

Biodegradable polymers from industrial compost

Soxhlet extraction method using the UniversalExtractor E-800

1. Introduction

A simple and reliable procedure for the extraction of biodegradable polymers from industrial compost is introduced. Commercial compostable plastics are composed of polyesters that undergo the process of biodegradation in industrial compost. In this study, compost samples were spiked with one of the major biodegradable polyester in compostable plastic bags, poly(butylene adipate-co-terephthalate) (PBAT).

2. Experimental

Equipment: UniversalExtractor E-800

Sample: Compost & Polymer: Industrial compost, very mature, sieved to < 5 mm (Normec, OWS, ^{Tabl} Belgium)

PBAT was provided by BASF SE (Germany) (see Nelson et al., 2017 [1])

Procedure: Samples were freeze dried, mixed and weighed into a cellulose thimble. Compost samples were spiked with PBAT before being extracted according to the parameters listed in Table 1. The extracts were quantified using ¹H-NMR.

Table 1: Soxhlet extraction with the UniversalExtractor E-800.

Step	Value
Extraction method	Soxhlet
Solvent	Chloroform : Methanol 9:1 (v:v)
Extraction Heating level	10 cycles 11
Soxhlet valve opening time	Long
Rinse	0 min
Dry (Step 1) Heating level	<input checked="" type="checkbox"/> AP, 60 min 5
Solvent volume [mL]	160



3. Results and discussion

The results of the spiked extraction recoveries of PBAT in compost are presented in Table 2.

Table 2: Overview of spiked extraction recoveries of PBAT in compost (averages ± standard deviations; n= 3)

PBAT spiked [mg]	PBAT extracted [mg]	Recovery [%]
45.2 ± 0.3	46.2 ± 1.9	102.3 ± 4.3
21.0 ± 0.1	21.0 ± 0.9	99.9 ± 3.9
10.5 ± 0.3	10.0 ± 0.5	95.5 ± 5.4
4.6 ± 0.1	4.3 ± 0.6	94.5 ± 13.0
2.1 ± 0.1	2.1 ± 0.4	103.5 ± 14.7
1.4 ± 0.1	1.8 ± 0.4	131.7 ± 37.4

4. Conclusion

The extraction of PBAT from industrial compost using the UniversalExtractor E-800 allows to reliably and accurately quantify PBAT. The method can be extended to other biodegradable polyesters such as polylactic acid and polycaprolactone.

5. Acknowledgment

We thank F. Wille, S. Arn and Dr. M. Sander from ETH Zürich, Switzerland for the cooperation and sharing their data for this Short Note.

6. References

[1] Nelson, T. F., S.C. Remke, H.-P. E. Kohler, K. McNeill, M. Sander; Quantification of Synthetic Polyesters from Biodegradable Mulch Films in Soils. Environmental Science & Technology 2020 54 (1), 266-275; DOI: 10.1021/acs.est.9b05863

For more information, please refer to Application Note 856/2024.

