AUTO SHREDDER RESIDUE SEPARATION AND PYROLYSIS

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Abstract

This work deals with auto shredder residue (ASR or car fluff) refining since Directive 2000/53/EC claims for 85% material recycling from end-of-life vehicles (ELVs) in 2015. Plastics amount at about 10%by weight of modern cars and their use is likely to increase due to lightweight requirements and design freedom concerning colors and shapes. Current ELVs metal content is around 70% and with pretreatment 75% recycling rate can be easily achieved. ASR represents the remaining 25% ELV mass, and plastics are a rough 35% of the total car fluff. Plastics separation and recycling is thus strategic in order to meet ELVs Directive targets. In this work, floatation and sieving are used as ASR pretreatment. Pyrolysis of each obtained fraction has been carried on in order to evaluate which fraction is more suitable to feedstock recycling and whether pyrolysis could be used as recycling technique in ELV management. Results show that PP/PE mixture has highest conversion rate. Pyrolysis can be exploited to liberate metals and recover them from the char as well. Finally, if light plastics mix oil could be refined in a "waste to chemicals" optic, ELVs Directive targets can be achieved with pyrolysis.

Keywords: *Auto shredder residue (ASR); pyrolysis; plastic separation; plastics recycling*

1. Introduction

This work deals with auto shredder residue (ASR or *car fluff*) refining since Directive 2000/53/EC claims for 85% material recycling from end-of-life vehicles (ELVs) in 2015. Plastics amount at about 10% (by weight) of modern cars and their use is likely to increase due to lightweight requirements and design freedom concerning colors and shapes. Current ELVs metal content is around 70% and with pretreatment 75% recycling rate can be easily achieved. ASR represents the remaining 25% ELV mass, and polimers consist of little less than 50% of the total car fluff.

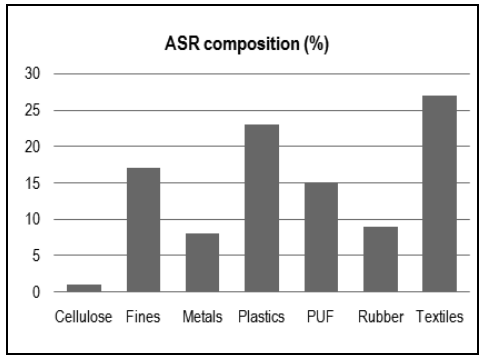

Fig. 1. Car fluff composition [1].

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2. Materials and Methods

Two density stage floatation has been used to sort plastics from the non-organic matrix. The Pyrolysis reactor consists of a semi-continuous reactor provided with a helicoidal stirrer [2]. In a typical experiment, 10-15 grams of the chosen sample were loaded into the reactor. Products were collected as light and heavy oils in two coolers and gases in a Tedlar bag. Solid residue was recovered once the reactor cooled down as well and metal content weighted. Oils and gases were then analyzed with GC-MS to identify products. Authors decided to carry out also some runs using a nanocrystalline HZSM-5 zeolite catalyst placed in the reactor together with the plastic-rich samples.

3. Results and Discussion

Results show that PP/PE mixture has highest conversion rate. Pyrolysis can be exploited to liberate metals and recover them from the char as well. Moreover, catalyst enhanced cracking by cutting down hydrocarbons chains shorter, and producing

more gases and lighter compounds in the oil. Finally, if light plastics mix oil could be refined in a "waste to chemicals" optic, ELVs Directive targets can be achieved with pyrolysis.

4. Conclusions

Catalytic refining of the pyrolysis oil (and gases) remains the bottleneck of the "waste-to-chemicals" recycling in Europe, as well as an interesting field to develop research. Although in industrial applications they are currently used for generating heat, gaseous products could be also refined and exploited as chemicals in order to enhance ELVs recycling rate.

References

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