

Comparing end-of-life vehicle (ELV) and packaging-based recyclates as components in polypropylene-based compounds for automotive applications

Response to Reviewer 1 Comments

Thank you very much for taking the time to review this manuscript. Please find the detailed responses below and the corresponding revisions/corrections highlighted/in track changes in the re-submitted files.

Abstract and Title: I am not sure the manuscript title clearly reflects what was investigated. I would suggest the authors to review the title in order to mention that ELV recyclates were compared to a packaging-based PCR for automotive applications.

Thanks for the suggestion – we tried to keep the title simple but have changed it now to “Comparing end-of-life vehicle (ELV) and packaging-based recyclates as components in polypropylene-based compounds for automotive applications”.

Lines 22-38: There was a lot of information regarding the European context, but it was not specified in the title that the focus would be in Europe. Additionally, the journal audience is global. I would strongly suggest the authors to include information that represents other regions or global numbers (e.g., how much PP was produced globally? Or does other countries/regions also have targets for recycled plastic content in cars?)

The focus of our work is clearly on Europe, and here the database is also best. We have added some further references for the US and China, including respective figures. The global production number for PP has also been added (it is part of already cited ref. [1] anyway).

Line 139: What is a “(semi)commercial” recyclate? It is commercially available or not.

This is explained better now. The term “semicommercial” is quite common in the polymer industry and implies availability in limited quantities from pilot-scale operations.

Lines 146-148: Is the light fraction PCR-ELV from the Netherlands also originated from bumpers? I did not understand the light fraction terminology. The density value showed in Table 1 is similar to common unfilled polypropylene.

The nature of the “shredder light fraction” (SLF) and its origin has been explained better now (it has a higher density despite the low ash content due to the HDPE fraction). In addition, we have harmonized the nomenclature in tables and figures.

Lines 149-150: I have never seen the use of the term “double-screw extruder”. Is that a twin-screw extruder? Also, please include extruder diameter, L/D, pelletization mode, temperature profile and screw speed for reproducibility. Was the temperature profile the same for all three PCR resins evaluated? What kind of melt filter was used? Please include model/manufacturer information.

The unusual term has been replaced and further information on the extruder has been added.

Lines 168-169: What is the composition of the virgin polyolefin mix 1 and 2 used in the study?

The overall composition of the materials as indicated by CRYSTEX parameters is given, but we are in no position to disclose details of the preparation.

Lines 212-222: Information regarding the equipment used for injection molding the specimens and for the mechanical tests is missing. Please include model/manufacture.

While this information is strictly speaking irrelevant, it has been added.

Lines 224-226: Include SEM instrument information.

The respective information has been added.

Lines 229-231: Please include L/D and screw speed of the extruder.

The respective information has been added.

Lines 331-335: The MFR of the virgin compounds used to mix with the PCR were lower than the virgin resin used as a control. Why a virgin compound with higher MFR was not used if processability (MFR) is necessary to match the MFR = 22 g/10 min of the virgin resin (0% PCR)?

As specified in the revised introduction, the main target was to match the mechanical performance OEM specifications.

Lines 347-350: These targets are for Europe. Please mention this fact.

This has been mentioned.

Lines 361-363: What are the authors suggestions to improve flowability (MFR) of the PCR compounds? For example, could peroxide visbreaking be an alternative? Or improve PCR sorting to obtain a PCR fraction with higher MFR (possibly containing high-MFR thin-walled PP containers)?

We have added a paragraph on that aspect – simple visbreaking is not an option, and high MFR PP recycle fractions are not existing on the market. We will be further working on that!