EPD®
ENVIRONMENTAL PRODUCT DECLARATION

MADREPERLA

VINK PLAST

ENVIRONMENTAL PRODUCT DECLARATION

greencast

BASED ON:
PCR 2018:10 (version 1.01).
CPC code 36390
ISO 14025:2006

REGISTRATION NUMBER:
S-P-03495

PROGRAMME:
The International EPD® System, www.environdec.com

DATE OF ISSUE:
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DATE OF REVISION:
2021-03-30

DATE OF VALIDITY:
2026-03-29

PROGRAMME OPERATOR:
EPD International AB

An EPD should provide current information, and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com.

Programme information

EPD REFERENCES

EPD OWNER: Madreperla S.p.A, Via Aquileja 39/41, 20092 Cinisello Balsamo (MI), Italy

PROGRAM OPERATOR: epd international ab, box 21060, SE-100 31 stockholm, sweden; info@environdec.com

INDEPENDENT VERIFICATION

This declaration has been developed referring to the International EPD System, following the General Programme Instructions v 3.01; further information and the document itself are available at: www.environdec.com. EPD document valid within the following geographical area: Italy and other countries according to sales market conditions.

ISO standard ISO 21930 and CEN standard EN 15804 served as the core PCR
PCR 2018:10, Version 1.01, Boards, blocks, panels, sheets of plastics, or in composite system, for structural application (non construction), 2022-12-27
PCR review was conducted by: The Technical Committee of the International EPD® System. See www.environdec.com/TC for a list of members. Review chair: Claudia A. Peña, University of Concepciòn, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact.

Independent verification of the declaration and data, according to EN ISO 14025 : 2018

Third party verifier: Michela Gallo as Individual Verifier

☐ EPD process certification (Internal) ☑ EPD verification (External)

For individual verifiers: "The International EPD® System"

Procedure for follow-up during EPD validity involves third party verifier: ☐ YES ☑ NO

Environmental declarations published within the same product category, but from different programmes may not be comparable. In particular, EPDs of construction products may not be comparable if they do not comply with EN 15804. EPD owner has the sole ownership, liability and responsibility of the EPD.

CONTACTS

Madreperla S.p.A. is available to release an Environmental Product Declaration for one specific product at the customer's request. To get more information about this environmental declaration or about Madreperla S.p.A. activities please contact:

Ing. R. Carlesso – r.carlesso@madreperlaspa.com

MADREPERLA

Technical support to Madreperla S.p.A. was provided by Life Cycle Engineering, Italy. (info@studiolce.it, www.lcengineering.eu).

LCE

The company

The history of Madreperla S.p.A. has its roots in the early 1950's, and it's a history of a company's development and growth based on a family tradition, that it's now in its third generation.

Madreperla started the plant for the production of acrylic sheets for the manufacturing of acrylic buttons, that following the fashion trends of those years had a mother of pearl look – hence the name Madreperla (that means mother of pearl in Italian).

In the 80's significant investments allowed reconversion of the production for sheets for industrial application and in the late 80's the first trials for the regeneration system of PMMA (the recycling of pre- and postconsumer waste Polymethylmethacrylate waste material). From 2000-2005 Madreperla developed the idea of improving the production of the recycling process to such a quality standard that could be used to produce high quality cost acrylic sheets complying with ISO 7823.1. In the year 2010 Green Cast® acrylic sheets were launched in the market.

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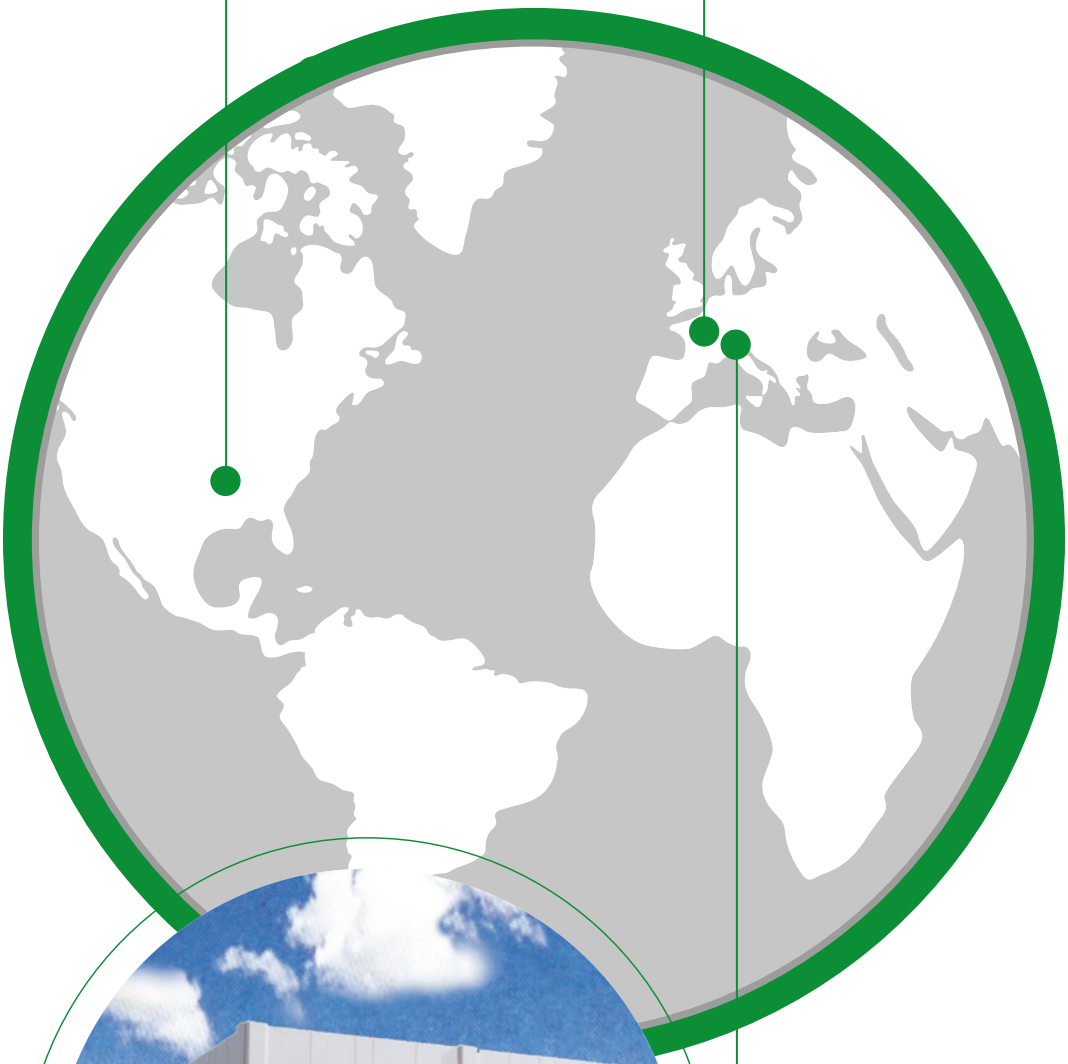
MADREPERLA
USA

MADREPERLA S.A
France



MADREPERLA S.p.A
Italy (Headquarter)

The product

Object of this EPD® is the transparent Green Cast® acrylic sheet (polymethylmethacrylate sheet).

GREEN CAST®

The Green Cast® acrylic sheet is produced with 100% R-MMA, recycled methylmethacrylate monomer produced by Madreperla SpA in Cinisello Balsamo (Italy). Green Cast® acrylic sheet is complying with ISO 7823.1 has an excellent workability, so has a considerable range of applicability. General features of Green Cast® are high resistance to external agents and UV rays, high light transmission, resistance to chemical aggression by saturated hydrocarbons, acids and diluted alkali, mineral oils and oils and greases of natural and vegetable origin.
In addition, a wide range of colours and finishing are available upon request.

Available technical specification are listed in the table:

Technical specification	Value	Unit	Standard
Compressive strength	130	MPa	ISO 604
Tensile strength	76	MPa	ISO 527 - 2/1B/5
Elasticity modulus	3300	MPa	ISO 527 - 2/1B/1
Flexural strength	130	MPa	ISO 178

Content declaration

The Green Cast® sheet does not contain any of the substances listed in the SHVC list in quantities >0.1% and comply with the most recent REACH regulations regarding the "Substances of very High Concern".

The Green Cast® is composed by 100% recycled R-MMA and additive as listed in the table below.

The packaging materials for distribution are:
PVC gaskets, PE film, cardboard, pallets.

In this study, only the transparent Green Cast® sheet has been considered.

RAW MATERIAL	GREEN CAST
R-MMA	99%
Catalysts	<1%
UV filters	<1%
Antioxidants	<1%
Polymerization regulators	<1%
Release agents	<1%
Lubricant	<1%
Descaling additives	<1%

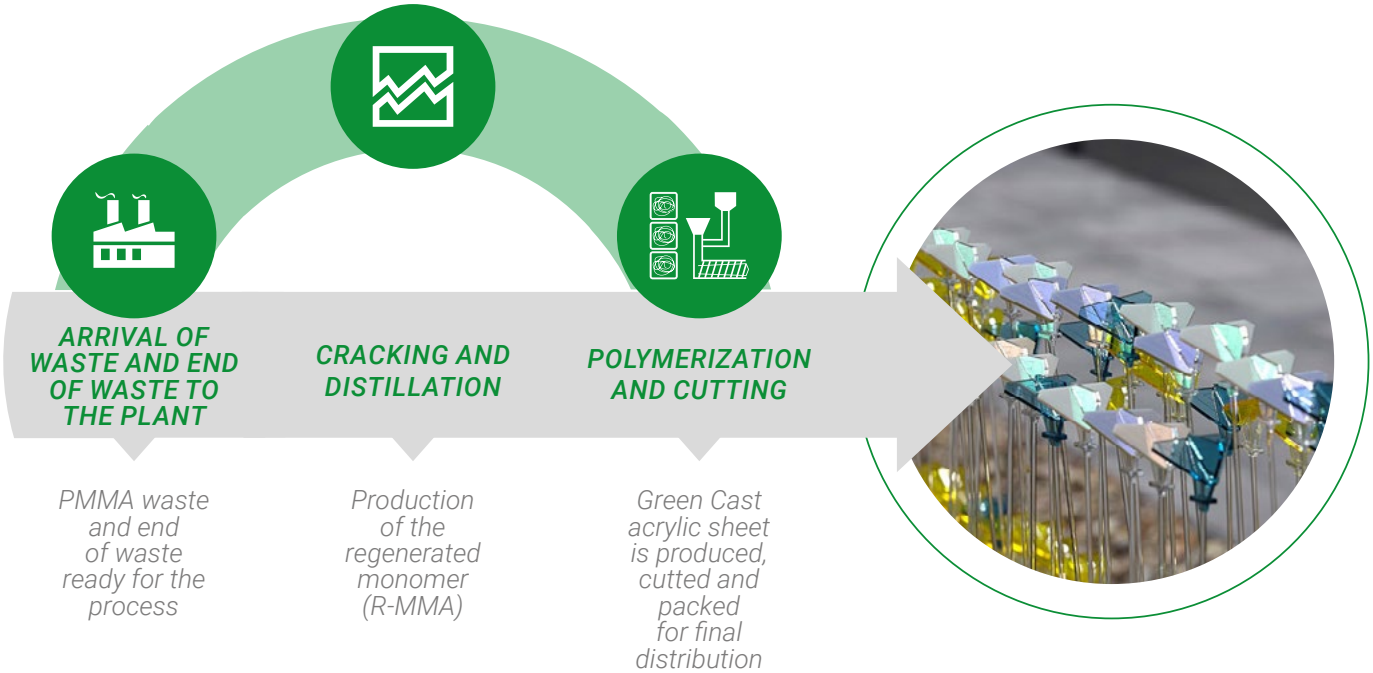
Production process

Green Cast® sheets are produced in Cinisello Balsamo's plant (Italy).

The scheme below shows the manufacturing process of the **Regeneration System** (the recycling of pre- and postconsumer PMMA waste) launched in 2000 with proprietary technology, and subsequent production of polymethylmethacrylate sheets by casting process to obtain Green Cast® sheets.

The production process begins with the arrival of PMMA waste and PMMA end of waste, associated with an external activity of collection, sorting and grinding of PMMA polymers. These products are regenerated through thermal cracking under controlled temperature, followed by high quality distillation to obtain Regenerated monomer (R-MMA). The underproducts of distillation (oligomers) are used in the same process to produce energy.

The R-MMA produced is used at 100% for the production of Green Cast® sheets instead of virgin MMA (produced by chemical synthesis). The production process of the sheets is based on the casting technology with a high automated plant developed by Madreperla's technical R&S team.



Scope and type of EPD®

Geographical Scope: Global
Software: Simapro 9.1.1.1
Database: Ecoinvent 3.6, Plastics Europe
Declared Unit: 1 m^3 of Green Cast® sheet packed and ready for final distribution

The LCA study includes all the processes according to PCR 2018:10

UPSTREAM
Process

CORE
Process

DOWNSTREAM
Process

LCA METHODOLOGY

Product environmental burden has been processed in accordance with EPD general instructions issued by International EPD® System (GPI v3.01) and PCR 2018:10 v1.01, "Boards, blocks, panels, sheets of plastics, or in composite system, for structural application (non construction)".

This declaration is a cradle to gate with options EPD type, based on the application of Life Cycle Assessment (LCA) methodology.

Green Cast® at plant level was described by using specific data from Madreperla manufacturing facility (Cinisello Balsamo, IT) for year 2020. Customized LCA questionnaires were used to gather in-depth information about all aspects of the production system, in order to provide a complete picture of the environmental burden of the system from waste supply and monomer production (Upstream) to polymerization and cutting of Green Cast® acrylic sheets (Core), to final distribution (Downstream).
An Italian average delivery scenario of 500 km has been used. Further process in downstream, use phase and product end of life is out of the scope of the study.

The exclusion criteria applied in this study are consistent with those suggested by the reference PCR 2018: 10. Data for elementary flows to and from the product system that contribute to a minimum of 99% of the declared impacts are included.

UPSTREAM process

PMMA WASTE AND END OF WASTE SUPPLY

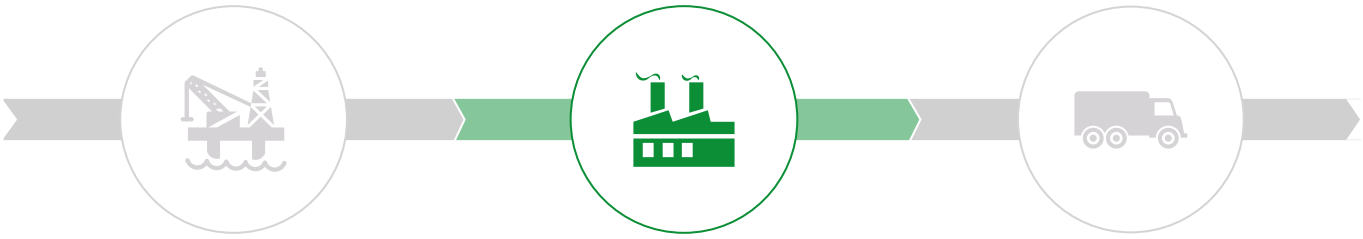
CRACKING OF PMMA POLYMERS

DISTILLATION OF CRUDE R-MMA

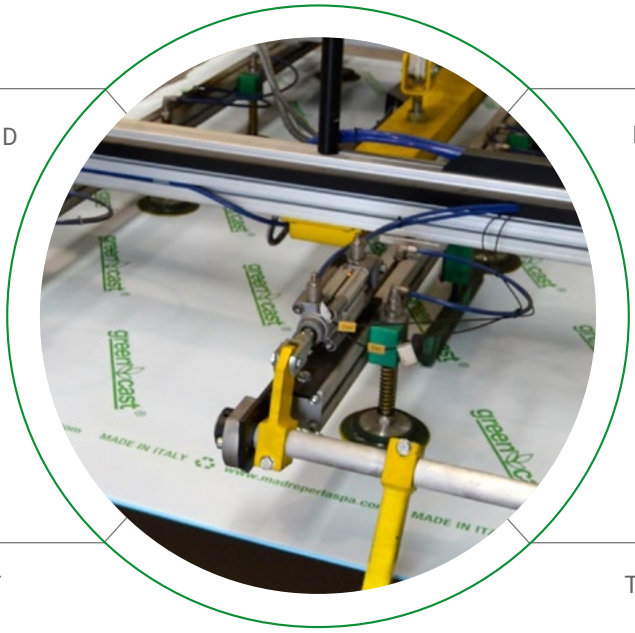
ENERGY WARES INPUT UPSTREAM PROCESSES (E.G. ELECTRICITY, HEATING FUEL);

TREATMENT OF WASTE GENERATED BY UPSTREAM PROCESSES

CORE process



CASTING PROCESS AND POLYMERIZATION



ENERGY WARES INPUT CORE PROCESS (E.G. ELECTRICITY 100% RENEWABLE, HEATING FUEL, ETC.)

TRIMMING OF GASKET AND PACKAGING

TREATMENT OF WASTE GENERATED BY CORE PROCESSES

DOWNSTREAM process

DISTRIBUTION TO
THE FINAL COSTUMER

ITALY:
DISTANCE BY TRUCK ~ 500 km

Environmental performance

The detailed environmental performance (in terms of use of resources, waste generation, potential environmental impacts) is presented for the three phases:

UPSTREAM Process, CORE Process, Downstream Process

According to PCR 2018:10, the values in the Total column are the sum of only Upstream and Core Process.

DECLARED UNIT (D.U.)

This study uses **1 m³ of Green Cast® sheet packed and ready for final distribution.**
1 m³ corresponds to 1,19 ton of Green Cast®.

ENVIRONMENTAL IMPACTS

IMPACT CATEGORY	UNITS / m³	UPSTREAM PROCESS	CORE PROCESS	TOTAL	DOWNSTREAM PROCESS
GWP-total	kg CO_2 eq	1,43E+03	1,11E+03	**2,54E+03**	8,19E+01
GWP-f	kg CO_2 eq	1,43E+03	1,08E+03	**2,51E+03**	8,19E+01
GWP-b	kg CO_2 eq	1,56E+00	2,92E+01	**3,07E+01**	5,17E-03
GWP-luluc	kg CO_2 eq	5,70E-02	2,35E-01	**2,92E-01**	6,55E-04
AP	mol H+ eq	2,84E+00	2,81E+00	**5,64E+00**	4,74E-01
EP	kg P eq	8,88E-03	1,60E-02	**2,48E-02**	4,92E-05
POCP	kg NMVOC eq	2,62E+00	2,00E+00	**4,62E+00**	5,45E-01
ADPe	kg Sb eq	1,52E-04	6,27E-04	**7,79E-04**	4,87E-06
ADPf	MJ	1,62E+04	1,25E+04	**2,87E+04**	1,17E+03
WDP	m³ eq	4,03E+03	1,20E+03	**5,23E+03**	-2,58E-01

GWP Global warming potential, total
GWP,f Global warming potential, fossil
GWP,b Global warming potential, biogenic
GWP,luluc Global warming potential, land use & land use change
AP Acidification Potential
EP Eutrophication Potential
POCP Photochemical ozone creation potential
ADPE Abiotic depletion potential minerals & metals*
ADPF Abiotic depletion potential fossil fuels*
WDP Water use deprivation potential*

RESOURCE USE PER DECLARED UNIT

IMPACT CATEGORY	UNITS / m³	UPSTREAM PROCESS	CORE PROCESS	TOTAL	DOWNSTREAM PROCESS
PERE	MJ	3,28E+02	2,24E+03	**2,57E+03**	1,64E+00
PERM	MJ	0,00E+00	0,00E+00	**0,00E+00**	0,00E+00
PERT	MJ	3,28E+02	2,24E+03	**2,57E+03**	1,64E+00
PENRE	MJ	1,15E+02	7,12E+02	**8,27E+02**	1,14E+03
PENRM	MJ	1,82E+04	1,39E+04	**3,21E+04**	0,00E+00
PENRT	MJ	1,84E+04	1,46E+04	**3,29E+04**	1,14E+03
SM	kg	0,00E+00	0,00E+00	**0,00E+00**	0,00E+00
RSF	MJ	0,00E+00	0,00E+00	**0,00E+00**	0,00E+00
NRSF	MJ	4,07E+03	2,97E+03	**7,04E+03**	0,00E+00
FW	m³	9,13E+01	2,72E+01	**1,18E+02**	2,32E-02

PERE Renewable energy (carrier)
PERM Renewable energy (feedstock)
PERT Renewable energy (total)
PENRE Non-renewable energy (carrier)
PENRM Non-renewable energy (feedstock)
PENRT Non-renewable energy (total)
SM Use of secondary materials
RSF Use of renewable secondary fuels
NRSF Use of non-renewable secondary fuels
FW Use of Net Fresh Water

OUTPUT FLOWS AND WASTE CATEGORIES PER DECLARED UNIT

IMPACT CATEGORY	UNITS / m³	UPSTREAM PROCESS	CORE PROCESS	TOTAL	DOWNSTREAM PROCESS
HWD	MJ	3,81E+01	2,98E-01	**3,84E+01**	0,00E+00
NHWD	MJ	0,00E+00	4,63E+01	**4,63E+01**	0,00E+00
RWD	MJ	0,00E+00	0,00E+00	**0,00E+00**	0,00E+00
CRU	MJ	0,00E+00	0,00E+00	**0,00E+00**	0,00E+00
MFR	MJ	7,92E+00	0,00E+00	**7,92E+00**	0,00E+00
MER	MJ	0,00E+00	0,00E+00	**0,00E+00**	0,00E+00
EE	kg	0,00E+00	0,00E+00	**0,00E+00**	0,00E+00

HWD Hazardous waste disposed
NHWD Non-hazardous waste disposed
RWD Radioactive waste disposed
CRU Components for re-use
MFR Material for recycling
MER Materials for energy recovery
EE Exported energy


Producer: Pyrasied Xtreme
Designer: Loes Heebink
Material: Green Cast by Madreperla

Annex

The declared unit of the study is 1 m3 of Green Cast® sheet packed and ready for final distribution while **in this annex** the values shown in the 3 tables below refers to **1 ton of R-MMA and 1 ton of Green Cast® sheet** .

According to PCR 2018:10, the values in the Total columns below both for R-MMA and Green Cast® are the sum of only Upstream and Core Process.

ENVIRONMENTAL IMPACTS

IMPACT CATEGORY	UNITS / ton	R-MMA	GREEN CAST
GWP-total	kg CO_2 eq	**1,12E+03**	**2,14E+03**
GWP-f	kg CO_2 eq	**1,12E+03**	**2,11E+03**
GWP-b	kg CO_2 eq	**1,21E+00**	**2,58E+01**
GWP-luluc	kg CO_2 eq	**4,60E-02**	**2,46E-01**
AP	mol H+ eq	**1,75E+00**	**4,74E+00**
EP	kg P eq	**6,95E-03**	**2,09E-02**
POCP	kg NMVOC eq	**1,42E+00**	**3,88E+00**
ADPe	kg Sb eq	**1,25E-04**	**6,54E-04**
ADPf	MJ	**1,29E+04**	**2,42E+04**
WDP	m^3 eq	**3,11E+03**	**4,40E+03**

GWP Global warming potential, total
GWP,f Global warming potential, fossil
GWP,b Global warming potential, biogenic
GWP,luluc Global warming potential, land use & land use change
AP Acidification Potential
EP Eutrophication Potential
POCP Photochemical ozone creation potential
ADPE Abiotic depletion potential minerals & metals*
ADPF Abiotic depletion potential fossil fuels*
WDP Water use deprivation potential*

RESOURCE USE PER DECLARED UNIT

IMPACT CATEGORY	UNITS / ton	R-MMA	GREEN CAST
PERE	MJ	2,57E+02	2,16E+03
PERM	MJ	0,00E+00	0,00E+00
PERT	MJ	2,57E+02	2,16E+03
PENRE	MJ	7,02E+02	6,95E+02
PENRM	MJ	1,39E+04	2,70E+04
PENRT	MJ	1,46E+04	2,77E+04
SM	kg	0,00E+00	0,00E+00
RSF	MJ	0,00E+00	0,00E+00
NRSF	MJ	3,13E+03	5,92E+03
FW	m^3	7,04E+01	9,95E+01

PERE Renewable energy (carrier)
PERM Renewable energy (feedstock)
PERT Renewable energy (total)
PENRE Non-renewable energy (carrier)
PENRM Non-renewable energy (feedstock)
PENRT Non-renewable energy (total)
SM Use of secondary materials
RSF Use of renewable secondary fuels
NRSF Use of non-renewable secondary fuels
FW Use of Net Fresh Water

OUTPUT FLOWS AND WASTE CATEGORIES PER DECLARED UNIT

IMPACT CATEGORY	UNITS / ton	R-MMA	GREEN CAST
HWD	MJ	2,93E+01	3,22E+01
NHWD	MJ	0,00E+00	3,89E+01
RWD	MJ	0,00E+00	0,00E+00
CRU	MJ	0,00E+00	0,00E+00
MFR	MJ	6,10E+00	6,66E+00
MER	MJ	0,00E+00	0,00E+00
EE	kg	0,00E+00	0,00E+00

HWD Hazardous waste disposed
NHWD Non-hazardous waste disposed
RWD Radioactive waste disposed
CRU Components for re-use
MFR Material for recycling
MER Materials for energy recovery
EE Exported energy

References

- General Programme Instructions for the International EPD® System v. 3.01, 2019
- Product Category Rules PCR 2018:10 v 1.01, “Boards, blocks, panels, sheets of plastics, or in composite system for structural application (non-construction)”, 2019-08-18
- EN 15804:2012+A2:2019
- ISO 14040:2006
- ISO 14044:2006
- LCA Report, "Life Cycle Assessment applicato a lastre Green Cast a scopo EPD e analisi interna", v1, 26/03/2021

MADREPERLA

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Cinisello Balsamo

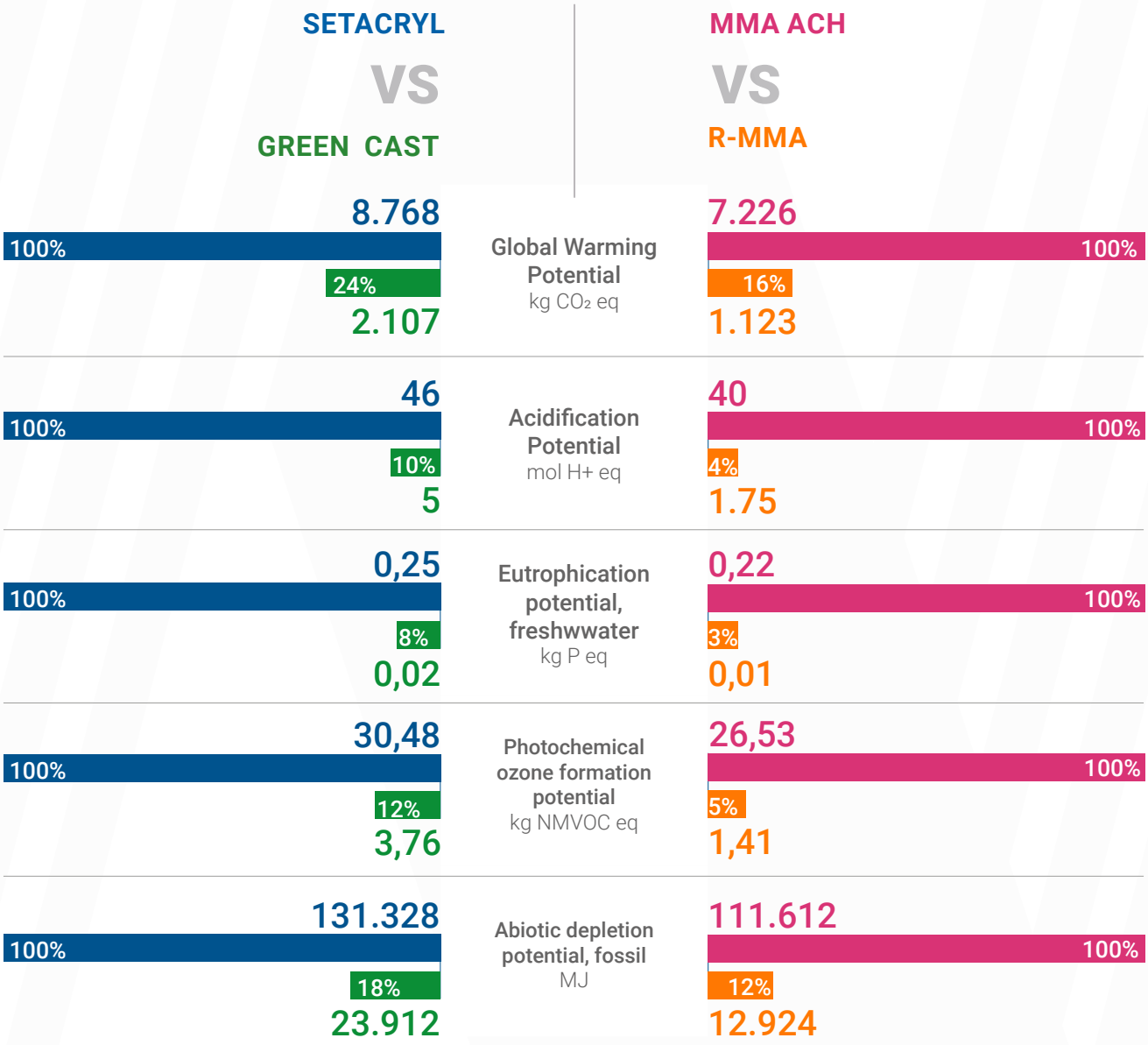
madreperlaspa .com

Comparison extrapolated from the LCA between **Setacryl** and **Green Cast**

On the same production line as the Green Cast® of Madreperla it is possible to obtain Setacryl sheets, using synthetic monomer produced with **ACH technology**. The benefits of using recycled monomer for the production of Green Cast® sheet are evident if you look at the values of the environmental impact indicators, expressed in the figure below.

100% represent Setacryl sheet produced with MMA ACH raw material

100% represent the impact of MMA ACH upon Ecoinvent figures for the different impact



Environmental indicators for impact categories such as Global Warming Potential undergo a considerable decrease of more than 75% compared to a sheet produced with synthetic MMA (ACH).
The decrease is over 80% for "Acidification potential", "Eutrophication potential, freshwater", "Photochemical ozone formation potential" and "Abiotic depletion potential, fossils".