CIRCULAR FOAM

Demonstrator for dismantling and fine sorting

D6.1

Author:

Interzero Circular Solutions Germany GmbH

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Technical References

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Project Coordinator	Dorota Pawlucka Covestro Deutschland AG Leverkusen, E54 51365 Leverkusen Germany
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History of changes

Version	Date	Short description of changes
V1.0	05.02.2025	First draft
V2.0	07.02.2025	Reviewed by INTERZ, COV

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1 Overall Results – Demonstrator

The project "CIRCULAR FOAM - Systemic expansion of territorial CIRCULAR Ecosystems for end-of-life FOAM" will develop and demonstrate technological steps required to achieve circularity of plastics in post-consumer applications, using the example of rigid PU foams used as insulation in refrigerators and construction.

The overall objective of WP6 is to demonstrate developed technologies for the value chain including necessary sorting and recycling technologies of cooling appliances as an example for the recycling of urban waste containing polyurethane rigid foam.

Following the activities assigned to WP3, the key goal of the present report/deliverable is to build-up a demonstrator of dismantling and sorting.

Over the course of the project, it became clear the importance of using the current appliance´s recycling structure available in Europe to access the PUR downstream.

According to the information provided by WP3, the implementation of fine-sporting technology at the current appliances recycling facilities might not be feasible due its technological requirements: specific particles sizes, which would lead to a possibly massive modification of the mechanical treatment current in place at the second treatment facilities of appliances, as well as the addition of a pneumatic flow that fine-sorting technology would require.

Further details on the fine-sorting technology and demonstrations are available in the Deliverable D3.3 “Classification model for PU rigid foams and pilot sorting machine” (WP3).

Oppositely to the downstream coming from insulation boards and metal panels, the PUR-downstream available in the appliances’ recycling facilities does not require sorting of PIR, PUR and PUR-brominated and therefore, the fine-sorting technology demonstration became obsolete within the context of the framework of the present report.

Therefore, the scope of the present report was focused on providing sufficient PUR-downstream samples to be analysed by the consortium partners to evaluate possible improvements on the current recovery and treatment processes of cooling appliances, as well as to demonstrate possible required mechanical treatments and further providing material for the demonstration of chemical recycling technologies in Task 6.2 “Scale up of the recycling and purification process to pilot plant scale”.

Following the above-mentioned scope, PUR-downstream samples coming from several appliances’ s recycling facilities within the project region were provided:

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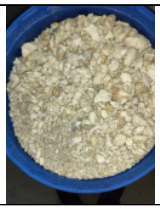
Sample-No.	Country	Picture
A-2023-001	Germany	
A-2023-002	Germany	
A-2023-003	Germany	
A-2023-004	Germany	
A-2023-005	Germany	
A-2023-006A	Poland	
A-2023-007A	Belgium	
A-2023-007B	Belgium	
A-2023-004	Germany	

TABLE 1– OVERVIEW OF COLLECTED PUR-DOWNSTREAM SAMPLES

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According with the mechanical properties and chemical composition evaluation of the PUR downstream samples, the bulky density might be improved to achieve a stable material to feed the pyrolysis reactor.

The fully results of the quality assessment of PUR-downstream samples and further details on the parameters identified to be possibly improved at the current second treatment facilities are available in the confidential Deliverable D3.2 "Designing the dismantling/inverse production process for end-of-life appliances as well as insulation panels and metal panels from C&D waste" (WP3).

To achieve the required density, pelleting technology might be a suitable solution. Pelleting is used for compacting product mixtures or individual components by using pellet mills. As consequence of improving bulk density, pelleting facilitates transportation and storage.

There are several compacting technologies available in the market. As part of the technology assessment done by WP3, compacting companies have been interviewed, and the following technology was pointed out as a suitable possible solution.

Pellet Mills – flat die: The products are pressed through our flat die by pan grinder rollers, formed into endless strands, and then cut to the desired particle length by means of knives. The product to be pelleted is fed by gravity. The low roller speed ensures a good deaeration of the product. The thick product layer between the pan grinder rollers and the large die surface results in a high throughput, even in case of products which are difficult to pellet[1].

Following the technical evaluation of the provided samples, additional samples coming from the facilities in Germany and Poland were provided to demonstrate the compacting technology at a pellet mill manufacturer:

FIGURE – PUR PELLETS FROM SAMPLES PROVIDED BY A COOLING RECYCLING FACILITY IN GERMANY

[1] Pellet Mills & Pelleting Plants | AMANDUS KAHL (akahl.com)

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FIGURE – PUR PELLETS FROM SAMPLES PROVIDED BY A COOLING RECYCLING FACILITY IN POLAND

Although the PUR-downstream samples were successfully compacted by pelleting technology, the mechanical properties and chemical composition evaluation has shown that the PUR-downstream material delivered by a French recycling facility provides the stability required at this stage of the project and therefore, will be used to demonstrate the chemical recycling technology – pyrolysis - in the following Task 6.2 “Scale up of the recycling and purification process to pilot plant scale”.

FIGURE – A BIG BAG OF EOL PELLETS MADE OUT OF PUR DOWNSTREAM COMING FROM A FRENCH FACILITY

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2 Conclusion

Based on the mechanical properties and chemical composition assessment of end-of-life PUR coming from cooling recycling appliances aligned with the stakeholders interviews performed within WP3 framework, it is possible to state the end-of-life PUR coming from second treatment cooling appliances recycling facilities located within the project regions could be used to demonstrate the chemical recycling technology. However, additional compacting technology might be required to achieve material stability.

Although the demonstration of fine-sorting technology became obsolete within the scope of this present deliverable/report, the fine-sorting technologies were demonstrated within WP3 framework in the context of end-of-life material coming from construction waste. The results are available in the confidential Deliverables/Reports D3.2 2 “Designing the dismantling/inverse production process for end-of-life appliances as well as insulation panels and metal panels from C&D waste” and D3.3 ““Classification model for PU rigid foams and pilot sorting machine”.

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