Perspectives on micro-plastics detection in biowaste via ATR-FTIR spectroscopy

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Abstract

Small plastic particles mainly from packaging, stemming from polypropylene (PP), low-density polyethylene (LDPE) and poly(butylene adipate-co-terephthalate) (PBAT) are expected to appear in source-separated biowaste. Often, their separation from the organic part may not be complete and consequently, their presence in residual amounts might jeopardize the compost use as a soil amendment or organic fertiliser. The current work aims to develop protocols to identify and quantify polymeric contaminants in food waste streams and contribute to establishing the pertinent compost specifications in terms of (micro)plastics content. Dried source-separated bio-waste of known composition was subjected to chemical digestion and the polymeric constituents were analyzed *via* ATR-FTIR spectroscopy to construct a calibration curve based on the integrated absorbance.

Methodology



Sample preparation

(PP), Methods: Virgin polypropylene low-density Materials and polyethylene (LDPE) and poly(butylene adipate-*co*-terephthalate) (PBAT) were cryomilled into flakes (< 500 μ m), loaded to dried source-separated biowaste of known composition (Table 1) and subjected to Fenton.

source-separated bio	waste
Composition	% d.b.
Oils	12.0
Water soluble	30.8
Volatile solids	88.5
Ash	11.5
Cellulose	12.7
Hemicellulose	9.3
Starch	7.1
Acid soluble lignin	1.8
Acid insoluble residue	12.4

Table 1. Composition of the dried

Results and Discussion

I. Identification of the characteristic peaks per polymer type after digestion

	1456 1376		1464	718		1710	726
foodwaste	C-H (-CH ₃) sym. bending $-CH_3$ sym. bending	foodwaste	C-H bending	-CH ₂ - rocking	foodwaste	-C=O stretch CH- out-of	-plane bending



II. Construction of calibration curves per polymer type





a

b)

Conclusions

• Chemical digestion of food waste is essential for the appearance of the characteristic peaks that can be attributed to PP, LDPE and PBAT microplastics • Linear relationships with good fitting ($R^2 > 0.9668$) were attained between the different polymeric contamination levels in the source-separated biowaste following Fenton pretreatment and absorbance area

• Challenge tests of the calibration curves (with new, known concentrations of plastics) were successful

References

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