

PMMA recycling: a major societal challenge

PolyMethyl MethAcrylate (PMMA) is a well-established polymer known for its optical properties. About 300 000 tons of PMMA are produced in Europe every year, or close to 1 billion Euro of market value. It is estimated that currently only 30 000 tons of PMMA waste is collected to be recycled annually in Europe, or only around 10% of the yearly production, although PMMA can be turned back into its monomer by thermal depolymerization, thus saving precious resources and CO2 emission.

For a large part, recycling of PMMA in Europe is currently reliant on a lead-based process which does not allow to reprocess the lower PMMA qualities. Moreover, PMMA scraps current recycling processes focus on post-industrial PMMA, rather than end-of-life PMMA which represents the main share of the total PMMA waste stream which is either exported, landfilled or incinerated.

The challenge of this project consists in converting PMMA post-industrial scraps and end-of-life waste into high quality raw material and therefore contribute to the circular economy.

The horizon 2020 program in a few words

The Horizon 2020 R&D program represents a total of around 80 billion Euros and a pillar of this program is dedicated to industrial sustainability.

Simon van der Heijden, co-founder of Heathland B.V. (The Netherlands) and Jean-Luc Dubois, Scientific Director for Catalysis, Processes, Renewables and Recycling at Arkema (France)



Simon is the project coordinator and Heathland will collect and pretreat PMMA waste, provide equipment for the depolymerization process and the exploitation of the MMAtwo technology and process in one or more PMMA waste recycling plants.

Jean-Luc is the chairman of the project Executive Board and Arkema will supply PMMA scraps, investigate the depolymerization technologies, contribute to the purification of the recycled monomer, contribute to the quality and standards and will use the recycled monomer for the development of products in non-optical applications.

Key numbers

13 Partners

6 Countries

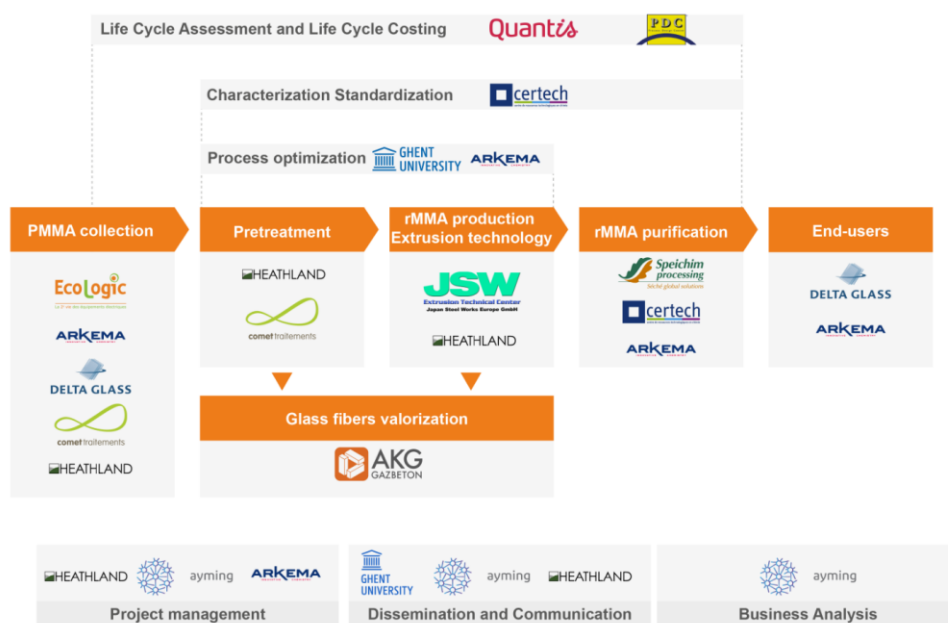
8.9 M€ total budget

6.6 M€ funded by EC

48 Months

MMAtwo 3 major objectives:

- Construct a **new PMMA recycling value chain in Europe**, covering the whole value chain of the PMMA lifecycle with both production waste and end of life waste
- Avoid down-cycling through **reactive recycling** (depolymerization)
- Develop an **innovative lead-free technology** enabling recycling of lower quality waste



MMAtwo is divided into 7 Topics (so called Work Packages)

- WP1:** Collection of scraps and pretreatment,
- WP2:** Depolymerization,
- WP3:** Purification,
- WP4:** Exploitation, end-users tests, business analysis,
- WP5:** Techno-economic and environmental assessment,
- WP6:** Project management and
- WP7:** Communication, dissemination and academic outreach.



Signage



Decorative



Vehicles



LCD-flat screens

PMMA Applications



Construction



Furniture Displays



Advertisement



Future: Composite

The project expected impacts include

- Increase waste collection (particularly end-of-life PMMA waste) by boosting public and professionals' awareness of PMMA recyclability;
- Full recycling of PMMA inside Europe including co-products;
- High-end products (high optical properties);
- Reduce energy consumption and CO2 emissions compared to virgin monomer supported by preliminary lifecycle analysis;
- Positive economic business model;
- Positive impact on people through supporting recycling technology;
- Gaining of (academic) knowledge.



Advisory Board meeting, COMET Traitements guided tour

Main Events



Main results achieved so far

WP1: Heathland, Comet and Ecologic identified and collected PMMA production waste and PMMA end-of-life waste. **Heathland** has started the implementation of the RecyclePMMA-platform.

WP2: Arkema performed benchmark trials for depolymerisation. **UGent** developed a modeling tool for reactive depolymerisation. **JSW Europe** modified the existing twin-screw extruder.

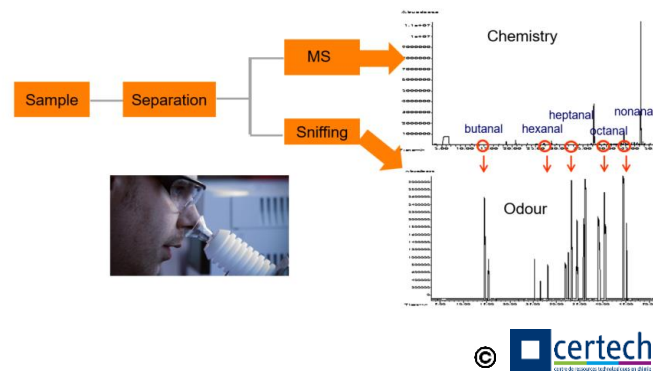
WP3: Speichim started purification trials of MMA. **Certech** carried out emissions and odors analysis on rMMA samples.

WP4: Trials with separated fibers and the rMMA, respectively performed by **AKG Gazbeton** and **Delta Glass**, look promising.

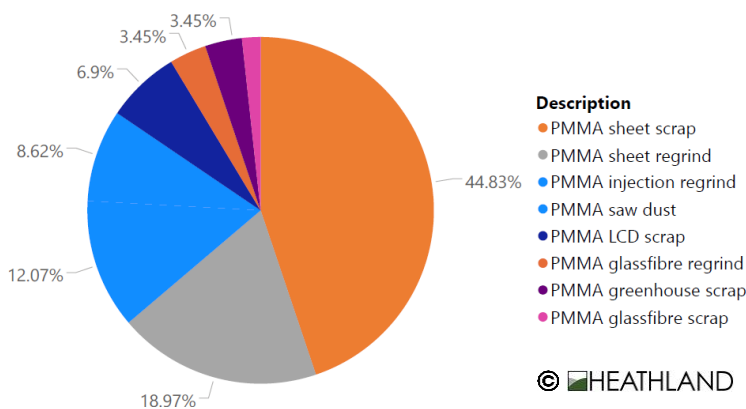
WP5: Together with **Arkema's** benchmarking, **Quantis** analysis and **Heathland** business model resulted in the first version of LCA. **PDC** analysed MMA purification processes.

WP6: Management took place through **Ayming's** platform.

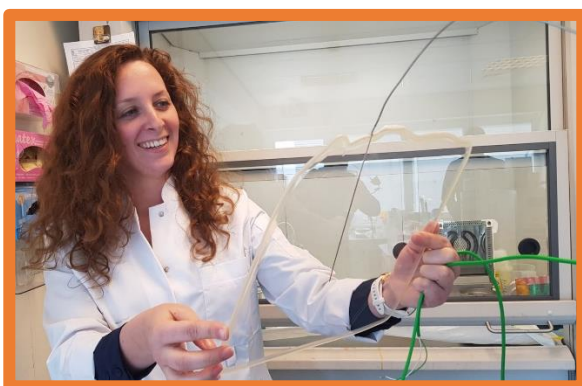
WP7: Website now available @ www.mmatwo.eu. You can also follow us on [LinkedIn](#).



Chemistry-odour correlation using thermal desorption-gas chromatography-mass spectrometry/expert panel sniffing

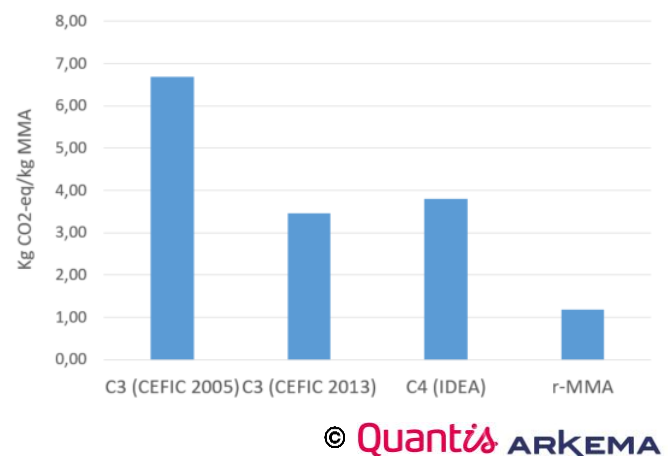


Type of PMMA waste



PMMA cast sheet from rMMA © DELTA GLASS

Preliminary results of the life cycle assessment



Preliminary results regarding the Carbon Footprint

Compared to virgin production:

- -69% versus C4 route
- -66% versus C3 route (CEFIC 2013)

showing a large potential for PMMA depolymerization

We were there

- Recyclers' Forum, December 2018, Hong Kong, China
- 2019 HARMONI Summit, January 2019, Brussels, Belgium
- Argus Petrochemical Markets, February 2019, Frankfurt, Germany
- Material District, March 2019, Rotterdam, Netherlands
- EuPC chemical recycling symposium 2019, June 2019, Brussels, Belgium
- Plastics Recycling Technology 2019, June 2019, Düsseldorf, Germany
- Emissions and Odours from Materials 2019, Oct 2019, Brussels, Belgium
- K Fair 2019, Oct 2019, Düsseldorf, Germany

MMAtwo 12 month General Assembly

The MMAtwo consortium had the great pleasure of welcoming two Advisory Board members and several external parties to discuss MMAtwo progress and to exchange about PMMA recycling technologies.

During this meeting, **M. Peter Kelly** (advisory board member) - **3A Composites**, a major producer of PMMA sheet, stated that "The development of a large scale, environmentally friendly and economically viable process in Europe for the recycling of PMMA sheet post-consumer use is a critical objective for 3AC and the wider PMMA sheet manufacturing industry. 3AC will continue to work with the consortium members to support the development of the MMAtwo project."

Ms. Savina Pianesi (advisory board member) - **Delta Srl / Plados Telma**, producer of kitchen sinks with recycled MMA, stressed that best results are obtained from different know-how of men and women of companies who speak the same scientific language and turn their attention to innovation, "This is the case of the MMAtwo project for the reduction of PMMA waste. The recovery of waste in order to make it a resource through innovative technology and a more pure and sustainable product MMA.". Ms. Pianesi also shared that recovery materials resulting from the MMAtwo project will be appreciated by Delta for tests of the production of composite sinks, as soon as available.

M. Ahmet Ural and M. Mert Baysal - **M-D2** declared that "for the sake of nature each scientist and technologist has to take responsibility. MMAtwo will create a platform on which we can share our knowledge and experiences with other responsible persons. Thanks to this approach we are closer to the goal even more." M-D2 is coordinating a project on acrylic waste recycling via eco-friendly and energy efficient process. This project aims to sell lead free recycled monomer to Plastic Sheet Manufacturers.

The MMAtwo 12M GA was also an occasion to share expertise with **M. Nicolas Couchot** - **X-crusher**, who uses high pulsed power technology to turn complex waste into its main components, **M. Jürgen Schoenherr** - **Zittau Görlitz University of Applied Sciences** - **iTN**, who studied different sorting methods and **M. Koenraad Verbeke** - **Seebach**, expert of hot melt filtration technology.



You would be interested to contribute to the MMAtwo project or simply want to stay informed about all our news?

Please let us know by completing the following form

<https://www.mmatwo.eu/contact/>

Save the date!

MMAtwo first Workshop
Sept 15th 2020 in Ghent, Belgium
 More details will be disclosed shortly