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LIFE PlasPLUS is a

project within the

EuropeanUnion's

LIFE programme

for Environment

and Resource

Efficiency.

With €1.43M EU support and a total budget of €3.17M.



Aims to improve the recycling of high-purity secondary thermoplastic and

enhance a circular

value chain





Recover Antimony, a critical raw material, coming from plastic waste in EoL and WEEE sectors. Run by a consortium of 5 partners, covering the full value chain from recycling to car manufacturing

Welcome to our second LIFE PlasPLUS Newsletter.

The LIFE PlasPLUS project revisits the concept of recycling with its holistic approach to simultaneously close the loop for two traditionally siloed material value chains, plastics and minerals, by producing high purity recycled thermoplastics and antimony.

5 EU PARTNERS

The project is run by a consortium of five EU partners covering the full value chain from recycling to car manufacturing as illustrated below.







SERI PLAST



Waste sorting and valorisation Research and development

Production of antimony

Plastic compounding

Car manufacturing

LIFE PlasPLUS

NEWSLETTER #2



3 STEPS

Production of high purity thermoplastics



Automated multi-class sensor-based sorting and separation of FR **Plastics (FRP)**

Recycling of byproduct Sb through catalytic conversion and hydrometallurgy





FROM JULY 2019 TO DECEMBER 2022





STEP 1 PRODUCTION OF HIGH PURITY THERMOPLASTIC



Triboelectrostatic installation engineering

Following detailed design engineering, the and equipment procurement culminated with the reception of the machines, parts and piping at the COMET **Obourg site in Belgium** over a two-month period from August to October 2020.

Assembly was completed by mid-January 2021 and cold commissioning of the triboelectrostatic unit was carried out during the last week of January 2021. The hot commissioning was initiated in early February 2021 and is currently ongoing.



Triboelectrostatic installation first results

Step 1 will be optimised and operated to treat COMET's own mix of ABS/PS/FPP from ELV (mainly) and WEEE shredder residue at input capacity of 1.5 t/h output. The triboelectrostatic unit is being operated for testing purposes before supplying materials to partners for the implementation of downstream project actions. COMET has to indeed certify that the new unit process complies with the standards and specifications of its complete treatment line by means of operational tests and characterisations (quality control) of the output plastics fraction.

During the commissioning phase, operational parameters for the triboelectrostatic unit are being fine tuned and consist of input materials flow, moisture and dusts contents of the input materials, voltage and output materials flow.

The first load tests are being carried out on an input mix of ABS/PS/FPP and produced two output streams : output stream a) consisting of FPP (polyolefins) and output stream b) consisting of ABS/PS (styrenics). Figure 1 below shows these three streams.



STEP 1 PRODUCTION OF HIGH PURITY THERMOPLASTIC

The first tests show that up to 100% polyolefins can be obtained in output stream a) (99.4% FPP and 0.6%PE) with targets of 98% polyolefins (with less than 1.5%PE) obtained on a regular basis. Further optimisation has to be executed to smooth out outlier results showing sub-optimal separation.

The output stream of ABS/PS will be further treated by the triboelectrostatic unit to separate ABS from PS.

Figure.1 : Input mix of ABS/PS/FPP, output stream a) (FPP or polyolefins) and output stream b) (ABS/PS or styrenics).



Input : ABS/PS/FPP

tests.

Output : FPP

Output : ABS/PS

In the picture As the quality of FPP is now consistent, we took the first 50kg sample for **Seriplast's extrusion**



STEP 2 AUTOMATED MULTI-CLASS SENSOR-BASED SORTING AND SEPARATION OF FLAME RETARDANT PLASTIC (FRP)

"**Drainaplus**" is the commercial name of a residual heavy plastic fraction with a density >1.08 g/cm³ generated by COMET's recycling activities.

The 2020 preparatory work consisted in the analysis by XRF gun of every individual plastic fragment from four representative FRP waste streams :

DRAINAPLUS

- 1. Classic "Drainaplus" fraction
- 2. WEEE "Drainaplus" fraction
- 3. Lamp fraction
- 4. WEEE fraction from another recycling company

Sensor-based sorting orientation testing

In 2021, XRF gun calibrated plastic fragments were subjected to an adaptation testing phase of the PICKIT robotic sorting pilot for recovery of FRP. The following tasks were performed.

- 1. Adapting the LIBS setup for the PICKIT V2 industrial prototype
- 2. Data Acquisition

3. Signal Processing

- Adjust geometric parameters to improve conveyor tracking,
- Update data logging logic to allow better raw spectrum analysis,
- Define and test a new calibration procedure to reach required scanner accuracy on smaller plastic samples,
- Optimize crater depth.

- Select samples with high Sb concentration,
- Shoot 10 times in raw measurement & double pulse mode.
- Reconstruct full signal from raw package,
- Isolate meaningful Sb emission lines,
- Define regions of interest and backgrounds.

Figure.2 : Testing phase of the PICKIT robotic sorting pilot for recovery of FRP.





STEP 2 AUTOMATED MULTI-CLASS SENSOR-BASED SORTING AND SEPARATION OF FLAME RETARDANT PLASTIC (FRP)



REDWAVE XRF - Equipment supplier sorting unit

In parallel with the sensor-based sorting orientation testing on the PICKIT module by ULiège, **COMET** decided to use the opportunity of the LIFE PlasPLUS project to benchmark a separation equipment produced by REDWAVE, an Austria-based pioneer in the XRF technology.

The only current existing technology to remotely detect FRP is X-ray fluorescence (XRF), a nondestructive analytical technique used to determine the elemental composition of materials. REDWAVE has adapted the XRF technology to the field of plastic recycling with the possibility to separate FRP. PICKIT is an emerging alternative technology for plastic recycling which notably uses the LIBS technique for FRP separation (Laser-Induced Breakdown Spectroscopy).

After initial lab-scale testing of the REDWAVE technology in Q3 2020, COMET proceeded with **a pilot size test in Q1 2021** which yielded several hundred kg of FRB plastics.

While this approach allows the LIFE PlasPLUS consortium to effectively **compare FRP separation with two technologies**, REDWAVE and PICKIT, it also serves another purpose. In order to maintain the project schedule, it is desirable to **provide the hydrometallurgy team at ULiège with sufficient volumes of char** early in the project to rapidly initiate the development of the hydrometallurgical extraction of the antimony (Sb).

The FRP material recovered from the Q1 2021 REDWAVE pilot testing will therefore undergo a first pyrolysis pilot testing campaign at COMET to produce sufficient material to be shipped to the ULiège hydrometallurgical team. In due course, the adaptation and scaling up of the PICKIT technology will allow the generation of sufficient volumes of separated FRP to meet the objectives of the project by 2022.



Figure.3 : Cross section of REDWARE XRF chute type



STEP 3 RECYCLING OF BY-PRODUCT ANTIMONY (SB) THROUGH CATALYTIC CONVERSION AND HYDROMETALLURGY



- 1. Catalytic cracking (pyrolysis) and halogens extraction (from organic condensate) at COMET's respective PHOENIX pyrolysis (200 kg/h) and brine treatment (50 kg/h) semi-industrial scale pilot plants
- 2. Hydrometallurgical processing to extract antimony and produce sufficient amounts of Sb2O3 intended for flame retardant applications to demonstrate a closed recycling loop for Critical Raw Materials (such as Sb, contained in WEEE).



The preparation tests for Step 3 executed in 2020-2021 comprise the following developments:

Pyrolysis laboratory testing

- 1. Lab test pyrolysis of FRP,
- 2. Characterisation of Sb and Br in subproducts from pyrolysis,
- 3. Showed that most Sb (>90%) is concentrated into char fraction.

FRP and char characterization to optimize hydrometallurgy

- 1. Characterisation of the char coming from the lab test pyrolysis of FRP,
- 2. Validation of the analytical protocol and chemical analyses,
- 3. Speciation of Sb in the char (SEM-EDS).

Figure.4 : Characterisation of the char coming from the lab test pyrolysis of FRP.



86-88% Sb 4% Br

77-79% Br 2-6% Sb

97% Sb

BaSO4

85-86% Sb 4% Br



WHAT'S NEXT?





NEWS & EVENTS

Recent events

LIFE PlasPLUS at a Recycling & Circular Economy webinar (20-10-08)

- LIFE PlasPLUS presented the concept of recycling with its holistic approach to simultaneously close the loop for two traditionally siloed material value chains, plastics and minerals, by producing high purity recycled thermoplastics and antimony.
- The presentation was held by Philippe Giaro (University of Liège) during webinar session "Recycling and Circular Economy" that took place on 8 October 2020 in a cross-collaboration between Belgium, Luxembourg and France.



LIFE PlasPLUS attends a webinar on Fire properties of polymers and Flame Retardants (21-02-08)



- LIFE PlasPLUS was represented by Philippe Giaro (University of Liège) during a webinar titled "Fire properties of polymers and Flame Retardants (FR)" on 2 February 2021 hosted by PLASTIWIN, the Walloon business cluster for plastic.
- Plastiwin is a sectorial network devoted to industry, focusing on the development of high added value products and solutions, by the use of methodologies based on value chain, open innovation and networking.



NEWS & EVENTS

New European Raw Materials Alliance to secure 'strategic autonomy' on critical raw materials

20-09-30



- The EC has launched a new industry alliance aimed at strengthening the EU's "strategic autonomy" on raw materials, which are considered key for the bloc's green and digital transitions.
- The Alliance aims at identifying barriers, opportunities and investment possibilities at all stages of the raw materials value chain from mining to waste recovery while at the same time trying to minimise the environmental and social impacts.

Visit by COMET & ULiège

Christina Rauls, **Monitoring Expert by NEEMO**, visiting accompanied by project coordinator Hervé Demoulin and team, the facilities of **COMET Traitements**, where the plastic components are sorted, and the facilities of the **GeMMe research** unit of the University of Liège, where **PICKIT** is developed.





21-05-19/20 - Empack Namur « La journée de l'emballage »
21-05-19 - Congrès International « Plasturgie : Innovation et Industrie 4.0 »
21-06-16/19 - Salon FIP 'France Innovation Plasturgie"



CONTACT





mail@lifeplasplus.eu





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