

The recyclability of filled polyolefins

Who we are (SAPRO)

The South African Plastic Recycling Organisation (SAPRO) is an industry body consisting of, and representing South African Plastic recyclers. The SAPRO purpose is defined as follows:

“Our purpose as SAPRO is to assist recyclers in:

- 1. building a recycling industry that is respected and acknowledged by government, industry and the general public;*
- 2. addressing our collective challenges in a constructive way;*
- 3. growing our industry and respective recycling businesses in volume, technology and profitability;*
- 4. presenting a united voice that influences external decision-making positively;”*

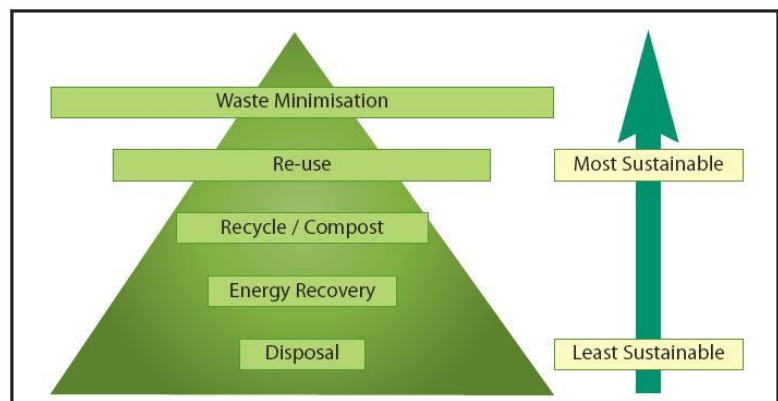
The South African Plastic recycling industry

Plastic recycling and recovery is broadly categorised as follows.

1. Mechanical (Primary and Secondary) recycling represents the re-processing of the plastic to manufacture similar types of products as the original, e.g. used bags and drums are turned into black bags and carrier bags;
2. Chemical (Tertiary) recycling represents various processes that recover chemicals and fuels from the plastic;
3. Thermal (Quaternary) recycling uses plastics as part of feedstock in a thermal process for energy-from-waste.

Of these three, mechanical recycling is internationally considered more sustainable and environmentally friendly as depicted on the European Waste Legislation ‘*Waste Hierarchy*’.

Only mechanical recycling is currently commercially exercised in South Africa. There are two or three small private incineration and diesel-from-waste plants on trial.



An annual industry funded survey on plastic recycling in South Africa found that 284 520 tons or 20.3% of all plastic converted in South Africa were mechanically recycled with almost 62.7% of the recyclable materials obtained from post-consumer sources such as landfills. These statistics indicate that South Africa's recycling market is exceptionally well developed. At 20.3%, our country's mechanical recycling rate is the highest in the world and the envy of developed countries. By comparison, Europe's mechanical recycling rate is between 9% and 11% and Australia averages 9.2%. They mostly employ tertiary and quaternary recycling techniques like energy-from-waste.

Although unheralded, South Africans should be proud of the world-leading work plastic recyclers are performing with regards to recycling and the industry should be supported in their efforts in every possible way.

Sink/Float washing and separation?

A material's density is defined as its mass per unit volume. It is essentially a measurement of how tightly matter is packed together. One of the most common uses of density is in how materials interact when mixed together. Wood floats in water because it has a lower density, while an anchor sinks because the metal has a higher density. Certain plastics float because the density of the plastic is lower than the density of the water.

A concept related to density is the specific gravity of a material, which is the ratio of the material's density to the density of water. An object with a specific gravity less than 1 will float in water, while a specific gravity greater than 1 means it will sink.

Polyolefin plastics separation and washing can easily be accomplished with a "sink/float" process. The concept relies on the specific gravities of the various materials processed in the tank relative to the specific gravity of the base solution (water) in the tank. Those materials with a specific gravity higher than that of water will sink while those with a lower specific gravity will float.

In the sink/float process, material is deposited onto the surface of the water in the tank. Heavy material like dirt, metal components and other contaminants sink to the bottom of the tank and are removed, while the buoyant material (i.e. the plastic) is conveyed to the opposite end of the tank where it is discharged.

Only polyolefin plasticss (i.e. PE-HD, PE-LD, PE-LLD and PP) can be separated and washed in this manner as their relative densities are between 0.92 and 0.98 g/cm³. The other plastics like PET, PVC and PS have specific gravities exceeding 1 and therefore sink with the dirt, also enabling the effective separation of these materials during the washing process.

Almost all mechanical recycling in South Africa that is performed on dirty, post-consumer polyolefins uses sink-float technology, as these facilities are reasonably accessible and facilitate

economically viable recycling. Any threat to the ability of recyclers to recycle dirty plastics will therefore have an immediate detrimental effect on recycling in South Africa.

In 2014, 212 090 tons of polyolefins were mechanically recycled which equates to 74.5% of all recycling done in the specific year.

What are fillers

In an attempt to reduce costs in the manufacturing of plastics products, convertors (manufacturers of plastic products) are continuously adding increased amounts of fillers like CaCO₃ (Calcium Carbonate) to their raw materials. Unfortunately, the fillers have very high relative densities. CaCO₃ has a density between 2.7 and 2.8 g/cm³. Even at low addition levels, the specific gravity of the mixture will exceed 1. This means that the average density of the product is more than water, effectively making the sink float technology redundant.

The following table is an abstract from a presentation given by Heritage Plastics, a supplier of CaCO₃ fillers in the USA, <http://www.heritage-plastics.com>. The table shows the effects of various addition levels of CaCO₃ (the most common filler additive) on the density and sink-float recovery rate.

CaCO ₃ Content %	TiO ₂ Content %	Polymax LDR %	Calculated Density g/cm ³	Measured Flake Density g/cm ³	Flake sink-float recovery rate %
0.0	0.0	0.0	0.940	0.940	99.8
4.0	1.5	5.0	0.977	0.976	99.8
5.0	1.5	6.3	0.980	0.977	99.8
6.0	1.5	7.5	0.990	0.982	99.7
7.0	1.5	8.8	0.997	0.996	74.3

As noted above, even at addition levels as low as 7%, the sink-float recovery rates start dropping dramatically. Most carrier bags and plastic furniture already contain levels in excess of 30%, which makes the recycling of contaminated, dirty, post-consumer products unfeasible.

Products already contaminated

To our knowledge almost all the carrier bags manufactured in South Africa contain very high percentages of fillers. These products are therefore not economically recycled in South Africa in significant volumes any more. The carrier bag industry alone is estimated at approximately 36 000 tonnes per year. This constitutes a very large source of raw materials for recycling and can greatly add to increase the sustainability of the industry. If 100% recycled, it could add a further 2.5% to the overall recycling rate. It has come to SAPRO's attention that manufacturers

are considering the addition of fillers to the material formulation of plastic furniture, buckets, pails and chemical drums.

Effect on South African Recycling Industry

To the knowledge of SAPRO, there is no economically viable alternative to sink-float systems to be used in the mechanical recycling of dirty, post-consumer polyolefin plastics with a specific gravity greater than 1. SAPRO also does not know of any reasonably accessible equipment that would enable a recycler to recycle the products in an economically feasible manner.

To further complicate matters, the products containing the fillers are indistinguishable from those without. Entire batches are therefore contaminated reducing the yield from sink-float operations. The prices recyclers are then willing to pay become too low to cover the overheads of collection, forcing collectors to completely stop collecting these products. As more products start containing fillers, the recycling rate on these products will continue to drop, having a detrimental effect on the future of the complete recycling value chain in South Africa.

Internationally, a similar problem is experienced with many plastics products that contain fillers, but these are not mechanically recycled and the end-of-life products can still be used for energy recovery.

Mobius loop symbol and other markings indicating recyclability

The Mobius loop symbol is internationally recognised for indicating that a product is recyclable. The Advertising Standards Authority, ISO and the South African Bureau of Standards prohibit the use of the sign or any other sign indicating recyclability unless very specific standards are adhered to. Many companies are incorrectly using the sign on their products.

The Advertising Code of Practice of the Advertising Standards Authority, Appendix G, Paragraph 1.3

“Advertisements may not by using the Mobius loop symbol or in any other way claim that the product is recyclable, merely because it is technically capable of being recycled, unless facilities, which are reasonably accessible, exist for collection and recycling.”

SANS 14021:1999 Environmental Labels and Declarations – Self-declared Environmental Claims

7.7.1 Usage of term “Recyclable”

A characteristic of a product, packaging or associated component that can be diverted from the waste stream through available processes and programmes and can be collected, processed and returned to use in the form of raw materials or products.

7.7.3 “when a recyclable claim is made, the use of a symbol is optional” and “if a symbol is used for a recyclable claim, it shall be the Mobius loop, as described in 5.10.2”

7.7.2 Qualifications

If collection or drop-off facilities for the purpose of recycling the product or packaging are not conveniently available to a reasonable proportion of purchasers, potential purchasers and users of the product in the area where the product is sold, then the following shall apply.

- a) A qualified claim of recyclability shall be used*
- b) The qualified claim shall adequately convey the limited availability of collection facilities*
- c) Generalized qualifications, such as “Recyclable where facilities exist”, which do not convey the limited availability of collection facilities, are not adequate.*

7.7.4 Evaluation methodology

Evaluation shall be undertaken in accordance with clause 6. The information referred to in 6.5 shall include evidence of the following.

- a) The collection, sorting and delivery systems to transfer the materials from the source to the recycling facility are conveniently available to a reasonable proportion of the purchasers, potential purchasers and users of the product.*
- b) The recycling facilities are available to accommodate the collected materials*
- c) The product for which the claim is made is being collected and recycled.*

SAPRO position

South Africa has a strong mechanical recycling industry that is the envy of most countries. The industry becomes jeopardized by the fact that manufacturers of polyolefin plastics products are adding more and more fillers to their products to reduce costs but to the detriment of recyclability.

These fillers increase the specific gravity of the product to more than 1 and therefore makes it unfit for use in the sink/float processing equipment widely used by our members. Although these products are theoretically recyclable, it is not currently possible to recycle dirty, post-consumer products where washing is an integral part of the recycling process. Maintaining the status quo on filled material formulations will mean that products are incorrectly marked with the Mobius loop as well as claims of recyclability and therefore in direct contravention of the Advertising Code of Practice and SANS 14021.

As the manufacturers, brand owners and users of the products are probably unaware of the fact that their products have become unrecyclable, SAPRO will inform leading brand owners and request the help of all parties involved to bring this document and its contents to their attention.

Taking into consideration the ***Extended Producer Responsibility as promulgated by the Department of Environmental Affairs in the recent “National Environment Management Waste Act”***, SAPRO hereby urges manufacturers and brand owners of polyolefin products to refrain from using material formulations that increase the specific gravity of the products beyond 1 and to remain in line with the requirements of the South African Bureau of Standards and the Advertising Standards Authority. This will ensure that the end-of-life products are recyclable in large volumes by South African recyclers.

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