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About the cover:
In our cover story, Re|focus Recycling Summit & Expo presenters reveal current trends and technologies in plastics sustainability and recycling. (Cover based on images from SPI.)
Sustainability: Big Challenges, Big Solutions

Refocus presenters describe the biggest sustainability challenges facing the plastics industry today—and what to do about them.
head of the Re|focus Recycling Summit & Expo, SPI asked some of the event’s speakers one important question: “What do you think is the biggest challenge facing sustainability in the plastics industry today, and what will it take to overcome it?” Here are some of their responses, many of which boil down to one common factor: the importance of reaching consumers in any effort to extract value from plastics throughout their life cycle.

Vicki Worden, Green Building Initiative
“The plastics industry has done a great job employing research and innovation to create products that have made consumer goods and market segments more sustainable. However, the industry continues to face public perception challenges, perhaps termed best as consumer guilt.

“The successful track record of the industry in reducing emissions, increasing recyclability and reuse, and minimizing the use of fossil fuels in production are all examples of continuous improvement and messages that consumers need to consistently be hearing. Consumers also need better information on what can be recycled or reused, and education on the many secondary markets that have been created worldwide. Ongoing focus on delivering messages about the continuous improvement of the industry would be extremely beneficial to minimizing consumer guilt.”

Levi Stewart, Sustainability Accounting Standards Board
“The predominant sustainability challenge facing the plastics industry today is balancing the impacts associated with product lifecycle management amid falling oil and natural gas prices. Considering product lifecycle management as the ability to minimize the environmental impacts of packaging, companies may seek to develop packaging products from recycled and/or renewable materials that are also recyclable, reusable, and/or biodegradable.

“Understanding that falling oil and natural gas prices reduce the cost of virgin plastic resins, plastics producers may find the economics difficult to develop cost-effective solutions to the challenges presented through product lifecycle management. Overcoming this challenge will require improvements to the current recycling infrastructure and increased consumer demand for products with reduced lifecycle impacts.”

Jeff Wooster, The Dow Chemical Company
“The biggest sustainability challenge our industry faces is one of focus. Not the focus of business, government, or other organizations on sustainability, but the focus of consumers. U.S. consumers are currently too focused on a single element of sustainability: recycling. They see low recycling rates for plastics and think that plastics have poor sustainability performance because they aren’t recycled at the same rates as materials that have been in the marketplace for much longer.

“To overcome this challenge we need to do two things. First, we need to help our value chain, industry influencers, community leaders, and average citizens understand that plastics have many sustainability advantages. They are lightweight, durable, and versatile and meet many different consumer needs in a very resource-efficient manner.

“Second, we need to increase the recycling and recovery of all types of plastics. We need to increase conventional mechanical recycling rates for materials that are already
recycled, and we need to expand capabilities to capture value from non-recycled plastic products via chemical transformation, energy recovery, and other emerging technologies.”

Tod Christenson, Healthcare Plastics Recycling Council (HPRC)

“Creating a sustainable and circular economy for plastic packaging and product resources. Short of a plastic resource availability crisis, it will take a combination of prudent policy (i.e., incentive) and collaboration on the part of industry to develop common, consistent packaging and product formats to enable re-use and upcycling at end of life. This reduces carbon contributions and minimizes global waste and litter.”

Richard Krock, Vinyl Institute

“First, investment must be increased in U.S. and international plastics industry infrastructure to recover, recycle, or convert end of life plastics to new materials or energy. Without more facilities and greater capabilities at existing facilities, many valuable resources in the form of waste plastics will be lost. The variable relationship between energy prices and recovered plastics values has hindered growth in plastics recovery infrastructure. As a result, many original equipment manufacturers (OEMs) and consumers do not fully comprehend the true value that recovered plastics bring to society.

“Second, more information must be provided to consumers and OEMs about the value that plastics provide to society. Typically, by the time the plastic application has reached the end of its useful life, many benefits have already been realized, such as energy savings, water conservation, food preservation, and other natural resource conservation and environmental benefits. This can only be accomplished through informative and steady communications programs.”

Robert Peoples, Carpet America Recovery Effort (CARE)

“The biggest threat facing the recycling world today is the price of oil. The dramatic fall from $105 per barrel to under $30 has sent shock waves through the global recycling community. In my world, the carpet recycling industry, we have seen the value and demand for post-consumer derived polymers drop in some cases below the price of virgin chip.

“While anyone with experience knows we go through cycles, this time is different. The rapid drop in oil [prices], coupled with what looks to be a prolonged period of low oil prices, is causing businesses to contract or shut down at an increasing pace. In an effort to offset this price/demand imbalance, CARE has implemented increased subsidies in California. As a result, ... post-consumer carpet and fiber are moving across the country and impact the infrastructure outside California.

“The pricing challenges have been further exacerbated by a loss of nylon 6 capacity in the U.S., the slowdown in the Chinese economy, and the fact that Iran is now pumping oil into the supply chain to raise cash after years of sanctions. How do we overcome these changes? There are no easy answers or silver bullets here. Cutting subsidies for oil is one possibility, and using procurement leverage to buy products containing post-consumer content could help. But it is not clear how quickly such changes could be implemented and how much damage will occur in the interim.”
Learn from the leaders driving the use of recycled content, design for recycling and sustainability in plastics manufacturing.

### April 25-27, 2016 • Orlando, Florida

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For more information, visit www.refocussummit.org
SPE and its Sustainability Division are sponsoring the “Engineering” track of sessions at Re|focus, and Plastics Engineering asked a few of those speakers about their talk’s topic, why it’s important, and what key points the audience will take away from their presentation (see all of this track’s speakers at www.refocussummit.org/speaker/engineering-track).

PE also asked two other presenters about their topics on how to reuse more material from less-often-recycled plastics streams.

James Mitchell, Solvay Engineering Plastics

“[I’ll speak on] how to develop high quality and sustainable recycled polyamide grades for the automotive industry. The sourcing of quality recycled engineering plastics is very difficult. Very low quality recycled grades which contain all sorts of additive systems are easy to source but very difficult to use and almost impossible to specify. Reuse of waste from production is the best way to guarantee specification, but it’s difficult for planning and limited in volume. “The best way to move forward is to source sustainable end parts to provide highly consistent and volume-guaranteed products for use in high-quality recycled compounds. However, there are not so many high-volume consistent uses where it is simple and makes economic sense to fully recycle and use [the material] again in new applications. One such application where it is possible is with PET bottles, while another is with PA66 from air bags or other textile fiber or fiber scraps.

“Recycling high-quality products is very difficult! ... [Solvay’s] Technyl answer to this problem is to depolymerize scraps from these fiber parts to gain a finished base polymer that is extremely close in performance to its virgin counterpart. This material can then be used in any application and can be guaranteed to be fully recycled and fully capable for the demanding needs of under-the-bonnet auto applications. ... This type of recycling is the future for recycling, and with our new high-quality range of Technyl-4-Earth products, we will be able to provide a sustainable recycled solution for our customers globally.”

Charlie Martin, Leistritz

“[My talk is tentatively titled:] ‘Integrating Compounding Twin Screw Extruders into PCR/PIR Reclaim.’ Adding value to recycled materials, in addition to merely reclaiming waste materials, is possible but not common. Co-rotating, intermeshing twin screw extruders (TSEs) are used for the compounding of fillers and additives into a plastic, as well as for the devolatilization of moisture and other undesirable volatiles from the process melt stream. There is a trend to integrate compounding and devolatilization functionalities into reclaim extrusion systems using TSEs to make value-added products from recycled materials.

“This presentation will describe the process tasks involved in feeding, cleaning, and compounding of PIR [post-industrial reclaim] and PCR [post-consumer reclaim] feedstocks to make value-added products in a one-step manufacturing operation. New and unique TSE reclaim systems that integrate proven technologies into atypical TSE systems are available to compound recycled materials with fillers, fibers, and additives with PIR and PCR materials to make high-value parts. Understanding the feedstock materials, final product property requirements, careful staging of unit operations, integration of the correct equipment, and system controls must all be addressed for a successful value-added reclaim installation.”

Tamsin Ettefagh, Envision Plastics

“[My talk’s title is:] ‘FDA Compliant 100% Post-Consumer HDPE: How we got there and end uses for the resin today.’ I was asked to speak on this, so I believe SPI is looking for the value [of this material] in diversified markets, as well as the ability to go from bottle to bottle with the challenges of the quality of supply today.”
There has been an assumption by those that understand the science of HDPE that it cannot achieve FDA compliance due to the nature of HDPE. [It] loves to absorb most volatiles, and HDPE is a common resin used for household chemicals. I hope to dispel that and encourage other end uses to get [people more] comfortable with using recycling in direct food packaging.

Scott Steele, Plastic Technologies, Inc.

“This assumption has been [the] result of not fully understanding the science of HDPE. [It] loves to absorb most volatiles, and HDPE is a common resin used for household chemicals. I hope to dispel that and encourage other end uses to get [people more] comfortable with using recycling in direct food packaging.”

Brian Riise, MBA Polymers

“I’ll present issues facing users of recycled resins and some of the new technologies on the horizon that present challenges and opportunities for the industry.”

“Identifying Obstacles and Solutions to Using rPET for Next-Generation Bottles.” Using recycled polyethylene terephthalate (rPET) resin as a material source for 100% recycled-content bottles is something that many companies are exploring. However, what is frequently not taken into account are the realities of the supply chain for rPET. Looking at the attributes of individual packaging components (adhesives, additives, labels, closures, liners, colorants, etc.) and activities (exposure to UV light, storage, etc.) will enable appropriate decisions to be made earlier in the life cycle. The goal is to positively impact the recycling stream and future bottle generations.

Image courtesy of MBA Polymers.
Equipment Innovations Give a Big Boost to Plastics Recycling

From technology upgrades to equipment that deals with mounting problems with incoming materials, equipment manufacturers are providing solutions to help plastics recycling grow

By Mike Verespej

The growth in plastics recycling, the increased amount of contamination in bales, and the need for reclaimers to become more efficient to offset a tight pricing market are driving innovations in recycling equipment and technology. The innovations run the full spectrum of the recycling process from sorting, washing, cleaning, and drying to the production of the recycled flakes themselves.

But with bale quality being still the most vexing problem for recyclers, much of the focus of innovation has been on ways to improve the efficiency of sorting equipment and finding better ways to deal with the full-wrap shrink sleeves on PET bottles that make it difficult to identify the resin underneath.

“The technology is getting better on bottle sorting, infrared sorting, and flake sorting,” says Byron Geiger, president of Custom Polymers PET LLC, in Athens, Alabama. “You are get-
ting better resolution on the optical cameras and better software on the electronics.

“We are losing less PET in our sorting, so the new technologies are helping yields to some degree,” adds Geiger. “But overall, yields are down because bale quality has declined.”

As Geiger explains, a lot of the innovations that have emerged have been in response to “shrink-wrap labels and other non-friendly material and problematic bottles. So we end up spending more resources,” he says, to get the same amount of material out of bales.

It’s a dilemma that equipment manufacturers have made their top priority.

“The number-one thing customers are looking for us to do is to prevent the loss of good material,” says Felix Hottenstein, sales director for MSS Inc., the Nashville, Tennessee-based optical sorting division of CP Group. “That’s driving a number of new developments that help customers improve product quality and decrease the loss of good product.”

Optical Sorters

Just this past December, MSS made improvements to both its Cirrus and L-Vis™ optical sorters, integrating the latest generation high-resolution cameras and infrared spectrometers. Both sorters also now have an optional illuminated reference, which allows the materials to be sorted in-flight over the illuminated reference instead of the traditional approach of detecting and sorting materials on a slide or conveyor belt. It also makes it possible to better adjust the color and light intensity for maximum contrast.

As a result, the company’s MSS Cirrus optical sorter, for example, now has scan rates of 345,600 pixels per second. Its other optical sorter, the L-Vis, is a high-resolution color sorter for small particles, based on camera identification technology.

“The cameras are getting higher and higher resolution, so we can sort out smaller and smaller particles and get higher accuracy,” says Hottenstein. “The resolution is at least 36 times higher than what we used to have.” In addition, software improvements enable image processing that is “orders of magnitudes” faster than in the past, he adds.

National Recovery Technologies (NRT) similarly uses its patented In-Flight Sorting of materials as opposed to sorting materials over the belt, says Travis Curtis, former sales manager for NRT who was recently promoted to the position of separation technology specialist for Bulk Handling Systems (BHS), which owns NRT.

BHS is providing nine new optical sorters for the $25 million expansion of the Unifi Manufacturing Inc. recycling plant in Reidsville, North Carolina, which turns PET bottles into fiber to make Repreve® fabric.

“Typically, there is a gap between detection and ejection,” says Curtis. “But with our technology, we detect and eject the material after it leaves [the] belt. It reduces motion-related errors and eliminates signal errors from belt interference.”

NRT’s In-Flight Sorting also means the sorters have access to transmissive detection, says Curtis. “Our energy source [light] travels through the PET container, giving us more confidence in the identification of the desired polymer.

“Transmissive detection also provides a robust signal—even on thin-wall containers and bottles with full-sleeve labels, which is a big issue for our customers,” he adds. “Additionally, with our PET Boost technology, we can further ‘boost’ the PET signal, improving the recovery and purity of final product.”

De-Labelers

De-labeling equipment, in its infancy just three years ago, has also improved and become more efficient at removing a higher percentage of shrink-sleeve labels without causing unwanted PET losses at the same time.

“We are putting in one dry de-labeler after the bale sorting area in the Unifi PET recycling plant and also installing one
Equipment Innovations Give a Big Boost to Plastics Recycling

wet de-labeler at the end of the sorting process—for all of the container streams (clear and colored) and materials,” says Anthony Georges, president, Amut North America Inc. in Vaughn, Ontario, Canada, which has close to 20 de-labelers installed in the marketplace.

“We’re using new metals to reduce the wear on the blades [short posts and teeth] on the inside of the drum that remove the labels,” says Georges. “We changed that blade design two years ago. The new blades have a much longer life span and can be resharpened.

“We also regulate the flow of material in and out of the de-labeler better by utilizing an automatic dynamic control of the throughput, in conjunction with the slow-speed RPM of the regulating auger.” The technology can now remove well over 80% of the full-body sleeves “and preserve the integrity of the bottles and the necks so recyclers aren’t losing good PET material” when the labels are taken off, he adds.

“We have increased the efficiency of the machines, lowered their operating costs, and increased the longevity of the metals that do the cutting,” he says. “This is a very effective solution as it does not normally require a total rebuild of the existing sorting/washing line.”

The advances in sorting technology aren’t just occurring at the front end of the process.

**Flake Sorting**

In December, Tomra Sorting Solutions launched its Autosort Flake unit that can sort flakes by color and type of material at the same time. “Compared to our first generation flake sorter introduced in 2010, this new generation machine is able to do the job of two separate units and with a much higher precision, reducing the loss of good material,” says Valerio Sama, Tomra product manager. “It has improved color sorting, improved reliability, and improved throughput. Its EM3 sensor can detect even the smallest parts.”

The Autosort Flake incorporates the company’s “flying beam” technology, which focuses only on the area of the conveyor belt that is being viewed, and the company’s newly developed Fourline 2-mm optic module, which the company claims has the highest near-infrared resolution of any sensor-based sorting equipment in the market.

The new optic module provides continuous calibration that eliminates human errors that can lead to costly downtime and contribute to low maintenance costs and low-energy consumption, Tomra says.

“The new machine is a major leap forward,” says Tomra's Alexander Wolf. “It can do the work of three machines and is designed to purify the PET flakes. It has a completely new design based on machines we developed for food sorting. It has a better feeding mechanism and uses a transmission color camera so the detection and ejection of materials is close together. You get a 10-25% performance improvement.”

**Efficient Melt Filters**

Another improvement on the back end of the recycling process is the development of more efficient melt filters that remove contaminants from polymers during the extrusion process.

Just one example of this: The Eco melt filter, introduced in 2014 by Ettlinger Kunststoffmaschinen GmbH. The melt filter has a self-cleaning function that provides a cleaner filtration surface and negates the need for screen changes for weeks, if not months, the company says.

The contaminated plastic melt flows from outside to inside through a rotating filter drum that has a large number of conical holes. Any contaminant in the melt remains on the filter surface, is removed by a scraper, and is forced into the
discharge shaft with every turn of the filter drum. As a result, no contamination builds up on the filtration, and particles—like gels—can’t be pushed through.

“It is a much more advanced piece of filtration equipment” than blackflush systems, says Scott Saunders, general manager of KW Plastics Recycling in Troy, Alabama. “It allows us to operate essentially with one man per seven machines,” he says. “It also gives you a much more efficient production run because the machine runs at a stable pace.”

Previously, explains Saunders, contamination would build up on a screen—necessitating downtime to make frequent screen changes. “The drum is continuously turning, and you have a blade scraping away the contamination rather than having a flat screen on a plate.

“It’s expensive; it’s sophisticated,” he says. “But if you have multiple machines, it’s a big benefit because it allows you to calculate what your production rate will be more accurately, and it eliminates many of the human element problems that can affect production negatively.

“Ettlinger has changed the whole dynamic with that machine,” says Saunders. “It is much better than the previous blackflush systems we used. You have lower labor costs, better retention of materials, a lot less purge, and it’s safer.

Another innovation at the backend is the year-old Intarema Regrind Pro®, which has taken the latest recycling system design by EREMA (Engineering Recycling Maschinen und Anlagen) and optimized it specifically for processing thick-walled regrind. Particles are warmed in the preconditioning unit and fed into the extruder with minimum shearing forces, while any impurities in the melt remain large enough to be filtered out by a high-performance filter.

“The EREMA high-performance filter systems ensure continuously high throughput with outstanding melt quality at the same time,” says Clemens Kitzberger, EREMA business development manager, post-consumer recycling. “With the recently enhanced EREMA Laserfilter, contaminants are removed even more quickly through the redesign of the scraper geometry and discharge system, resulting in even better filtration performance.”

What’s more, compared to a normal backflush system, “the laser filter disc can stay in for extended periods of time because there is continuous removal of the contaminants by the scraper,” says John Capece, sales manager for EREMA North America Inc. “It allows recyclers to process material contaminated with paper and labels to produce high-quality pellets—quality even worthy of film production.”

Dryerless Cleaning, Waterless Pellet-Making

Some innovations also give recyclers that extrude flakes into sheet the option of dryerless cleaning of PET and PLA.

The HVTSE (high vacuum twin-screw extrusion) system from Italian equipment maker Luigi Bandera that’s sold exclusively in North America by Processing Technologies International LLC is one option. It offers a patented single atmospheric and dual-layer vacuum vent system that removes moisture through a co-rotating twin-screw extruder. It can handle moisture levels of up to 12,000 parts per million and be run at speeds of up to 300 rpm, says Sushant Jant, a senior scientist in applications and technology with the company.

“It eliminates drying and provides a 35% energy savings compared to conventional single-screw extruders,” says Jant. “You eliminate the need to run the material through dryers and you get perfectly functional sheets.”

Critically, the HVTSE system—17 have been sold in North America since 2011 and more than 1,000 worldwide since 2000—can be used with a variety of materials, including PET, HDPE, PP, PS, and PLA. “You can
switch resins without changing the process and product changeover time between different colors or different materials in as low as 20 minutes,” says Jant. “That minimizes in-house regrind inventory buildup.”

Similarly, MAS Maschinen- und Angenbau Schulz GmbH has upgraded its double-rotor disc (DRD) waterless drying and cleaning systems for plastic film, flakes, and fibers that was originally launched ten years ago. (MAS products are sold in North America by eFACTOR3 LLC in Pineville, North Carolina.)

Its newest generation DRDs—models 21 and 26—reportedly offer a significant increase in throughput—even though they’re similar in size to the previous unit and use the same amount of air consumption.

“By doubling the number of rotor blades to 12, increasing rotor speeds and drive power, and increasing the diameters of the centrifuge, the material throughput per batch could be doubled with almost the same volume of process air,” says Hartmut Bendfeldt, president of eFACTOR3. “The DRD system has a clear advantage over its ‘wet cleaner’ counterparts not only in energy consumption, but also in lower operating costs.”

The DRD system houses its double-rotor system in a centrifuge housing. Heavier objects fall through the bottom, while other contaminants are removed by friction as the plastic travels through a floating area of hot air. Moisture content is reduced by a heater. Additionally, the MAS dry cleaning system can be used as a two-stage stand-alone system or in combination with a wet cleaning system.

Meanwhile, though it’s still in the prototype stage, the waterless recycled pellet-making system of Mexico City startup Ak Inovex has caught the attention of the industry, earning the Award for Technological Innovation in the Cleantech Challenge Mexico 2014 competition.

Ak Inovex has developed three patent-pending technologies that cool plastics through contact with special walls in order to form plastic pellets. The special walls both mold the plastic into the desired pellet shape and cool those pellets at the same time. That’s in sharp contrast to the conventional approach where recycled plastic containers are ground, heated, and then cooled with water before the pelletization stage. The removal of water altogether from the process also cuts energy consumption in half and reduces the space needed to make pellets from recycled resin.

**Closed-Loop Energy Savings**

Similarly, the year-old HydroDynd closed-loop plastic washing line from Vecoplan LLC reportedly can reduce operating costs (when used with a Vecoplan size-reduction system), including energy consumption, water usage, and chemicals, by 25%, says the company.

The system, geared toward rigid plastics and film, uses two discs—one stationary and one rotating at high speed—that physically “unfold” the flakes and give the flakes a thorough cleaning through friction. Friction during this process also generates heat. And since HydroDynd is a closed system that integrates its own water treatment, the reused water establishes a warm wash system without having to use additional external energy or power.

“By being able to do this in one step, you have lower capital costs and lower operating costs and have a smaller footprint for the equipment,” says Greg Parent, sales representative for Vecoplan. The process is particularly good for post-consumer rigid plastics, agricultural film, and post-consumer films.

“Recyclers are paid by how much volume they can generate and the quality of their recycled plastics,” adds Parent. “By redesigning the equipment, we lower their operating costs and give them cleaner material that has a higher value in the marketplace.”
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Recycling the Unrecyclable

Industry innovations aim to keep traditionally difficult-to-recycle plastics out of the landfill

By Nancy D. Lamontagne

Although the amount of plastic that is recycled has grown tremendously in the last few decades, some materials and products still pose challenges. Through education, technology advancement, and creative approaches, the plastics industry is finding ways to keep even more plastics out of landfills.

From Chip Bags to 3-D Printing

TerraCycle, Inc. is known for turning difficult-to-recycle items such as drink pouches and used coffee pods into useful products. One of its newest endeavors involves creating raw materials that can be used in 3-D printing from potato chip bags, which are difficult to recycle because they are made from a blend of polypropylene (PP) and polyethylene (PE).

The recycling process begins with TerraCycle collecting the chip bags through its recycling program, removing any contaminants, and then shredding the bags and compressing them into a solid material. This solid material is extruded into plastic pellets that remain a PP/PE mix. TerraCycle’s partner, 3D Brooklyn, melts the plastic pellets and forms them into a plastic filament for 3-D printer machines.

In addition to being used for the 3-D printer filament, TerraCycle also processes the PP/PE pellets into new plastic products such as park benches, picnic tables, and recycling bins. “As with any recycling process, the main concern was maintaining strength and durability in the final product, which we were successful in doing,” says TerraCycle’s Colleen Duncan. “Our partnership with 3D Brooklyn has expanded our opportunities to create new products from material otherwise destined for the landfill.”

3D Brooklyn uses the filament to print its own products and has also sold or given schools or beta testers 80 spools that each contain a pound (0.45 kg) of filament. “We were pleasantly surprised at its popularity, although we probably shouldn’t have been; the maker community has a history of getting behind novel ideas like this,” says Nate Kolbeck, CEO and co-founder of 3D Brooklyn.

The company plans to launch a Kickstarter project to help pay for the manufacturing of another batch of the recycled filament. 3D Brooklyn is also expanding its recycled 3-D printer filaments to include ones made from recycled high-density PE from plastic milk jugs and yogurt cups.

“These types of approaches to manufacturing are core to...
our brand identity and our company vision,” says Kolbeck. “We are pioneering manufacturing techniques for a new world. By developing ways to work with bioplastics and recycled plastics instead of oil-based plastics, we are taking steps in a greener direction that will become more and more relevant in the coming years.”

A Recyclable Stand-Up Pouch

Stand-up pouches are growing in popularity due to their resealable convenience and customizable packaging. However, most pouches are made of multiple layers of different materials, rendering them difficult or impossible to recycle.

A recent collaboration between The Dow Chemical Company’s Packaging and Specialty Plastics business, the Sustainable Packaging Coalition (SPC), Accredo Packaging, and Seventh Generation has produced a new recyclable stand-up pouch. It will replace laminate pouches made with a traditional polyethylene terephthalate (PET)/ink/adhesive/linear low-density PE structure that was previously used for packaging Seventh Generation’s Dishwasher Pods.

“The new stand-up pouch takes us from co-mingled structures with multiple material ingredients to multi-layer, single-source structures that don’t need to end up in landfills,” says Stacy Fields, North American director of Packaging solutions at Dow. “For Dow, these types of collaborations with converters, brand owners, and others in the value chain to drive packaging innovation are common and help us develop packaging that end users demand.”

Historically, multi-material, multi-layer pouch development involved the use of different types of materials for each layer. PET, PP, or biaxially oriented nylon are still often used to provide functionality such as stiffness, temperature resistance, barrier properties, and surface finish, and PE is used to provide toughness and sealability. But the films that result from those combinations aren’t handled by the PE recycle stream.

Derrick Lawrence, director of packaging development at Seventh Generation, explains that the main challenge for this project was developing materials that provided functional and aesthetic attributes similar to those of the previous pouch. In particular, the clarity and gloss of the new PE-based structure needed to match that of the previous PET-based pouch. Malcolm Cohn, director of sustainability at Accredo Packaging, Inc., points out that the necessary sealability, stiffness, toughness, temperature resistance, and gloss properties are difficult to attain using PE only.

Bringing together Dow’s RecycleReady™ resin technology with new processing approaches developed by Accredo were key for making a multi-layer pouch made completely out of PE. The resulting AccredoFlex® RP™ recyclable pouch has a structure made of multilayer PE coextrusions and solventless laminated adhesive.

“We believe the AccredoFlex RP all-polyethylene stand-up pouch has the potential to be an ‘industry changer,’ moving from multi-material structures whose end-of-life will be landfill, to a single-source, homogeneous substrate that can be recycled and so diverted from landfill,” says Accredo’s Cohn.

Another challenge with recycling stand-up pouches and other types of film packaging is ensuring that consumers know where to recycle them. Plastic bags, films, and wraps are typically not accepted in curbside recycling bins, but stores across the country have plastic-bag recycling bins that accept these items. The new dishwasher pod packs feature the “How2Recycle” label, which alerts consumers to take the pouches to one of these drop-off locations for recycling.

GreenBlue’s Sustainable Packaging Coalition began the How2Recycle Label project in 2008 to provide consistent on-package recycling information to consumers. Research has
Recycling the Unrecyclable

shown that most people don’t understand resin identification codes, which were never intended to communicate recyclability to the public. The label helps to overcome this confusion and addresses variations in local recycling programs that make proper recycling a challenge.

Keeping PVC Out of the Landfill

Polyvinyl chloride (PVC) is another material that has faced some recycling challenges. Originally developed on an industrial scale as a way to deal with the chlorine byproduct of caustic soda and potash production, PVC is used today in consumer goods as well as durable goods such as window frames, pipes, and flooring. Diane Martel, vice president of Environmental Planning and Strategy for flooring manufacturer Tarkett, says that logistics and legacy chemicals pose the biggest hurdles to recycling PVC-based durable goods.

The logistics issues arise because even though it’s possible to form direct agreements with end-users to send back PVC-based flooring materials, it can be difficult to find economical and environmentally friendly ways to transport recovered flooring from all over the country, or even the continent, to flooring plants in the Midwest or on the East Coast. “Working with a small quantity of returned materials is not efficient and brings a high cost on the economical side and also on the environmental side,” explains Martel.

To solve the logistics issue, the company began to establish consolidation points across the USA, with Tarkett’s distributors acting as many of these consolidation points. In the last three years, the company covered 60% of the country in this way and continues to work towards complete coverage.

For many years PVC was manufactured in a way that used phthalate-based plasticizers and heavy metal stabilizers. Some older PVC flooring even contains asbestos, which prevents it from being recycled at all. Tarkett avoids legacy chemicals by keeping a close watch on the chain of custody for the recycled material. The company ensures any resilient flooring made from recycled content contains less than 1,000 parts per million of phthalates—the level defined by the U.S. Environmental Protection Agency as acceptable for toys for children as well as for food contact.

“We have clear specifications on what is acceptable for a finished good, and strict commitments and processes for both soft and resilient flooring,” Martel says. “We also have questionnaires and audits for our suppliers that ensure that they have their own environmental policies.”

Thanks to its innovative approach to recycling, Tarkett has recycled 115,516,048 pounds (52,397,197 kg) of resilient flooring and 64,270,112 pounds (29,152,432 kg) of carpet tile since 2010. “When we look at PVC, what we are making today is what we will be using as materials in the future, so it is important that it is made with safe and good materials that are responsible towards the climate and also people,” Martel says.

“Looking ahead, I think it is really important to look at and try to implement new ways of recycling and using this product. I am sure within the next ten years there will be new technology appearing to ease the process of recycling PVC, especially in terms of extracting it from the additives and fillers.”
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Rescuing the Ocean with Skateboards and Sunglasses

By Gerold Breuer
EREKA Engineering Recycling Maschinen und Anlagen GmbH
Ansfelden, Austria

By 2050 there will be “more plastics than fish (by weight)” in the ocean, according to the recent study “The New Plastics Economy: Rethinking the Future of Plastics,” released by the World Economic Forum and Ellen MacArthur Foundation.¹

Ben R. Kneppers, an engineer from the USA working with the government in Chile on sustainability and environmental issues, was joined by two friends, Kevin J. Ahearn and David M. Stover, also U.S. engineers with a shared desire to do something about the growing amount of plastics in the ocean. Together they formed Bureo, a company that manufactures skateboards and sunglass frames from reclaimed nylon fishing nets.

They also set up Net Positiva, a collection program for discarded fishing nets that offered multiple benefits. Net Positiva simplified acquiring material for the skateboards, reduced the number of nets reaching the ocean, and began to clean up the beaches.

For these engineers, who are also lifelong skateboarders and surfers, concentrating on nets was a natural move. They

Bureo founders Ben Kneppers (left) and Kevin Ahearn holding some of the raw material—a reclaimed nylon fishing net—used in their skateboards.
share an affinity for oceans and are especially moved by the marine life carnage caused by “ghost” nets—the lost or discarded nets that degrade slowly, if at all, and continue to entrap everything from sardines to whales.

Some estimates suggest fishing nets account for approximately 10% of the plastic in the oceans. An example that gives an idea of the amount of nets lost in the ocean is offered by Edward Humes in his book Garbology. He says three thousand nets are estimated to be loose in Washington's Puget Sound—a body of water well known as a habitat for large numbers of marine animals.2

Bureo = “The Waves”

The company name “Bureo” is derived from the indigenous Mapuche language word meaning “the waves.” The company founders want the name to connect the skateboards and sunglasses to the ocean and their fishing net origins and to acknowledge respect for Chile’s indigenous people. David Stover says the Bureo name itself is also intended to resonate further, associating ocean waves with waves of change in how we care for our environment. Bureo hopes to be a successful inspiration for all ocean-cleaning efforts, large and small.

Chile has nearly 4,000 miles (6,400 km) of coast with the coastal waters worked hard by a vital fishing industry, including more than 13,000 vessels of all sizes, from rowboats to ships. Despite diminishing stock, more than a million tons of fish per year are landed. The sheer size of the fishing industry means a lot of nets: a reliable, long-term supply of raw material to sustain a net-dependent recycling enterprise. In addition to a desire to reduce the discarded nets that reach the ocean, as engineers with well-honed instincts for the practical, the Bureo team recognized fishing nets as being eminently recyclable.

A recycling program works best when the reclaimed material is dependably homogenous. For all practical purposes, the nets found on Chile's shores are nearly all made of nylon. Most contaminants in the nets are easily found shells, vegetation, a scattering of ropes and tag lines made of other plastics or natural materials, and an occasional fish hook, all easily removed.

A Net Positiva

The Net Positiva program was in place before there was a plan to transform nets into skateboards. The Net Positiva program was initially planned to stand on its own merits. It was designed to provide a network of environmentally sound, strategically located places for fishermen to deposit unwanted nets.

When no longer useful as nets, nets are difficult for fishermen to discard. They can be heavy and unwieldy and occupy a lot of space. With no net-dedicated disposal program in place, it’s easy to understand the attraction of dumping them overboard or leaving them anywhere on the beach.

It turns out that trying to come up with a way to use so many old nets along the shore was inspirational for the Bureo crew. Their moment of inspiration was the moment they realized they could recycle nets into skateboard platforms.

As so often happens with Bureo, good practices—doing the right thing for the right reasons—produces multiple benefits. In this case the Net Positiva net collection program does double-duty and becomes a valuable recyclable material supply network for making skateboards. In 2015, Net Positiva involved 16 communities, collected 110,000 pounds (50,000 kg) of discarded fish nets, and produced 9,000 individual products.
Rescuing the Ocean with Skateboards and Sunglasses

Alchemy

Bureo skateboards are made in Santiago, Chile, by Comberplast S.A. Each skateboard platform contains about 30 square feet (2.8 m²) of nylon net.

The heart of the reclaiming process is a classic EREMA 1310 TE recycling system. The cleaned and shredded nylon nets are fed into the large vertical preconditioning unit that uses friction to compress, size-reduce, and pre-warm the material. The preconditioning unit blends the scrap materials while they are in the chamber. Any scrap, which may be inconsistent in its material makeup and amounts, is blended to produce a steady, predictable melt.

The preheated, densified material is then fed directly to the extruder screw. Compression and melting occur gradually, at a precisely controlled temperature, adding minimal heat history to the reclaim.

In this process, the nylon nets are transformed into high quality, easily used pellets. The nylon pellets, with a fiberglass additive for stiffness, are injection molded into finished skateboard platforms. The sunglasses frames are produced from 100% recycled fishing nets.

The platforms on the Minnow, Bureo’s first skateboard, are fish-shaped and feature a signature textured, fish-scale surface. Their wheels are extraordinary Eco-Cruisers fitted with 100% recycled urethane cores.

Distinctive and easily recognized, Minnows are becoming inspiring icons of success for all involved in working for cleaner oceans. Along with Bureo sunglasses, they are now widely recognized as emblems of effective recycling based on amazingly effective design, sound engineering, and quality-conscious manufacturing.

Altruistic Activism: An Effective Marketing Strategy

For Bureo there seems to be little difference between the altruistic and the practical. The Minnows are an integral, inseparable part of Bureo’s marine and coastal cleanup campaign. The expectation is that to look at a Minnow, to ride one, or to consider purchasing one, seals the deal while also connecting the rider or customer to a new world of environmental appreciation.

Recently, the Bureo team participated in the Our Ocean 2015 conference in Valparaiso, Chile, serving on a panel discussing ways to divert the waste stream from entering the ocean, a goal for which recycled skateboards are a tangible, if modest, example of success. During the conference U.S. Secretary of State John Kerry took the time to appreciate a Minnow and be photographed while admiring it.
Also recently, Britain’s Prince Charles, who has a stellar record of supporting events for cleaner oceans, was photographed with a Bureo skateboard being presented to him by Hugo Tagholm, head of @surfersagainstsewage, one of the many groups who have a mutually supportive relationship with Bureo.

The Bureo team participates in conferences, gives talks, participates on panels, and, perhaps most importantly, maintains mutually supportive connections to other active environmental groups. They have a gorgeous website and participate in social media. All they do seems to be the right thing to do, and it’s fun and has a sense of being effortless. Essentially, Bureo’s marketing strategy, by design or not, is an excellent example of what can be done today. Most likely, however, it can’t be faked.

References

About the author... Dr. Gerold Breuer is head of marketing and business development at EREMA. Breuer received his doctor’s degree in technical sciences with a focus on polymer science from Johannes Kepler University in Linz (Upper Austria) in 2008.

Note: See also the article “Equipment Innovations Give a Big Boost to Plastics Recycling” in this supplement to learn about EREMA’s newest recycling technologies.
The installation of a third extruder at Linpac Ritterhude is enabling the leading European food packaging manufacturer to deliver products made from up to 100% recycled content for the first time and addresses the growing demand for PET and rPET in northwest Europe.

For the past year, the German site has been able to manufacture mono sheet averaging 93% post-consumer recylcate (PCR), but the company says the new extruder provides the site with greater capacity and flexibility to manufacture products containing 100% recycled content.

In the past five years, Linpac has invested €9 million in new plant equipment at its two German sites, including €3 million on PET extrusion and automation facilities in Ritterhude, in a bid to significantly increase market share in Germany and surrounding countries.

Adam Barnett, managing director for northern Europe at Linpac, says: “This major investment demonstrates our commitment to an important market for Linpac. It is vital that, as the German market continues its shift from PP towards PET, we are able to meet growing customer demand for products which are lighter, cheaper, and more sustainable.”

Linpac has invested heavily in its in-house “supercleaning” technology to ensure its rPET meets the most stringent food safety and hygiene regulations for food packaging. The technical committee of the European Food Safety Authority vetted and approved the processes employed by Linpac in 2013, saying that products manufactured by the company did not give rise to concern for a risk to human health, even when made using 100% PCR.

Barnett adds: “Retailers and consumers are driving growth in the rPET market with demand for packaging which has strong environmental credentials; rPET is easily recycled and reduces carbon footprint by up to 70% when compared to virgin PET. Furthermore, it offers a high quality, crystal-clear material with no discoloration, boosting pack presentation for on-shelf appeal.”

www.linpacpackaging.com

The Dow Chemical Company was recently honored with the 43rd Kirkpatrick Chemical Engineering Achievement Award, a biennial recognition that honors the most noteworthy chemical-engineering technology commercialized anywhere in the world. The Award recognized Intune™, Dow’s new compatibilization technology.

Intune is the second innovation made using Dow’s proprietary olefin block copolymer platform, an advance in catalytic science and reaction engineering. Intune makes it possible to combine polyethylene (PE) and polypropylene (PP) and provide the best benefits of each material, while minimizing individual trade-off properties. It provides new flexibility for blending and bonding these important polymers, Dow says.

The technology allows designers and fabricators to engineer materials with blends or multi-layer structures containing PE and PP that take advantage of their common attributes such as low cost, low density, and environmental resistance—while combining their separate attributes in ways never before thought possible, like toughness, ease of processing, stiffness, and high-temperature resistance.

It can also allow property retention with the addition of PE or PP recycled content, the company adds.

www.dow.com

Clariant, a leader in specialty chemicals, has announced the introduction of a new liquid additive masterbatch that minimizes yellowing and graying of PET polymers caused by the introduction of post-consumer recycled resin (PCR).

The new optical brightening products, which are part of the HiFormer® family of liquid masterbatch and application technology, can be used in a wide variety of PET resin grades and processes, including injection-blow molding, injection
molding, and extrusion. The additive has received approval for food-contact applications from the U.S. Food & Drug Administration, the company adds.

“Packagers are under heavy pressure from consumers and environmental advocates to use more PCR in their products,” explains Peter Prusak, head of marketing, Clariant Masterbatches North America. “But the recyclate tends to reduce or discolor the crystal clarity that PEt is known for. Clariant’s new HiFormer PET-enhancing additives promise to minimize this problem, opening new opportunities for more sustainable packaging.”

The liquid masterbatches are resistant to sedimentation and segmentation, so they offer extended storage shelf life. They’re also easy to use in gravimetric metering systems that ensure accurate dosing and clean operation.

The liquid additives were reportedly tested on a production-scale blow-molding machine in the company’s facility in East Chicago, Illinois. Bottles made using 25% recycled PET and 75% virgin PET and no brightening additive were compared against bottles made with the same PCR resin and the additive in concentrations of 0.025, 0.035, and 0.05%. While the unmodified bottles showed significant yellowing, all the bottles made with the HiFormer additive were visibly brighter (i.e., less yellow and more blue).

“The human eye perceives yellowness as dirty or hazy, while blue light is seen as cleaner and clearer,” explains Prusak. “What is most significant, and what is most exciting to me, is how we can shift that blue value so dramatically with just 0.05% additive loading.”

Eriez offers a variety of mechanical conveyors engineered to move large amounts of bulk material for plastics processing operations. Many of these rugged, efficient, high-capacity units feature a compact, straight-line design along with an extremely low profile for easy maintenance. Minimum headroom is required for installation, the company adds.

The conveyors are available in single-mass and two-mass vibrating systems excited by a motor-driven eccentric shaft. Springs and trough sizes vary according to the type of application. Popular models include the Eriez® Horizontal Motion Conveyor, High Volume Vibrating Conveyor, and VMC Electromagnetic Conveyor, among others.

For instance, Eriez’s E-Z Slide™ Horizontal Motion Conveyor features a smooth, positive-sliding action to shuffle products along without breakage and without disturbing coatings on coated parts. The company says that in plastics processing applications, noise is greatly reduced because parts gently slide along the tray bottom. Drop-gate discharge mechanisms can be provided along the length of the tray to allow materials to be deposited onto other conveyors or feeders.

www.clariant.com

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