Plastics Recycling in South Africa

S.M. Pretorius. South African Plastics Recycling Organisation. annabe@absamail.co.za

ABSTRACT

South Africa is amongst the best in the world with mechanical recycling of plastics waste. In 2012, 20% of all plastics products manufactured locally were recycled into new products. If only plastics packaging is considered, the industry is ahead of the original targets set out in the Paper and Packaging Industry Waste Plan compiled in 2011. Plastics packaging recovery rates reached 34 % in 2012 and for the first time, the plastics packaging sent to landfill was less than the previous years. However, the growth is not substantial enough. The industry is now actively seeking out ways to grow the recycling rates.

The plastics industry has engaged in *Zero Plastics to Landfill by 2030*. To achieve this goal, two short term objectives have been identified: The industry needs to identify, and quantify, the recyclable plastics that are not recycled and need to establish what the stumbling blocks are, and the industry needs to quantify the non-recyclable plastics that are in the *separated* solid waste stream. One packaging component that is not recycled in any substantial quantities is non-bottle rigid packaging. These include products like tubs, trays, punnets, cups and lids. The quantification process is underway and the results and possible action plans to deal with this sector will be included in the presentation.

Non-recyclable plastics in the waste stream obtained from the urban Separation-at-Source domestic solid waste stream in Cape Town is currently being analysed and quantified. Alternative recycling methods need to be investigated to deal with this component of the waste.

Plastics recycling is *wired for growth*!

1. INTRODUCTION

1.1 Plastics Recycling in SA

Mechanical recycling is well established in South Africa and a total of 272 691 tons of plastics was recycled into new plastics products in 2012. Recycled packaging totalled 76 % of all the recycling done. If all the plastics packaging in the waste stream is taken into account, 34 % was diverted from landfill.

1.2 Plastics Recycling in Europe

There are some challenges in comparing data from EU 27+2 with the well-known data from South Africa but if we compare mechanical recycling as a percentage of products manufactured, Europe recycled 14.2 % in 2012 versus the 19.9 % of South Africa. This is despite all the formalised collection and recovery mechanisms in place in Europe already. Nearly half of all the materials recycled locally were sourced directly from the solid waste stream where the recyclables were hand picked off landfills.

1.3 Plastics Recycling in Australia

As South Africans, comparison with Australia is coming natural in all aspects of life! Australia recycled 9.2 % of all plastics in 2012. If the exported waste is taken into account, a total of 20.5 % was diverted from landfill vs. the 21.0 % of South Africa.

1.4 Growing recycling in South Africa

Very little tonnages are converted in alternative recycling methods like incineration or energy recovery and pilot plants were only becoming operational in 2013.

What happened to the other 66 % of packaging not yet recycled?

Plastics recycling developed over the last five decades as an autonomous, independent industry based on pure economic principles. Only PET recycling had some influence from the brand owners and raw material suppliers and the recycling rates of beverage bottles are reaching 50 % as a result.

Recyclers bought, built and scavenged plant and equipment together based on the demand for recycled materials. Only a few recyclers are totally geared for soiled, contaminated post-consumer recycling.

Solutions need to be found to access the post-consumer recyclables and recycle it effectively and economically. Mechanical recycling rates will only increase if these challenges can be managed.

2. ZERO PLASTICS TO LANDFILL BY 2030

2.1 Introduction

The plastics industry has engaged in *Zero Plastics to Landfill by 2030*. To achieve this goal, two short term objectives have been identified: The industry needs to identify, and quantify, the recyclable plastics that are not recycled and need to establish what the stumbling blocks are, and the industry needs to quantify the non-recyclable plastics that are in the separated solid waste stream. One packaging component that is not recycled in any substantial quantities is non-bottle rigid packaging. These include products like tubs, trays, punnets, cups and lids.

2.2 Tubs and Trays

Tubs and trays form an important part of the rigid packaging sector in South Africa – they range from aluminium foil, paper, waxed paper, plastics to compostable materials. They are lightweight and extremely versatile and are a popular choice for consumer products, fresh produce and many more applications. The downside is that they are quite challenging in the waste stream. Due to the number of different polymers used for tubs and trays and often combination of polymers, they are not picked in any substantial numbers from the solid waste stream for recycling.

In order to come up with workable end-of-life solutions, the magnitude of the challenge needed to be established first. Plastics|SA, Astrapak, PETCO and POLYCO initiated a study to establish how many tubs and trays are manufactured, for which industries and from what materials they are made.

Terminology

“Tubs and trays” is the term used to describe a number of products. Non-bottle rigid packaging was the term found in literature from the United States of America, United Kingdom and Europe describing a similar product range.

The criteria used for this survey was based on observations of waste pickers at Material Recovery Facilities (MRF’s) and landfill sites. Products were selected that were generally speaking not picked by waste pickers although theoretically perfectly suitable for mechanical recycling. Both injection moulded and thermoformed products were included.

2.3 South African Market

The total amount of tubs and trays that were sold in 2012 was calculated at more than 4.846 billion units or 95 per capita, i.e. each person in South Africa used and disposed of 2 tubs and trays every week!

2.4 Level of Contamination

Due to the nature of tubs and trays, the bulk of the end-of-life products will be originating from consumers and will enter the solid waste stream as post-consumer waste. The product application or market sectors will influence the level of contamination and residual content levels which have an impact on the recyclability of the product in the waste stream. For example, thin, lightweight punnets heavily contaminated with meat juices and blood will most likely not be picked from the waste stream whereas a clean biscuit tub stands a better chance to be recycled.

Slightly less than half of all the tubs and trays, i.e. 47.7 % was sold into the *fast moving consumer goods* market. “Other, including Dairy” was the largest FMCG market application with 15 436 tons. Most of the 3 500 tons that were formed, filled and sealed at the customer were for dairy products as well.

The products that will most likely be heavily soiled with fair quantities of residual content will be diary packaging like yogurt cups, margarine tubs, meat punnets and take-away food containers. Unfortunately, these mentioned products represent over 45 % of the total tubs and trays market in 2012.

Products that will most likely be clean and recycling-friendly will be punnets and trays for fresh produce, bakery products like cake domes and muffin trays. Although only a very small portion of the tubs and trays market, haberdashery and hardware packaging, toiletry- and electronic packaging would all be clean and ideal for recycling if collected. Even these are not recycled.

2.5 Recycling challenges

Many of the recycling challenges also relate to the low recycling rates of tubs and trays. These are briefly discussed below.

2.5.1 Polymer identification codes

Polymer identification codes are absent, illegible or incorrect. “Other” is often used and does not refer to any particular material. If the product is made from ABS, the number 7 should be used with ABS underneath the chasing arrows. Waste pickers and collectors do not have the time to manually identify each unidentified “other” material.

Different materials are often thermoformed in the same mould without changing the material identification mould insert. The identification code is sometimes left empty where the same mould is used for different materials.

The more difficult and time-intensive the process is for the manual sorters to identify the recyclable materials from those destined for landfill, the higher the reprocessing costs; therefore, the more expensive the recyclate and the less competitive it will be.

2.5.2 Labels

Large labels are stuck onto most consumers packaging with reams of information to the consumer about the contents. Water soluble adhesives should be used for these labels but label integrity could then be sacrificed if the packaging gets wet for one or other reason. The conventional recycling methods will not remove the non-water soluble labels successfully.

Polymeric labels are used for shrink-labels and stretch labels. The label construction material should be of a different density to the package for effective separation during recycling.

For in-mould labelling the same material as the pack should be used, e.g. a PP in-mould label on a PP tub. The label and the pack will be recycled together as they cannot be separated again.

2.5.3 Lids

Tubs and trays are often sealed with peel-off lids. The adhesives of peel-off lids should remain on the lid.

2.5.4 Critical mass

For some materials, packaging volumes have dropped to such an extent that it is not economically viable to operate a wash-plant for this particular material stream. This is specifically applicable to rigid PVC packaging. There is sufficient demand for the recycled PVC packaging but the tonnages converted into sheet, bottles and jars are so low that there is not enough PVC in any of the larger metropolitan centres to justify a post-consumer recycling plant. The long distances between our main centres make it uneconomical to transport all the PVC packaging to a central spot for recycling.

2.5.5 Demand

The recycling industry is based on demand and where products were developed based on certain recyclables; the subsequent materials got collected and recycled for this purpose. Such an example would be roof tiles manufactured from a substantial list of ingredients, including multi-layer plastics packaging. Collectors started to buy multi-layers from waste-pickers as they had a market for the material. As the demand for roof tiles drop, or if the factory experiences problems, the demand for multi-layers dropped. Waste pickers may then engage in alternative income generating activities such as paper and board collection.

2.5.6 Residual contents

FMCG packaging serves a simple purpose and has no perceived value. The consumer will remove, eat or consume the contents and will discard the packaging without paying any notice to the next step in the value chain. Very often, fairly large volumes of residual contents will remain in the packaging. The industry average for losses incurs between incoming and outgoing materials is currently between 30 and 35 %. In other words, 35 % of the mass purchased from the collector, would not be recyclable materials and will be discarded back to landfill. Residual contents contribute to this figure as it is not only the left-over yogurt but also the sand, paper and leaves stuck to the yogurt in the container that is collected, granulated and washed before it can be separated from the plastic to be recycled.

2.5.7 Selection of certain materials

Brand owners and retailers select certain materials based on past experience or product marketing and not on the suitability of a material for the application on hand. For example, PET bottles are widely recycled and therefore PET trays were selected for confectionary packaging based on PET bottle recycling rates. Very little research by the product designer would have revealed that PET sheeting is not currently recycled in South Africa and that clear, conventional PS (say) would have been similarly suitable.

2.6 Possible solutions

Consertive effort will have to go into the collection and recycling of tubs and trays to increase the recycling rates of this non-bottle rigid packaging sector as well as plastics packaging in general.

2.6.1 International solutions

The problem is not unique to South Africa, but South Africa is unique in the sense that we only have mechanical recycling. No large scale incineration or energy recovery is taking place.

To reach their sustainability goals, Wal-Mart chose a collaborative approach in Canada. It formed a number of technical working groups called Sustainable Value Networks, which were made up of a diverse group of internal resources and outside experts. The Wal-Mart Packaging Scorecard in Canada evaluates the sustainability of product packaging based on several criteria, such as material type and weight, product-to-package ratio, and cube utilisation. Several organisations worked together to explore ways of how to improve recycling rates for packaging and increase the volume of waste diverted from landfill.

One of the options was to transition most tubs and trays to PET. The PET bottle recyclers can accommodate a certain percentage of PET tubs and trays in the PET bottle bales (*mixed* bales). (No other packaging materials are recycled in substantial volumes in Canada and PS nor was PP therefore considered.)

In the United Kingdom most Material Recovery Facilities (MRF's) concentrate on separating mixed plastics recyclables for further sorting at a specialist plastics recovery facility (PRF). As a result, the volumes of mixed plastics increased considerably in the last couple of years in the UK. Increasing numbers of sorting facilities now have optical sorting capabilities able to differentiate between polymer types. As a result, many collections and material handling contractors now advise that they accept rigid plastic packaging alongside bottles. Non-bottle tonnages increased by 101 % in 2010 in the UK but their total rigid plastics recycling rate is still only about 8 %. Close to 50 % of all plastics bottles was recycled in the same year.

The United States of America published a report on a survey done in 2010 in which they state that there is a challenge with regards the various polymers used and the multitude of shapes and sizes. The report stated that the collection and recycling of tubs and trays was not economical viable in the USA and was therefore not done in any significant manner. Since then, PET trays were successfully introduced into the PET bottle

recycling streams mainly as a result of the introduction of a “Protocol for Evaluating PET Thermoform Labels and Adhesives” suitable for PET recycling.

2.6.2 South African solutions

Looking at the above and after spending some months working on possible solutions for tubs and trays in the solid waste stream as well as the author’s fair understanding of the South African recycling industry, the following potential solutions are listed that could be pursued further.

Different industry organisations to discuss and agree on the way forward with regard tubs and trays in the waste stream. The objective must be a consolidated plastics approach and not single material focus;
Develop a standard (or protocol) for the size and position of the polymer identification code on all tubs and trays together with the brand owners and retailers, including compostables;
Ensure all convertors, brand owners and retailers understand the “Design for Recycling guidelines” published by PACSA in 2014;
Work with MRFs to develop more efficient sorting systems for tubs and trays and encourage industry collaboration for the development of an “easy” way to visually identify the different material types as they move down the line, facilitating efficient sorting and lower reprocessing costs;
Investigate the potential for PRF’s in the larger metropolitan areas.
Initiate the development of local LCA’s for local vs. imported materials, virgin vs. recycled materials.
Work with government (local, provincial and national) to generate investment in sophisticated sorting technologies;
Determine the technical feasibility of recycling PET thermoforms with PET bottles regardless of the various grades;
Develop local markets for contaminated post-consumer recyclate, be it recyclers, converters, product producers, brand owners, retailers, etc; (This is not currently a priority as there is insufficient supply to justify new product development.)
Educate consumers and the industry about the importance of recycling plastic packaging;
Limit the amount of post-consumer recyclable plastics bales exported to grow local tonnages;
Encourage that the polymer types used in the manufacturing of tubs and trays be limited in order to generate large quantities of the selected fewer material types available for recovery post consumer;
As a last resort, trial and investigate the opportunities for non-recyclable mixed materials for fuel from waste plants, including PET and PVC materials amongst others.

There are probably other excellent local solutions that will only surface once the various stakeholders work together now that the magnitude of the problem is known. Cost effective recycling should always remain the first option as there are end-product demand for recycled ABS, PE-HD, PP, PS, PS-E and PVC.

3. NON-RECYCLABLES

The only commercially successful Material Recovery Facility (MRF) is based in Kraaifontein, Western Cape. Domestic users separate their recyclables at source. A service provider collects it and sorts it at the MRF. Large quantities are perceived to be non-recyclable as the products are not picked from the conveyor by the manual sorters.

A study is currently underway to identify and quantify the products that were picked as recyclable by the domestic waste generator but were not selected off the conveyor for recycling.

Considerable costs were incurred to get it onto the MRF conveyor for it not to be recycled into a raw material again. Are these products not recyclable, are there not known markets for the recyclate, should they not have been sorted into the recyclable waste stream to start with?

The results for the study will be used in the design of similar MRF’s around the country to limit the amount of non-recyclables that move through such facilities.

(The City of Cape Town partnered with a Japanese donor company to trial Energy from Waste by using the non-recyclables as fuel.)

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ABBREVIATIONS AND ACRONYMS

ABS	Acrylonitrile/butadiene/styrene
AIB	American Institute of Baking
BRC	British Retail Consortium
CPET	Crystalline poly(ethylene terephthalate)
EPR	Extended Producer Responsibility
FFS	Form-Fill and Seal
FMCG	Fast Moving Consumer Goods
HACCP	Hazard Analysis Critical Control Points
ISO	International Standards Organisation
LCA	Life Cycle Analysis
MRF's	Material Recovery Facilities where mixed dry recyclables (typically paper, card board, metals, mixed plastics, bottles and sometimes glass) are separated into material types and baled for processing by specialist recyclers.
OPS	Orientated Polystyrene
PACSA	Packaging Council of South Africa
PE-HD	High density polyethylene
PET	Poly(ethylene terephthalate)
PETCO	PET Recycling Company
PETG	Poly(ethylene terephthalate) glycol modified
PLA	Polylactic acid
POLYCO	Polyolefin Recycling Company
PP	Polypropylene
PRF	Plastics Recovery Facility set up specifically to sort plastics by polymer type and/or colour
PS	Polystyrene
PS-E	Expanded polystyrene as well as extrusion gassed polystyrene
PS-HI	High impact polystyrene
PSPC	Polystyrene Packaging Council
PVC	Poly(vinyl chloride)
PVC-U	Unplasticised (or rigid) poly(vinyl chloride) – tubs and trays in this survey were all made from rigid PVC
SAVA	South African Vinyl's Association

4. REFERENCES

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