Valorisation routes of materials from urban bulky waste

Executive summary

This document summarizes deliverable "*Complete report on Valorisation routes of raw materials obtained from urban bulky waste case studies: PU foam, mixed textiles, hard plastic, hard plastic fractions and wood*"; this task was performed by ECOFRAG and started in December 2016 (Month 6 of the project), ending in November 2017 (Month 18 of the project).

The report aims at providing a brief presentation on the optimization of the laminated cutting technology (fragmentation) to separate materials and products (urban bulky waste) to be adapted to different urban bulky waste types. ECOFRAG's fragmentation technology showed to be mainly suitable for foam and mixed textile streams. On one side, the optimization improved the characteristics of products, to achieve the validation for industrial valorization. On the other side, the improvements made increased the efficiency of the process, wasting less time, water and energy.

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1 Modifications and improvements on fragmentation technology

After the analysis of the materials obtained in the fragmentation process, the results were used to define possible improvements and optimize the parameters of the technology itself, or the pilot plant overall, to obtain the best quality for each of the materials that will be sent to the different valorisation routes.

On the part of ECOFRAG, the improvements made were aimed at reducing the amount of water (humidity) of the products obtained, since it was found to be excessive for the correct valorisation in further processes; besides, the efficiency of the fragmentation process was improved, resulting in a reduction of the amount of water and energy consumed.

Besides, two other shredding technologies were tested within the URBANREC Project (figure 3): TANA shredder by VAF and VEKO-plan shredder. These technologies were able to fragment the bulky waste in small pieces, although the results obtained for plastics and textile were only suitable for low quality applications

2 Results and valorisation routes

After the previous selection and division of bulky urban waste, ECOFRAG together with the URBANREC industrial partners worked to define which materials were useful for the next phase of validation in industrial manufacturing and which are rejected for this phase and sent to the catalytic hydro-gasification (CHGP) pilot plant.

Figure 1. Fragmented streams approved for industrial applications

Bulky urban waste has the peculiarity of being heterogeneous, that is, each waste has a different composition. Technical sheets were elaborated for each type of waste in order to resume and define the main characteristics (appearance, physical state, particle size and humidity) of the recovered bulky waste materials.

On the one hand, ECOFRAG's fragmentation technology is mainly suitable for foam and mixed textile streams. Altogether, seven materials have been defined with an adequate quality to be processed in industrial scale applications (Figure 1).

Figure 2. Wood valorisation route

2.1 Wood

After manual separation process, cutting and fragmentation, wood residues coming from CONSORCIO (Spain) were assessed by IMOG (Belgium) and approved for wood plastic composite (WPC) applications due to their purity and water content (Figure 2); WPC is used to produce outdoor appliances and furniture. Besides, the assessment for CHGP (to obtain methylal) by BPP is being carried out.

2.2 Matresses

Foam mattresses come from CONSORCIO and can be composed of Polyurethane (PU) or Latex foam. First, in the case of mattresses with springs, metal parts were detached and sent for reselling. The fragmentation process resulting in high purity products were assessed for rebounding, that is, the fabrication of new mattresses. In addition, PU foam was assessed for glycolysis, to obtain adhesives. Textile parts were approved to produce textile applications (needlefelts and composites).

Figure 3. Matresses valorization route

2.3 Tyres

After fragmentation, tyres were separated into rubber, metal parts and textile parts. The latter (Figure 4) were assessed and approved for textile applications, due to their quality.

Figure 4 Textile parts in tyres. Valorization routes

2.4 Jute carpets

Jute carpets coming from VANHEEDE were separated into their front and back parts. Front parts, composed by cellulose and Polypropylene (PP), were assessed for textile applications (needlefelts and textile composites) while back parts, with high amounts of glue, were not approved for this route.

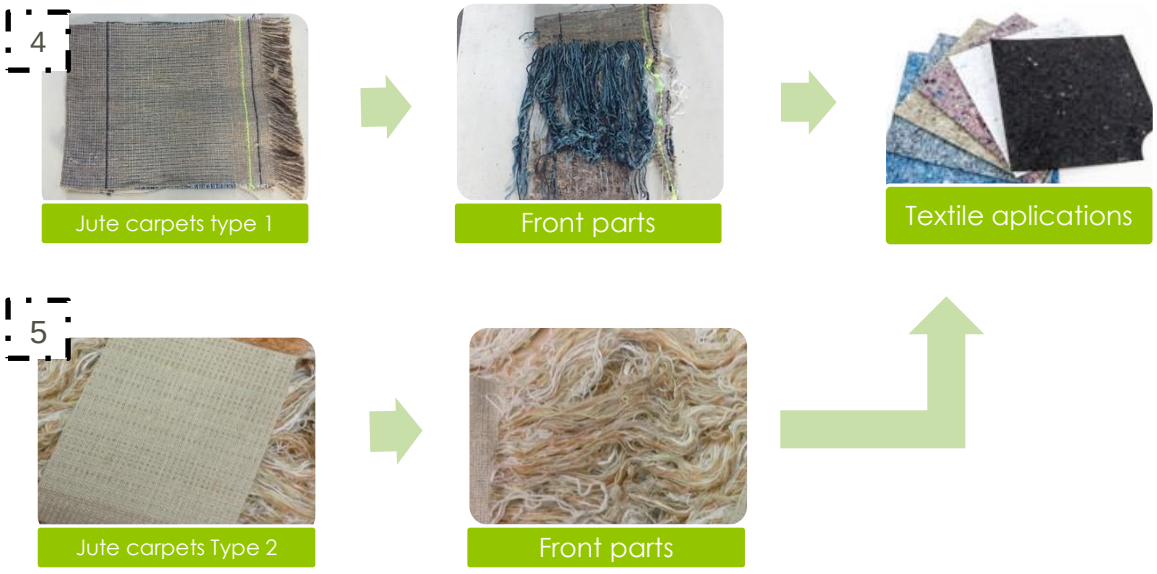

Figure 5 Jute carpets. Front part

2.5 , Polyamide (PA) carpets

Jute carpets coming from VANHEEDE were separated into their front and back parts. Front parts, composed by cellulose, were assessed for textile applications (needlefelts and textile composites) while back parts, with high amounts of glue, were not approved for this route.

Figure 6 PA carpets. Front part

2.6 Artificial grass

Provided by VANHEEDE, the structure was similar to carpets and were separated into their front and back parts. Green parts, composed by Polyethylene (PE) fibres, were assessed for textile applications (needlefelts and textile composites).

Figure 7 Artificial grass

2.7 Streams assessed for CHGP process

In addition to the above, other streams (Figure 8) did not achieve the quality requirements and were sent to CHGP process for the production of methylal.

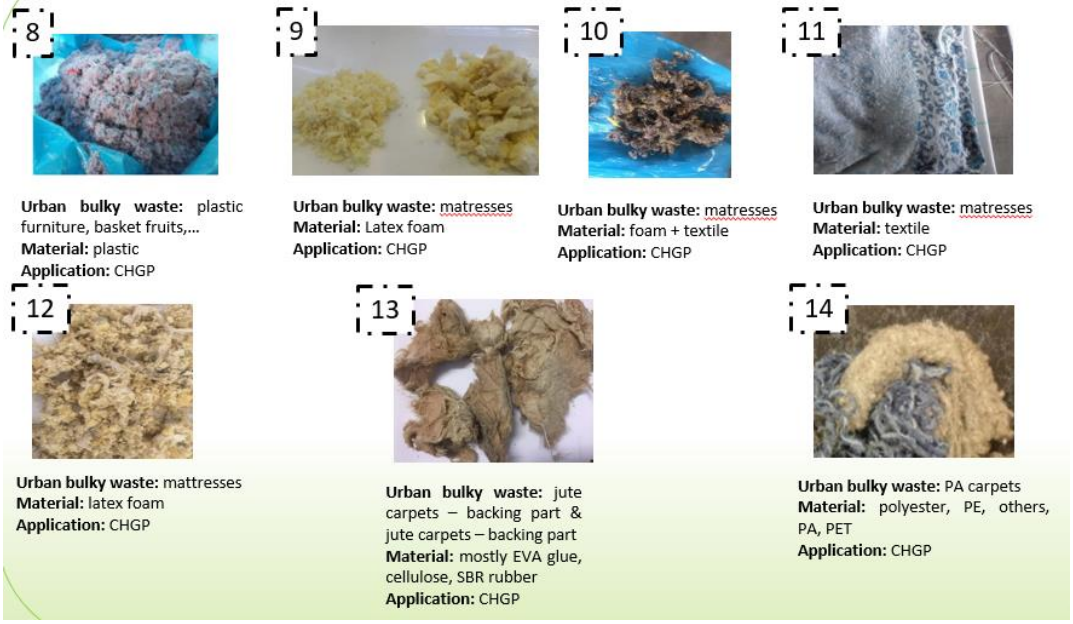

Figure 8. Materials from ECOFRAG forwarded to gasification (CHGP)

3 Conclusions

The implementation and adaptation of the fragmentation technology for bulky waste pilot plant, led by ECOFRAG, has been carried out according to plan. This optimization, together with the analyses and recommendation made by the project's industrial and research partners, has led to an improvement of material quality (cleanness, purity, size) for the valorisation routes that were assessed.