

Title: **Novel approaches to compositional analysis of mixed polyolefins for recycling applications**

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Abstract:

Note: maximum length of 400 words.

Knowledge of the material composition of plastic waste streams is an important prerequisite for recycling. Screening technologies for the identification of polymeric impurities are therefore indispensable in the pursuit of circularity. In this work, state-of-the-art chromatographic and thermal polyolefin characterization are compared with a proof-of-concept version of a novel thermodynamical testing device for material identification (MADSCAN). Their respective possibilities and limitations are explored using the example of model virgin polyolefin-mixtures down to 1 wt-% PP in HDPE.

The model mixtures were separated using high-temperature HPLC with a binary pump and a Hypercarb® column and moreover analyzed with differential scanning calorimetry. With these state-of-the-art methods, the detection of 1 % PP in HDPE was possible. The challenge here is the representativeness of highly heterogeneous material mixtures, for sample sizes are within the mg-range.

Using MADSCAN, a detection down to 10 wt-% of PP in HDPE was achieved, while smaller concentrations were identifiable down to 2 wt-%, but not quantifiable. However, sample sizes up to 2 g are used in the analysis without the need of sample preparation, resulting in a higher representativeness. Both approaches therefore have substantial advantages, the current MADSCAN version being more suitable for industrial screening tests, while polyolefin chromatography yields more in-depth information about the composition.