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MOVING FORWARD ON PET THERMOFORM RECYCLING

THERE'S A PUSH UNDERWAY TO IMPROVE THE RECYCLING OF PET THERMOFORM PACKAGING. WHAT STEPS IS THE INDUSTRY TAKING IN ADVANCING THIS PROJECT AND WHAT DOES IT MEAN FOR MATERIAL RECOVERY?

BY MICHAEL SCHEDLER AND KATE EAGLES

In late 2007, three major sheet/thermoform packaging manufacturers Pactiv, Placon and Genpak petitioned the National Association for PET Container Resources (NAPCOR) for membership. Up until that point, NAPCOR membership had been limited to PET bottle and resin manufacturers and suppliers to these two industry segments, the primary mission of the organization being to facilitate the recycling of PET bottles. The petition to join reflected these companies' desire to develop recycling opportunities for their PET thermoformed packaging – a rapidly growing package choice due to strong organic growth in retail applications, as well as conversions from other resins.

Much of this move to PET was attributable to the resin's superior environmental footprint, mainly owing to widespread use of PET bottle recyclate (PET sheet and thermoform manufacturers have been successfully incorporating recycled PET content into their food and non-food packaging for over two decades).

The concerns of these thermoformers were two-fold: 1) their packages were not being recycled, and 2) they needed more recycled content. Existing NAPCOR members understood these concerns as relevant to the larger NAPCOR organization and, as a result, opened membership to PET sheet/thermoformers. These members immediately formed the NAPCOR Thermoformers Council, expanded their membership to eight companies within 12 months, and embarked on addressing these issues. What follows is a brief summary of that work and where it stands today.

Reaching critical mass

NAPCOR has defined a PET thermoformed package as: "PET packaging other than bottles and jars, made from PET sheet of 0.008 inch thickness or greater, and that has the resin identification code No. 1, including, but not exclusively, clamshells, cups, trays, tubs and lids."

Needless to say, the average consumer probably doesn't know what this means. Converting this definition to consumer-friendly education is something that will ultimately be necessary, but it allowed us to identify and agree on our working "universe" in the meantime.

In 2009, NAPCOR determined that there were 1.4 billion pounds of these packages produced in the U.S. and Canada annually, representing about 25 percent of the thermoformed packages made from all resins. It's important to note that this data, so essential to the planning process, is not readily available. To come up with these numbers, NAPCOR has commissioned a survey of all thermoformers for the past three years. The group also has purchased independent data, obtained proprietary member information, and cross-pollinated all of this with data obtained from both waste composition studies and numerous

production tests.

This answers the first question that is asked when programs contemplate collecting a new material: Is there critical mass? Certainly, estimated PET thermoform volumes exceed the Association of Postconsumer Plastic Recyclers (APR) criteria of a minimum of 400 million pounds per year. More importantly, when looking at growth and conversion rates, it is not unreasonable to assume that, by the end of 2013, the annualized volume of PET thermoforms may be half that of bottles, or around 3 billion pounds. It is not inconceivable that PET thermoforms will be the most prevalent rigid plastic packaging in the waste stream, after PET bottles. This ratio of bottles to thermoforms was used as the basis for all of the laboratory research.

The objective, and how to get there

NAPCOR's objective was simple: To identify and remove the obstacles throughout the recycling system (from collection to end use) that prevent PET thermoforms from being recycled and, by doing so, increase the amount of rPET available to be used in packaging. The additional challenge was to do this without jeopardizing the existing PET bottle recycling infrastructure.

The plan embraced consisted of three main parts:

1. Conduct laboratory research to identify potential technical issues that would impede or prevent the recycling of PET thermoforms as either a dedicated stream or mixed with bottles.
2. Work with collectors and intermediate processors to move truckloads of post-consumer thermoforms through the system, to reclaimers and technology providers, in order to identify and remedy logistical as well as technical issues.
3. Create partnerships wherever possible.

The obstacles

Prior to embarking on this initiative, when NAPCOR staff was asked why PET thermoforms could not be recycled with bottles, the response was that the thermoformed packages currently in the waste stream all look alike, although made from a variety of different resins (OPS, PVC, PLA, PETG, other). Contamination levels would potentially be too high to successfully process the material. A secondary concern was that PET thermoforms' intrinsic viscosity (IV) was lower and/or more variable than that of bottles (IV is a measure of molecular weight or density).

After much R&D, the reality proved to be a bit different. Indeed the primary issue is that of unwanted contamination, a result of look-alike packages. No scenario is envisioned that would allow intermediate processing operations a manual sorting option until the percentage of these look-alikes is reduced down to no more than 10 percent of the total. However, with more and more MRFs installing autosort technology, this issue can be overcome.

The IV variation did not prove to be a show-stopper with more technologies in place to mitigate this, so the obvious question emerged: if a bale is produced using autosort technology, why can't the bottles and thermoforms be recycled together?

Taking action

Moving forward – and to ultimately answer the question posed above – the strategy employed was to run a parallel course of laboratory research and production trials, as previously mentioned. In this undertaking, NAPCOR was fortunate to have the support of Waste Diversion Ontario (WDO), Stewardship Ontario (SO), the Canadian Plastics Industry Association (CPIA), and the APR, all of which provided both the staff time and financial resources critical to success. Also, the Region of Waterloo, Ontario, provided a total of over half a million pounds of PET thermoform bales – to nine PET bottle reclaimers and six technology providers – without which little progress would have been made. Plastics Technologies, Inc. was retained to perform a series of laboratory tests and evaluations, including the APR applications protocol for PET bottles and sheet, on a range of samples from different locations in the U.S. and Canada. Briefly, here are what were determined to be obstacles, aside from the look-alike contamination issue.

1. The biggest surprise was that fluorescent material was found in most of the samples produced and evaluated, at levels up to 5 percent. The presence of this material is unacceptable for PET carpet manufacturers, as it causes inconsistent dye uptake and streaking. Further research found that the fluorescent matter was coming from produce containers shipped from Chile.
2. Most labels used on thermoforms tend to be pressure-sensitive paper labels with substantially more aggressive adhesives than those typically found on bottles. Removal at reclamation plants to acceptable levels required either more residence time during washing; more caustic solution; higher wash temperatures; or in most cases, all three.
3. Thermoform packages behave differently than bottles within the recycling system because of their shapes and how they are manufactured, causing a wide range of mechanical engineering issues, including:
   - Baling thermoforms at the same platen pressure as bottles results in a bale density more than 25 percent greater than that of bottles. Early bales of thermoforms produced were bricks that could not be de-baled without totally destroying the material.
   - Even bales produced at a lower platen pressure tend to come apart in "sheets" that can pass through trommels and de-clumpers and jam transition points.
   - Many belts, augers and transition points in bottle reclamation plants were not designed to handle the larger thermoforms, such as catering trays and lids, resulting in line stoppages.
   - Thermoforms, particularly clamshells, have different aerodynamics than bottles and tend to "flutter" going through autosort units, greatly reducing the accuracy.
   - Thermoform granulate can have less bulk density and uniformity than that of bottles.

All of this amounts to quite a challenge for the collective industry to overcome and will require cooperation from a lot of different industry segments.

For example, the mechanical engineering issues are just that; they really fall in the domain of individual reclaimers that want to pursue recovering this material. While the retrofits required may be substantial in some cases, there is nothing insurmountable here, rather the need for innovation, something that has unquestionably been one of reclaimers' fortes over the years. Of course, MRF operators will have to retrain their baler operators to make sure the density issue is addressed. So, that leaves the look-alike contamination, fluorescence,

and non-recycling-friendly adhesives as the major obstacles.

On the positive side with respect to performance tests, blends were made from 67 percent bottle rPET and 33 percent thermoform rPET reflecting the likely PET bottle/thermoform market mix as mentioned above. This blend was used at a 25 percent content level for bottles and a 50 percent level for sheet; both applications passed all performance tests prescribed in the APR Applications Guidance. The only exception were some color issues (B values) that were once again traced back to adhesive residue.

Canadian grocers ride to the rescue

About the time that these issues were being understood in their entirety, Loblaw Companies Limited, the largest grocer in Canada, approached NAPCOR for an update on the status of PET thermoform package recycling. Its attempt to better understand this issue formed part of Loblaw's initiative to move toward having only recyclable packaging in their stores, and they digested the complex situation accordingly. Shortly thereafter, the same information was requested by Walmart Canada and subsequently by the Canadian Council of Grocery Distributors. After these discussions, the question back to NAPCOR was threefold:

1. Did these grocers control enough of the market to solve the look-alike issue by requiring suppliers to switch to PET?
2. If they further required that their suppliers provide packages that do not fluoresce and that labels use only recycling-friendly adhesives.
3. Would it then be reasonable to expect that the thermoforms could be recycled with the bottles, clearly the most efficient and desirable option for intermediate processors?

After reviewing sales data by channel, and the information gathered with respect to adhesives reviewed by both the NAPCOR Technology Committee and the NAPCOR Thermoformers Council, we agreed that if the grocers were to move forward with these actions, then it would be reasonable to assume that the bottles and thermoforms could be recycled together in Canada.

The grocers then asked NAPCOR and APR to develop a test protocol that would determine what adhesives are recycling friendly. This protocol has now been finalized and is posted on the APR website (www.plasticsrecycling.org). Through their trade association, the Retail Council of Canada (RCC), grocers including Loblaws, Sobeys, Walmart Canada, Metro and Safeway Canada are urging their suppliers to register for testing with the intention that only approved label adhesives will be used after January 1, 2012.

To their credit, Walmart Canada has taken on the Chilean fluorescence issue since they have assets in that country. The five grocers named above are moving forward in converting to PET for their in-store packaging, category by category, according to their own particular schedules. The future for PET thermoform recycling in Canada is bright.

What now?

Placon Corporation has recently opened its Ecostar reclamation plant in Madison, Wisconsin. The new plant used test loads of PET thermoforms, as described above, in order to design the plant with the capability to process them. The recyclate produced is going back into PET thermoforms suitable for both food and non-food products. Other existing plants are being retrofitted, and new ones designed, with thermoform processing capability in mind. However, unless the two main obstacles can be addressed – the look-alike contamination and aggressive adhesives – indiscriminate inclusion of thermoforms in PET bottle bales will do nothing but devalue the bales.

NAPCOR understands that there is still a tremendous amount of work to be done, particularly in the area of consumer education, intermediate processing, and special event and venue recycling for cups. To that end, SPI: The Plastics Industry Trade Association and NAPCOR have announced the availability of grant funds of up to $100,000 to support a model program(s) for PET thermoform recycling in order to address these issues.

While the last chapters in this story have yet to be written, the events summarized with respect to the Canadian experience on this project are illustrative of what can happen when all of the various stakeholders work together. The APR, Adhesives and Sealants Council, CPIA, RCC, Stewardship Ontario, the Tag and Label Manufacturers Institute and Waste Diversion Ontario all provided input, resources and leadership while respecting the concerns of each others' constituencies. The roles played by Stewardship Ontario and Waste Diversion Ontario especially cannot be minimized as they provided the forum where the essential question was asked: "What's it going to take to get this material recycled, and what is the best way to do it?"

Although there is no equivalent forum in the U.S., it doesn't preclude us from asking and answering the same question. NAPCOR feels that the time has come, and will continue to work with U.S. stakeholders to overcome the barriers to successful PET thermoform recycling. RR

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