

Trinseo Sustainable Cast Acrylic Sheets:

Product Environmental Summary

Trinseo has been developing material solutions enabling more sustainable applications for over a decade and is ready to accelerate its leadership position as a material solutions provider through ambitious sustainability goals.



THREE IMPORTANT PILLARS

Trinseo strives to become the solutions provider for sustainably advantaged plastics based on three important pillars:

- **Sustainable Solutions:** an entire product portfolio of materials solutions focuses on energy usage and raw material efficiencies enabling sustainable change throughout the value chain.
- **Sustainability Culture:** environmental and social responsibility are embedded into the company culture and the corporate governance.
- **Future Solutions:** changing consumer landscape and trends will shape our future. Trinseo collaborates with its customers to develop future-oriented solutions aligned with their individual sustainability goals.

INTRODUCTION

Trinseo meets the demand for sustainably advantage materials with ALTUGLAS™ R-Life, a range of PMMA sustainable solutions including chemical, mechanical recycling as well as Bio technologies.

All of TRINSEO PMMA products that fall under the ALTUGLAS™ R-Life brand, i.e., extruded sheets, cast sheets, resins, and compounds, are similar in that they enable customers to meet their sustainability objectives. Trinseo recently developed a sustainable cast sheet solution using an advanced chemical recycling process. Through this process a minimum of 90 percent recycled Methyl Methacrylate (rMMA) monomer is combined with virgin MMA.

ALTUGLAS™ R-LIFE CN SHEETS

ALTUGLAS™ R-Life recycled cast sheets provide comparable performance to a virgin material:

- Optical quality (high light-transmittance)
- Low weight (50% lighter than glass)
- High weathering and UV resistance (no need for coating)
- Wide range of colors and finishing (glossy, satin)
- Easy processability (drilling, milling, bonding, thermoformability, ...)
- Adhere to ISO norm 7823-1
- The product has the potential to be recycled multiple times

ALTUGLAS™ R-Life cast sheet provides a solution to customers who seek to accomplish their sustainability goals.

APPLICATIONS

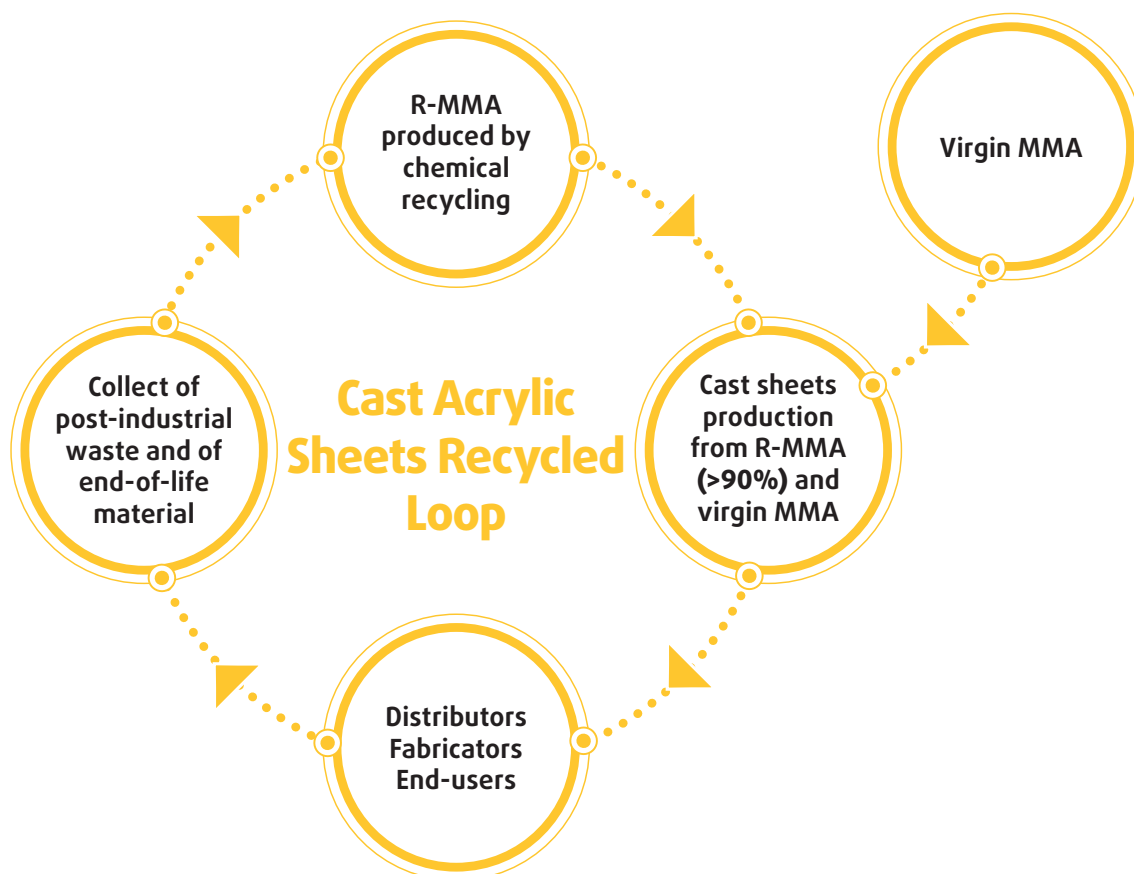
Trinseo's ALTUGLAS™ R-Life cast sheets can be used for a broad range of applications including:

- Retail/POS (visual communication)
- Building & Construction (esthetical & protective partitions, lighting, balustrades, sign...)
- Transportation (glazing for marine, caravanning industries...)
- Industry
- Interior Architecture/Furniture and Design
- Building & Construction (sanitaryware, bathtubs)

PRODUCTION PROCESS

To produce ALTUGLAS™ R-Life cast sheets in Saint-Avoid (France), we rely on a standard casting process with recycled and virgin methyl methacrylate (MMA) monomer. Post-industrial waste and pre- and post-consumer end-of-life materials are depolymerized into recycled MMA monomer.

The casting process consists in filling the recycled and virgin monomers in a flat mold (two glass sheets sealed by gasket that gives thickness of the sheets) and to heat it for the monomer to polymerize. Once polymerization is completed, PMMA sheets are demolded, and a PE protective film is added.



SUSTAINABLE CONTENT DECLARATION

For ALTUGLAS™ R-Life cast sheet, Trinseo provides a sustainability content declaration of minimum 90% of chemically recycled methyl methacrylate monomer.

ENVIRONMENTAL BENEFITS OF ALTUGLAS™ R-LIFE CAST SHEETS VERSUS VIRGIN PRODUCT

ALTUGLAS™ R-Life product portfolio offers a measurable product carbon footprint (PCF) reduction when compared to its virgin counterpart grade.

LIFE CYCLE ASSESSMENT (LCA) CALCULATION

Declared Unit of Measure

The LCA results presented here consider the production of 1 kg of Cast Acrylic Sheets containing 90% recycled MMA.

System Boundary

LCA data for the standard fossil MMA and PMMA sheets comes from the LCA study done by Bio Intelligence Services in 2013 (now Deloitte). ALTUGLAS™ R-Life Cast sheets. LCA results are consistent with the cradle-to-gate approach (from raw material extraction up to processing in manufacturing plant) for LCA calculation.

LCA Estimation Method

The estimated LCA results in this document are based on the following calculation approach:

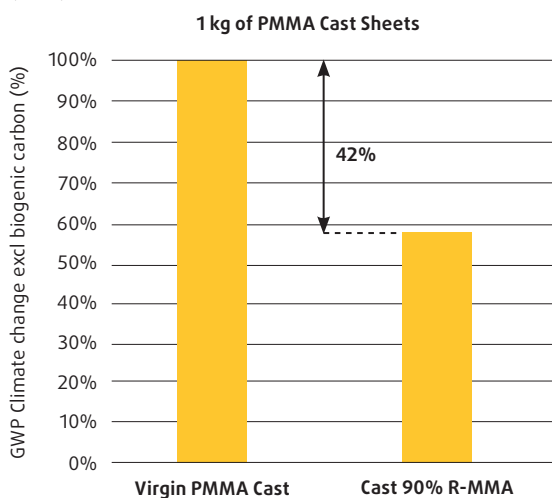
- Contribution of the virgin MMA to the total product environmental indicator in question is replaced by the corresponding KPI value of the recycled MMA or by the contribution of recycled MMA and virgin MMA in case a mixture of both is used. All selected KPI's are calculated in the same way.
- The environmental indicator units of measure from the ReciPE LCA methodology have been used. This method was selected because it is the most used method and allows for easier comparison with the virgin PMMA and MMA LCA.

Most Relevant Environmental Indicators

The definition of each of the selected environmental indicators categories, is described below:

- **GWP:** It is calculated as a sum of emissions of the greenhouse gases (CO₂, N₂O, CH₄ and VOCs) multiplied by their respective GWP factors. The different greenhouse gases are expressed relative to the global warming potential of CO₂, which is therefore defined to be 1.
- **Non-Renewable Primary Energy Use:** Use of non-renewable primary energy, excluding renewable primary energy resources used as raw materials.
- **Photochemical Oxidant Formation:** Indicator of emissions of gases that affect the creation of photochemical ozone in the lower atmosphere (smog) catalysed by sunlight.
- **Terrestrial Acidification:** Indicator of the potential acidification of soils and water due to the release of gases such as nitrogen oxides and sulphur oxides.
- **Eutrophication (Freshwater + Marine):** Indicator of the enrichment of the fresh water and marine ecosystem with nutritional elements, due to the emission of nitrogen containing compounds.

In the graph below, the impact for Global Warming Potential (GWP) is shown:



Data Sources Used and Assumptions

- Virgin LCA data comes from 2013 Bio Intelligence Services LCA report mentioned above. The LCA information remains relevant and did not require an update.
- LCA data for Recycled MMA used in the ALTUGLAS™ R-Life calculation is coming from a different supplier than the current supplier. This is because no LCA data is available yet from current supplier on Recycled MMA. Deviations are expected to be negligible. This data is from 2021.
- 1 ton MMA gives 1 ton PMMA. No material losses are considered.

For other selected environmental indicators, the improvement (in %) when using the ALTUGLAS™ R-Life version versus the virgin version, is shown on the table below:

Environmental Indicator	
Global Warming Potential	42%
Non-Renewable Primary Energy Use	54%
Photochemical Oxidant Formation	55%
Terrestrial Acidification	67%
Eutrophication (Freshwater + Marine)	61%

The reduction in GWP when using 90% recycled MMA in the manufacturing of a PMMA cast sheet is about 42%.

Use of ALTUGLAS™ R-Life recycled cast acrylic sheets versus the virgin product can contribute to

- Acrylic Waste reduction going to landfill or incineration
- Carbon Footprint reduction
- Reduction of the production of virgin acrylic monomer
- Potential to be recycled multiple times

CONTACT US

For additional information, please contact your Trinseo representative or visit us at www.trinseo.com

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