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Publication date: 2018

Document Version
Publisher's PDF, also known as Version of record

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Citation (APA):

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System perspective in material flow analysis for LCA studies

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INTRODUCTION

Plastics are produced in large volumes and used in many industrial sectors. However, there is a lack of comprehensive understanding of plastic flows from a system perspective. Material Flow Analysis (MFA) accounts for material inputs, outputs and stocks for a selected material. MFA is essential when performing a Life Cycle Assessment (LCA) of waste management systems. This work illustrates a system perspective when performing MFA of plastics in Europe.

METHODOLOGY

Flows of plastics in the European Union (EU) were estimated for a variety of polymers used in selected industrial sectors (packaging, agriculture, etc.). An example of polypropylene (PP) polymer is presented here. Both pre-consumer and post-consumer plastic waste was considered when quantifying flows of plastics in different waste management alternatives. Data presented here represent preliminary results of an ongoing research.

RESULTS AND CONCLUSIONS

- Approximately 12,000,000 tonnes of PP polymer are annually produced in the EU and 20% are exported
- Roughly half of PP is used in packaging, followed by “other” (20%) and automotive (15%) sectors
- The six industrial sectors considered generate more than 5,000,000 tonnes of PP waste in the EU
- Approximately 40% of the (pre- and post-consumer) waste PP is collected for reprocessing and recycling
- Collection efficiency of the waste PP varies between 20% and 50% depending on industrial sector
- Almost 20% of the collected waste PP is exported outside of the EU for further sorting and reprocessing
- Less than 20% of PP consumed in the EU comes from recycled plastics (assuming no imports of recycled PP)
- LCA can be used to optimize environmental performance of the waste plastic management system
- Results of a potential LCA will depend on the choice of a material being displaced by recycled PP
- Potential chemical contamination of PP waste (e.g., BFRs (Pivnenko et al., 2017)) should be considered