distribution, viscosity analysis and other relevant polymer properties. "We are one of the only companies that can perform high-temperature gel permeation chromatography, or HT-GPC, at the same time as chemical composition analysis, which provides tremendous information about the material's microstructure," says Ortin. "This is helpful, for instance, when processors are used to running a material, and then, suddenly, they see changes in the end product. The microstructure information can be used to find errors or figure out if there is a difference in the material that is leading to different properties in the end product."

Monrabal adds that analysis of recycled materials will be an important focus of the new PAL facilities. "Using recycled materials is making processing more complex because processors don't receive a homogenous material, and you have to match product quality even when using recyclates that come from different sources. We are working on building a Polymer Analytical Laboratory brand with a focus on characterization of polymers, and recycled polymers are an important part of this."

Deciphering Content

Robert Brüll, manager of material analytics

company said it did.

"Based on this and other requests we developed technologies and approaches for determining the content of recyclates," says Brüll. "We discovered that, for the most part, we could use the same toolbox of analytical methods that we've always used for virgin materials, such as chromatography, spectroscopy, mechanical tests and other analytical methods."

The institute then began receiving requests for characterizing the recycle content of samples. This can be used to figure out which sorting processes produce the best recyclates, for example. "We get a lot of inquiries from collection and sorting companies because they are not usually as equipped with the analytical equipment that a virgin resin producer would have," says Brüll. "However, the more they know about their recycled material, the better they can position themselves in the market."

Another common question the institute helps answer is how much recycle can be added to a product without causing problems with the product's durability or production processes. Brüll says the biggest difference between working with virgin materials and recyclates is that with recyclates the material itself fluctuates—by region and even by season—and this causes the quality to vary a great deal.

PORTABLE MEASUREMENT TOOL IS MULTI- MODAL

Agr International recently introduced the ThicknessPen, a portable thickness measurement gauge. The gauge is the first to offer capacitive and magnetic measurement modes in one device, according to the company.

"Almost every plastic operation uses some kind of thickness gauging device," says COO Sudha Jebadurai. "However, these devices, which haven't been redesigned in 20 years, take a lot of time to calibrate and adjust and are very fragile." The ThicknessPen is not only robust but small and lightweight, making it easy to use anywhere, from the laboratory to the plant floor or even at a job site. It is also Bluetooth-enabled so data can be sent to the cloud.



Agr's ThicknessPen is lightweight, portable and can be used in capacitive or magnetic measurement modes. Courtesy of Agr International

When in magnetic mode, the ThicknessPen is used with a magnetic target ball for measurements. This is ideal when high measurement precision is needed, such as for thin, non-ferrous materials such as ultra-lightweight containers and packaging. The capacitance mode provides a way to perform single-sided measurement without a target ball. This offers a quick touch-and-go measurement that is useful for large containers, sheet, plastic panels and large shaped parts or measurements on a production floor where the use of a target ball is not practical.



Fraunhofer LBF has developed technologies and processes for determining recycle content. Shown are samples before analysis. Courtesy of Fraunhofer LBF

"We are on the way to a circular economy, and by supplying our partners with analyses and helping them with the interpretation of data, we can help show that plastic is not bad, it's part of a solution," says Brüll. "Based on our findings we may offer recommendations on how to improve a sorting or collection process or what the best applications are for certain recycled materials, for example."

Looking ahead, he sees food contact materials as one of the next applications for plastic recyclates. "Health and safety issues will be much more relevant for materials that come into contact with food," says Brüll. "Proper analysis will be even more critical because trace levels of certain chemicals will need to be detected."

Variability Detection

Agr International Inc., of Meridian, Pa., offers online and offline equipment for testing plastic packaging. This includes pressure and top-load testing capabilities as well as inline systems that perform automatic process control for PET bottle blow molding machines.

"We work with all the major carbonated beverage producers, water bottle and lightweight water bottle producers in the U.S. and around the world," says Sudha Jebadurai, COO. "Some of our customers are running over 100,000 bottles an hour, which means even 10 minutes of bad production can be costly."

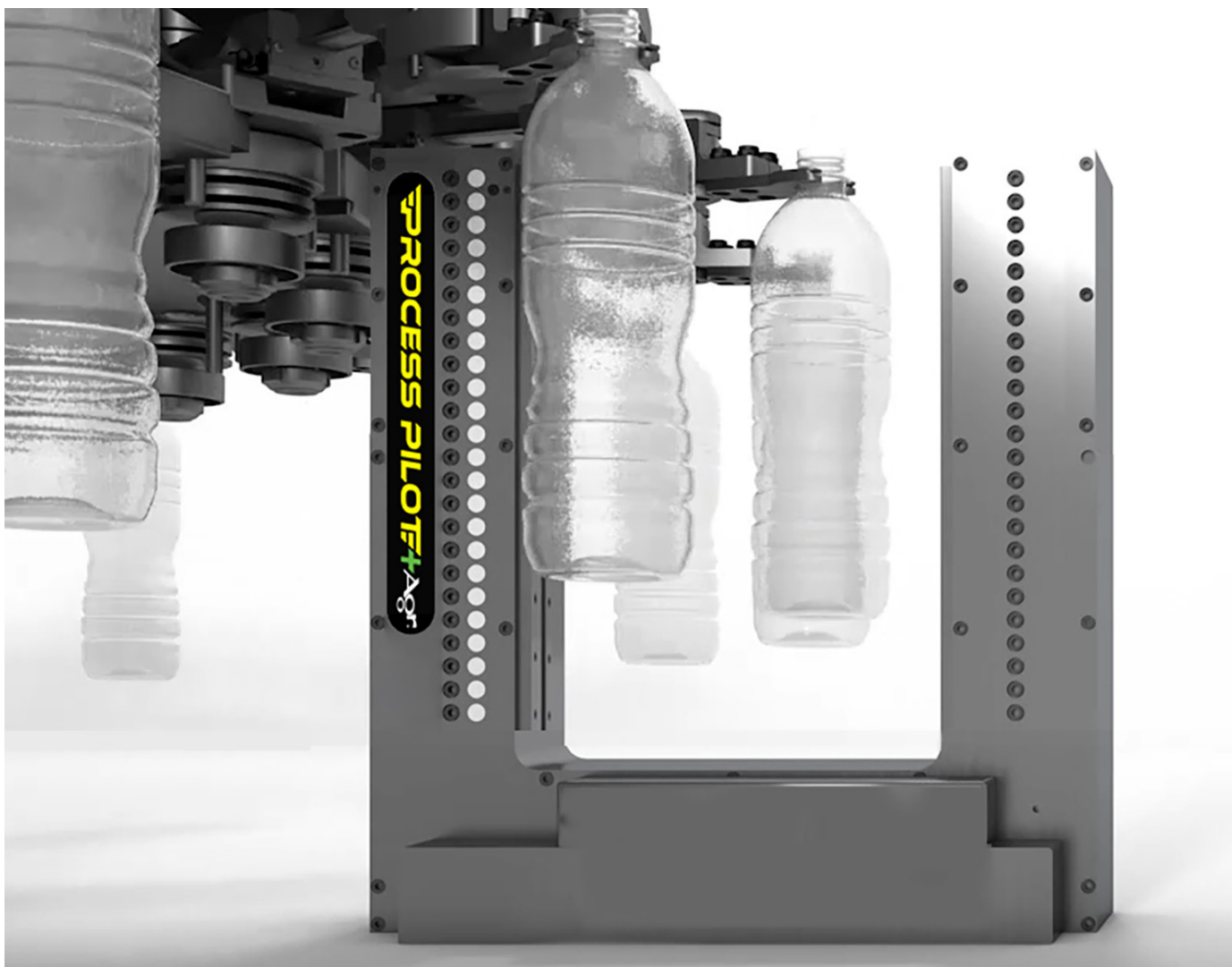
Agr's Process Pilot automated blow molder control system provides continuous

monitoring that pinpoints problems as they arise and immediately makes processing adjustments. This type of monitoring is critical as the use of recycled PET (rPET) increases. The company has shown that rPET produces a 7 to 10 percent increase in material distribution variation and bottle variances compared to virgin material production. This type of variation invariably causes jams or problems with downstream processing equipment, which increases scrap because any bottles stuck inside the system must be discarded. rPET also brings problematic contaminants, which can show up as black specs anywhere in the bottle.

"The additives, or toner, used to compensate for yellowing in the recycled material also cause challenges because they directly affect the heat absorption rate of the preform," notes Jebadurai. "This ultimately changes the heating profile of the bottles, which leads to variances in material distribution that affect thickness. This, in turn, can cause issues with top load, for example, which might mean you can't double or triple-stack these bottles."

Agr's blow molding management system uses a proprietary infrared light absorption technology to collect around 2,000 data points for a single bottle. "This gives us the ability to clearly detect any thin spots across the bottle," says Jebadurai. "We have found that measuring the thickness profile captures any variance that arises, including from stretch rod failures, improper heating, wrong preforms or incorrect pre-blows."

By keeping everything within spec all the



The Process Pilot+ system offers consistent processing of bottles with high levels of rPET content. Courtesy of Agr International

time, the automatic system helps ensure that machines stay up and running. It also brings labor savings because there's no need for a process person to constantly manage every variance or situation that occurs.

The newest version of the automated platform, known as Process Pilot+, comes with the ability to segregate different controls. Because heating changes take longer to implement while pressure profile changes are almost immediate, separating these can

speed up overall reaction times.

"Prior to this improvement, it took about 60 to 90 seconds for changes to be implemented in the machine, but now pressure parameters are changed every 15 to 20 seconds," says Jebadurai. "This is especially helpful when a blow mold first starts up because a lot of bottles are thrown away while the heating profile is adjusted. Since our system has multiple loops, it might reduce the time that bottles are scrapped from 5 minutes to just 30

seconds," Jebadurai explains.

Jebadurai says that reducing scrap is especially important because one of the biggest problems bottle manufacturers face is running out of rPET. "The recycled material is actually more expensive than virgin material, and they're trying to figure out where and how they can source those," she remarks. "Using automation can help them to make the best use of what they have and not have to throw so much away." ■



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