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GO WITH THE FLOW The changing face

of recycling in the manufacture of PET thermoform packaging

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THERMOFORM RECYCLING

Progress in post-consumer PET thermoform recycling in North Ame

Progress in post-consumer PET thermoform recycling in North America is yielding interesting implications for the PET, and larger plastics, recycling industries. **Chandler Slavin*** analyses the market

Real progress has been made in the sorting and recycling of PET thermoforms in North America, says Chandler Slavin

n 2010, I published *Recycling Report: the Truth about Blister & Clamshell Recycling in America with Suggestions for the Industry* (the result of independent research on recycling catalysed by serving as Wal-Mart Canada's colead of the PET Subcommittee of the Material Optimisation Committee); I was 23 and had joined the family company Dordan Manufacturing, a plastics thermoformer based outside Chicago, Illinois.

Therein I stated that contrary to popular belief, PET clamshells and blisters are not 'recyclable' according to the FTC Green Guides' definition. This was because 60 per cent or more American communities did not have access to facilities that recycle PET thermoforms, only bottles. In the report I questioned why — if we manufacture post-consumer rPET clamshells out of 100 per cent post-consumer rPET bottles — we cannot recycle PET/rPET thermoforms with PET/rPET bottles.

I concluded the report by offering suggestions for how to alleviate some of the barriers to postconsumer PET thermoform recycling, which can be summarised as follows: If the cost of collection, recycling and remanufacture is less than or equal to the cost of virgin material/product production, then it is likely that this type of material/packaging type will become recyclable with investment in infrastructure, sorting technologies, consumer outreach, and domestic end markets. Fast-forward to 2012 and the publication of Moore Recycling Associates' *Plastic Recycling Collection National Reach Study*, which finds that "at least 94 per cent of the US population has access to PET bottle recycling and just over 57 per cent has access to all plastics bottles and all nonbottle rigid container recycling".

RPET

This means that in just a few years, PET thermoformed containers went from being largely land-filled to collected for recycling in the majority of American communities. Or does it?

Market drivers

The National Association for PET Container Resources (NAPCOR) is and has been the largest advocate for the PET industry. As such, it practically founded the PET bottle recycling infrastructure in the 1980s, working with stakeholders to eliminate the barriers to its efficient collection and reprocessing. Decades later, and with 23 PET reclaimers online in 2011, NAPCOR reports a domestic capacity to process 1.75 billion pounds (796,000 tonnes) of rPET annually, with 5.48bn lbs (2.48 million tonnes) of PET bottles produced and available for recycling in the US.

With more than 90 per cent of American communities having access to PET bottle recycling, according to Moore Recycling Associates, anyone in an economics 101 class would conclude that a market-driven, supply/demand equilibrium could be attained for post-consumer PET recycling. In other words, the increased demand for post-consumer PET by domestic reclaimers would signal to the market that it should produce more PET bales, which would motivate communities to collect more PET. But, with a recycling rate hovering below 30 per cent and plunging bale yields due to a variety of factors, there is simply not enough post-consumer PET available to meet the demand.

NAPCOR summarises: "The US now has capacity to process more post-consumer PET packaging than the amount collected. That means that in 2012, even if no PET bales are exported, these reclamation assets will be short of material. Investments in these assets are substantial and arguably the most sophisticated in the world... without reclamation plants there is no PET recycling, and these new plants are essential if respectable PET recycling rates are to be achieved. But without additional collection efforts or new streams of material, the increased capacity will only serve to drive prices to unsustainable levels".

Years of excessive demand and limited supply have resulted in poor quality bales dominating the market. NAPCOR reports that US reclaimers said that yield losses ranged from 25 per cent for deposit bottles to 35 per cent for curbside material and 28.9 per cent for California California Redemption Value (CRV). Moreover, while collection of post-consumer PET has increased, the amount of useable rPET has been flat-lining since 2008, claims Resa Dimino, director of public policy at NAPCOR.

NAPCOR warns: "These contamination levels are higher in all categories than in 2010 and have reached crisis levels according to industry experts".

Additional reasons for the declining PET utilisation rates include: excessive container lightweighting, brands neglecting APR's Design for Recycling Guidelines (full-wrap bottle labels); and, more community programmes switching to single-stream recycling, which while increasing the amount of material collected, also increases the level of contaminates entering the system.

How do you increase post-consumer PET collection and rPET utilisation in order to balance the supply/demand equation of PET recycling? There are many arguments: Implement public policy; Limit international exports; Increase MRF efficiency; Utilise Design for Recycling Guidelines; Increase consumer convenience and participation; Recycle all PET containers. The latter requires the confluence of all the aforementioned efforts.

Post-consumer PET recycling today

Since 2009 it has been widely recognised that adding post-consumer PET thermoforms to the PET recycling infrastructure would increase the material available for reprocessing; hence, assist in achieving a sustainable economic model for PET recycling.

Consequently, working groups along the supply chain have sprung into action, tackling everything from issues of contamination to issues of supply. The efforts have been far reaching and the progress in recycling PET thermoformed containers tremendous.

NAPCOR summarises: "2011 saw the first significant amount of PET thermoformed packaging moving through the system in both the US and Canada. Since 2009, NAPCOR has made the removal of obstacles to PET thermoform recycling its top priority, not only as a reflection of proper stewardship for PET's fastest-growing packaging segment, but as a way of increasing feedstock opportunities for reclaimers, and ultimately ensuring more rPET flake and pellet reaching



Retail packaging made from rPET (and opposite page)



end users. These efforts are bearing fruit, as all purchasers and processors of curbside bales are allowing some level of thermoforms mixed in with the bottles. In the short-term, increased PET thermoform collection is the best hope of addressing the key issue of increasing supply".

Said Dan Mohs, chief executive of Madisonbased thermoformer Placon, at the Waste Expo in May 2013, NAPCOR estimates that there are approximately 1bn pounds (453,000 tonnes) of PET thermoforms available for recycling in North America; in 2011, 45m pounds (20,400 tonnes) of PET thermoforms were recycled, including those sold to international markets as part of mixed bales.

With 2011 NAPCOR survey respondents indicating that all but two domestic reclaimers were purchasing PET bales with up to 10 per cent PET thermoform content, it is the thermoforming industry's hope that it is only a matter of time until PET thermoforms are recycled as readily as

PET bottles.

That being said, it is widely understood that in order to achieve such a reality, all stakeholders must take action to ensure that PET thermoforms will not compromise the established process of PET recycling, but add to the material available for recovery and increase bale yields and rPET utilisation rates.

One concern among reclaimers with adding post-consumer PET thermoforms to PET bottle recyclate is differences in intrinsic viscosity (IV); that is, a material's integrity, its 'gooeyness' or 'flow'. With each heat impression or mechanical stress, IV is sheered off, compromising the performance of the material.

That is why 100 per cent post-consumer rPET clamshells can be extremely brittle; the material has a lower IV as a result of the multiple conversion processes it endured in the transition from a blow moulded PET bottle to extruded sheet to thermoformed container. Carbonated PET bottles **>**

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enjoy the highest IV, followed by water bottles and PET sheet material/thermoforms.

That is why 'good quality dirty granulate material and deposit bottle bales continue to be in high demand and short supply, commanding a premium over curbside bales'; because, the material arguably enjoys an IV appropriate for bottleto-bottle recycling, the highest return for PET recycling.

However, that is changing: solid state polymerisation now grants reprocessors more control over material IV; and, experimenting with different PET/rPET blends and recipes has enabled one global plastics supplier to offer different grades of post-consumer/post-industrial rPET material, depending on the application. The issue of IV in discussions of PET thermoform and bottle recycling will soon become a non-issue, as more reclaimers learn to work with post-consumer PET thermoforms and material suppliers invest in the technologies and expertise to produce high performing rPET with this new and expanding feedstock.

One of the most enduring issues with PET thermoform recycling voiced by MRFs/reclaimers include issues of 'look-a-like containers'; that is, the understanding that unlike bottles, which are almost uniform in material, thermoformed containers are manufactured out of a variety of different resins, many of which are contaminates in PET recycling.

However, one of the largest and oldest PET recyclers in the US recently reported success with automatically sorting PET thermoforms from contaminating look-alikes, such as PVC blisters, and is now accepting and processing bales comprised of 10 per cent PET thermoforms and 90 per cent PET bottles; no real complications to the existing sorting systems having been reported.

In addition, thanks to a grant from SPI in partnership with NAPCOR, Montgomery Country in Maryland has reported success with training employees to manually separate PET containers from look-a-like contaminants, says NAPCOR's Resa Dimino.

Another dimension to this issue of container non-conformity is that thermoforms do not 'move down the line' at a MRF or reclaimer like PET bottles; they snag and disrupt the established sorting process, reducing productivity.

One piloted approach to this issue of container look-a-like occurred in June 2011, when Canada's top five grocery chains announced that they would require suppliers to shift to PET for clamshell thermoformed packaging in a move designed to simplify the product stream and increase recycling. By attempting to reduce the amount of non-PET thermoforms sold at retail, Canadian grocers signalled to the market a trust in PET reclamation, decreasing the likelihood of contamination through container look-a-like issues. During PET thermoform recycling pilots performed by NAPCOR and its industry allies, it was discovered that the pressure-sensitive labels used on thermoformed food containers are so aggressive that they are not removed in the washing stage of recycling, compromising the process. Consequently, the Association of Postconsumer Recyclers (APR) published PET Thermoform Label and Adhesive Evaluation, which looks to analyse the characteristics of labels/adhesives intended for use on PET thermoforms to confirm compatibility with PET recycling, though the ramifications of these guidelines have yet to be manifested in the market.

A revolution in the global recycling market was witnessed in 2013: China, historically a major buyer of US plastics bales, began enforcing the 'Green Fence'; a policy-driven attempt to reduce 'dirty scrap imports' and develop China's internal recycling markets, observed Mustan Lalani, project manager at Reclay StewardeEdge, a Canadian firm dealing with packaging stewardship.

Imagine that you are a Material Recovery Facility (MRF) and you collect post-consumer PET material for resale. With domestic demand for PET bales exceeding supply, the competition is fierce. Now marry that with the historical international demand, which prior to Green Fence did not require imported plastics bales to meet quality specs, and you can begin to understand why PET bale yields and rPET utilisation rates have been plunging.

Why sort PET from other materials when my Chinese buyer will take all the scrap for a price Ground PET ready for recycling into rPET (in the vase) shows the process that leads to rPET clamshells and retail-ready packaging

competitive with what a domestic buyer is willing to pay for just the PET portion?

Green Fence, therefore, implies that more pressure will be exerted on domestic MRFs and intermediate processors to efficiently sort PET for consumption by domestic end markets because the Asian buyer of dirty scrap bales is quickly becoming a historical relic of yesteryear's largely unregulated market.

Post-consumer PET recycling tomorrow

With the majority of American communities now accepting all non-bottle rigid containers for recycling and the technical barriers to post-consumer PET thermoform recycling being resolved, the floodgates to PET thermoform are almost ready to be opened.

While the implications of China's Green Fence are yet to manifest in the PET reclamation market, all signs point to a stable increase in PET collection and recycling in order to continue to add to the amount of usable rPET available to secondary markets. Will recycling PET thermoforms be the silver bullet to cementing a sustainable PET recycling market? Will we soon arrive at a reality where retailer preference for postconsumer PET packaging sends a signal to municipalities to invest in community collection efforts for PET packaging? And, thereby, generating the needed supply of recycled and cost-competitive rPET for packaging manufacturers to meet the demands of its end customer?

Unfortunately, the data is not too compelling. While we have been recycling for decades, recycling rates have reached a plateau, even with increased industry engagement.

For some, it is believed a structural flaw is to blame; that is, a disconnect between those who sit on the supply and those who need it. North Carolina Department of Environment and Natural Resources director of recycling, Scott Mouw, summarises the tensions inherent in creating a market-driven recycled commodities market utilising the existing municipally managed collection and reprocessing schemes: "If you were going to design a responsive commodity supply system, why would you rely on decision-makers who appear unmotivated by prices, have competing internal investments and are essentially unrewarded by the market place? And why would you set up a system in which the cost of collection is not remotely covered by system income?"

There are three prevailing perspectives about the likelihood of creating a market-driven and sustainable PET recycling market: Those who believe it is completely possible to develop a sustainable PET recycling market based on real market drivers with enhanced consumer education and Best in Class package design and recovery processes; Those who believe it is possible to develop a sustainable PET recycling market with governmental intervention aimed at incentivising collection and recycling, like landfill bans or

Thermoforming is a versatile process for packaging manufacture

bottle deposit legislation; and those who do not believe it is possible to develop a market-driven PET recycling market where the cost of recycling is competitive with the cost of virgin material production and attest that recycling will always be a cost to the system. But the question now is, whose cost?

In my 2010 *Recycling Report*, I argued that a sustainable model for post-consumer PET recycling can be reached, assuming that the cost of collection, reprocessing and remanufacture is less than or equal to that virgin PET production. With the fossil fuel crisis in full swing and American boots on the ground overseas to protect these assets, the idea that recycled PET could become cost competitive with virgin PET was not uncharted territory.

Conversations with stakeholders to understand the state of PET thermoform recycling coupled with our new access to natural shale gas deposits only further complicates the issue of achieving a market-driven PET recycling market in North America, independent of public policy measures.

Regardless of which camp you reside in, we all can agree that there is no plastics sustainability without recycling. Moreover, it is best to be proactive when dealing with issues of environmental protection, lest you be caught off guard with irrational regulatory mandates, such as bag bans.

By being present in the dialogue on plastics recycling and sustainability, plastics stakeholders can benefit from the value of collaboration, best manifested through the development of real, end-of-life management options for all plastics packaging.

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