

Exciting results towards the creation of a PMMA closed-loop recycling process

In the current context, MMAtwo’s goals have become more relevant than ever. Exporting PMMA waste to countries outside Europe has become increasingly difficult and the need for recycling capacity of PMMA waste inside Europe is evident. At the same time awareness and demand for circular raw material is rising, spreading the MMAtwo message for PMMA recycling throughout the PMMA value chain and triggering interested parties to connect with the MMAtwo consortium.

Enthusiasm within the consortium peaked as well, supported by very promising results, some of which are shared in this second newsletter. Partners from Belgium, France, Germany, Italy, Switzerland and The Netherlands joined forces in what is to become a TRL7 closed-loop continuous recycling process for all types of PMMA wastes, including composite and end-of-life PMMA wastes.

As the world was hit by the effects of Covid-19, this also impacted MMAtwo. So far delays have been limited and meetings were held remotely whenever possible. But since MMAtwo is about PMMA, and PMMA is one of the main the materials used in protective barrier screens against Covid-19, MMAtwo partners have examined how they could contribute in this regard.

The consortium has presented a proposal to assist with the supply of re-usable or recycled PMMA sheets from the MMAtwo network in order to provide protection where this is needed and to contribute to the limitation of the spread of the virus. These sheets could, in a later stage, be collected and recycled by MMAtwo partners, supported by MMAtwo recycling technology and value chain. This initiative, in collaboration with other Horizon2020 project initiatives, will hopefully help to mitigate Covid-19 impact in the near future.



End-of-life PMMA waste © HEATHLAND



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 Work Packages (WP)

- 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.

Meet our new partner: Delta Plados

Delta Plados joined the MMAtwo consortium in January 2020 to cover AKG Gazbeton's initial activities.

Delta Plados, commercially known as Telma, is an Italian company founded in 1997. The company produces built-in kitchen sinks of acrylic composite material, which it commercializes along with other complementary products like taps, hobs, cooker hoods and ovens, all designed in matching colours as to form a perfect suite. Delta Plados is part of the **Plados-Telma group**, a family of vertically integrated companies.

Within the MMAtwo project, Delta Plados will be involved in WP4. The company will have the role of end user of the recycled materials recovered by the consortium. These raw materials will be used individually for the production of kitchen sinks, in bulk or as an external reinforcement. The goal will be to reuse the largest amount of recovered raw material while maintaining the high-level characteristics of the sinks.



Delta Plados Kitchen Sink



Signage



Decorative



Vehicles



LCD-flat screens

PMMA Numerous Applications



Construction



Furnitures / Displays



Advertisement

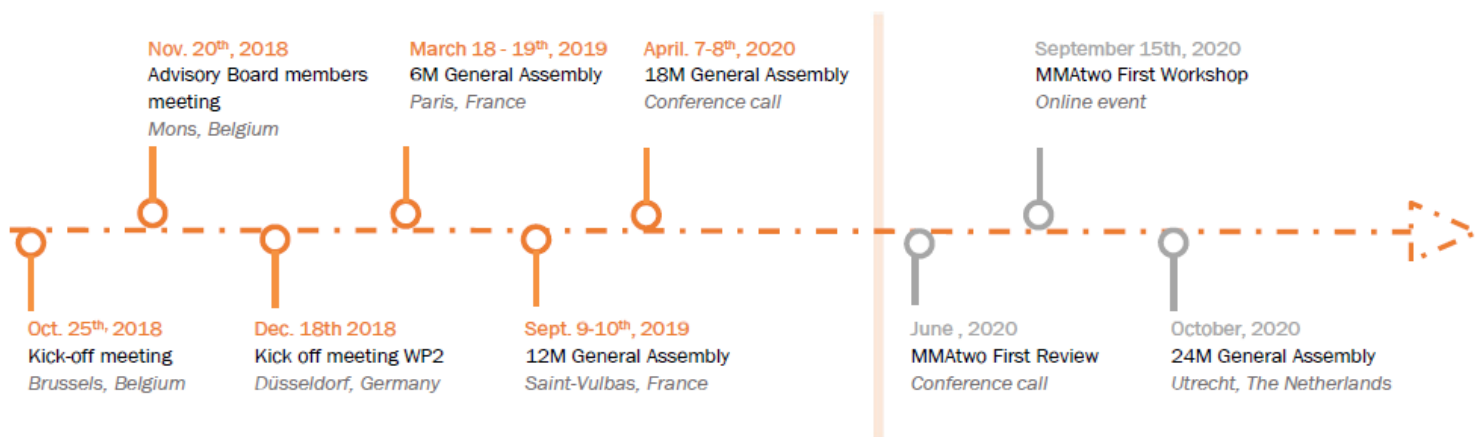


Bath tubs / Sink



Future Composite

MMAtwo Main events

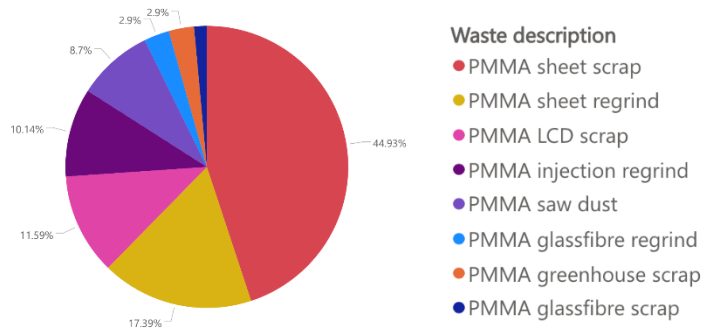


Main results achieved since Nov 2019

WP1 In collaboration with **Ecologic** and **Comet**, **Heathland** collected end-of-life PMMA WEEE waste and vehicle waste. PMMA with PVC waste was collected by **Heathland** from **Arkema** and **Delta Glass** and purified using specialized pretreatment technology into a raw material for the first depolymerization runs.



Collection of post-production PMMA waste © HEATHLAND



Waste description © HEATHLAND



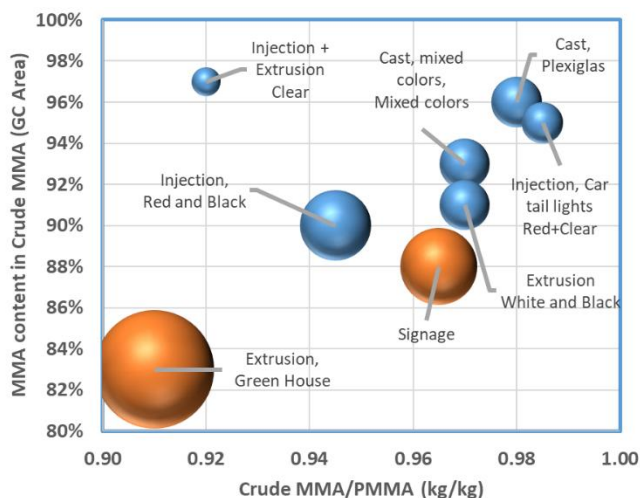
Heathland's pretreatment installation



© HEATHLAND

WP2 Several PMMA waste products (post-industrial and post-consumer) have been depolymerized by **Arkema** at bench scale. High mass yields with high monomer content can be achieved with most of the grades.

JSW Europe modified the existing twin screw extruder to operate at high temperature for the depolymerization trials. Heating-up test and gas leakage inspection of new barrel assembly were completed and the extruder is ready for being connected with a condenser for recovering the monomer. **Heathland** provided the downstream processing equipment in collaboration with **PDC's** analysis of the process. Significant progress was made by **UGent** on modelling the recycling process allowing for reaction insight and quality fine tuning.



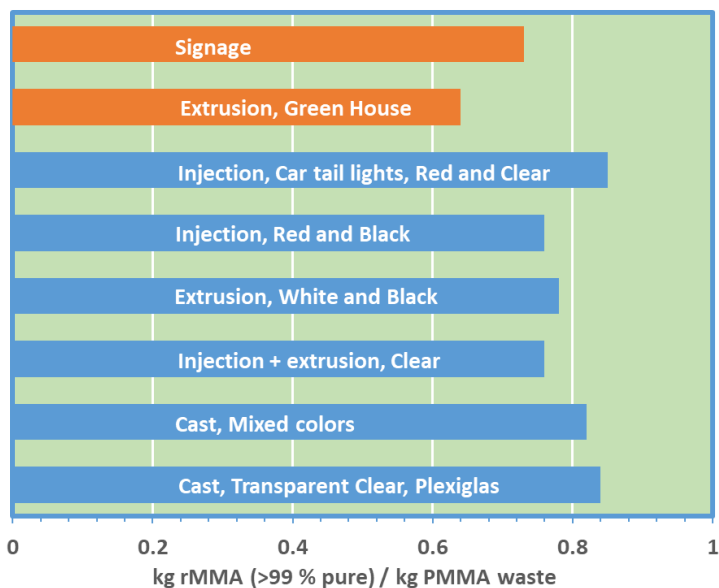
Orange: Post-Consumer, Blue: Post Industrial

PMMA depolymerization to crude rMMA



Twin screw extruder installation at JSW





Orange: Post-Consumer, Blue: Post Industrial

Recycled MMA yield (>99% purity grades)

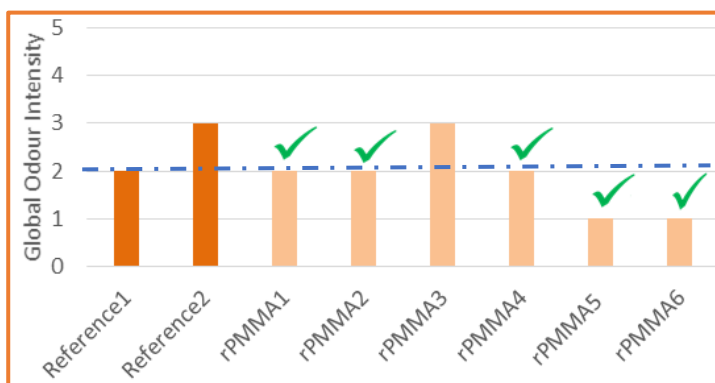


WP3 The crude MMA samples obtained in WP2 at bench scale were further purified by **Speichim** to above 99 % purity grade. The mass yield of high purity monomer from PMMA waste ranges from 64 to 85 wt %. All PMMA wastes were successfully converted to high quality monomer.

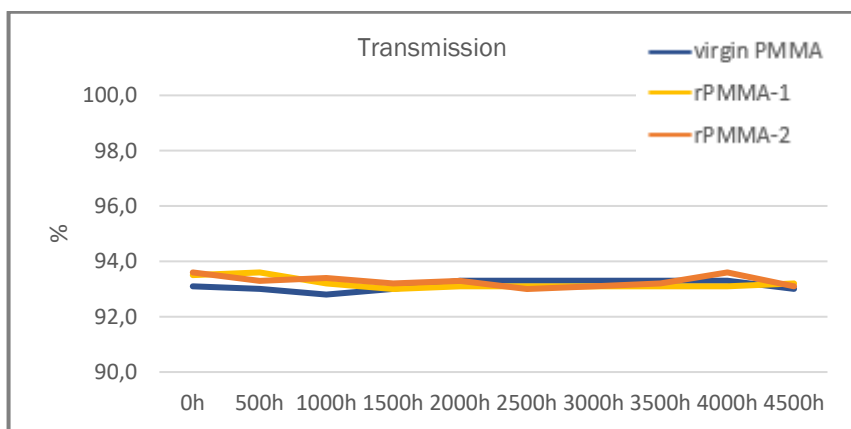
WP4 Global odour intensity determination by human panel was performed at **Certech**:

5 out of 6 rPMMA polymerised using rMMA from various sources (industrial scrap and post-consumer) have a global odour intensity lower or equal to that of *Reference1* which is PMMA from virgin MMA. *Reference2* is a copolymer doped with odorous impurities typical of PMMA depolymerisation.

Delta Plados progressed with works on 3 different products from the recycling process, providing a base for consecutive lab trials and application in end-products.



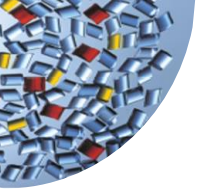
Global odour intensity determination



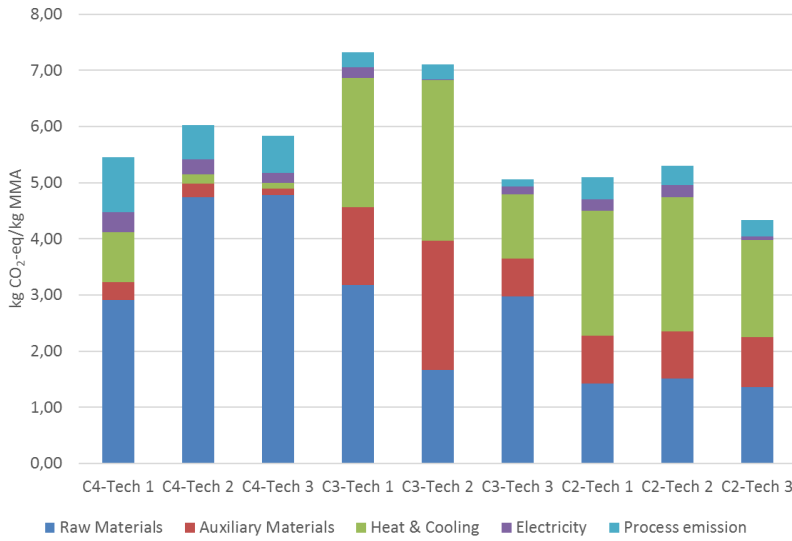
Weathering /Aging test
(Xeno Beta+ according to ISO 11341)



Delta Glass performed an accelerated weathering test on PMMA sheets made from rMMAs, optical transmission (%) at 4500 h, aging being identical to the reference virgin material.



WP5 Quantis obtained preliminary LCA results for benchmark technologies, taking into account the different routes for virgin MMA production as well as main recycling processes currently in operation.



Analysis:

- The environmental performance differs depending on the synthesis route (Cx)
- Raw materials and process energy also play an important role
- Process energy (electricity/heat/cool) impacts come mostly from heat rather than electricity

Virgin production routes



Save the date: the 'Polymer Recycling' workshop will occur September 15th, 2020



On September 15th, 2020 MMAtwo consortium will organize the **remote workshop 'Polymer Recycling'** in which sessions are included regarding skill development on mechanical and thermochemical recycling, process design, purification, innovation strategies and transition governance.

The workshop is intended for **people from the field of polymer recycling and innovation active in both industry and academia**. This workshop also welcomes Master level students to provide them with the appropriate tools to contribute in their future career to the realization of a circular economy for polymers through research and product & process innovation. Full agenda and possibility of registration will follow soon.

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/>

MEET US THERE

- [AMI Plastics Recycling Technology](#), 16 - 17 September 2020, Hotel Savoyen, Vienna, Austria
- [Plastics Recycling World Expo](#), 7-8 October 2020, Messe Essen, Germany
- [AMI Chemical Recycling](#), 3 - 4 November 2020, Hamburg, Germany
- [11th ICIS World Phenol-Acetone Conference](#), November 2020, Vienna, Austria

