

ESR 7: Development and evaluation of waste collection and sorting systems for bioplastics

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Structure

- 1. Introduction.**
2. Challenges in biodegradable plastics waste management.
- 3. NIR Sorting of biodegradable plastics.**
4. Identifying consumer confusion.
- 5. Where to throw biodegradable plastics?**
6. Effect of contamination on spectra.
- 7. Concluding remarks.**

Introduction

Early Stage Researcher 7

Title: Development and evaluation of waste collection and sorting systems for bioplastics.

Joint Doctorate Degree:

- **Home University** – Montanuniversität Leoben (MUL), Chair of Waste Processing Technology and Waste Management.
- **Host Uni** – Technical University of Denmark (DTU), DTU Sustain.



Industrial secondments:

- Saubermacher Dienstleistungs AG, Austria.

Saubermacher

- TOMRA Sorting GmbH, Germany.



PhD research topic – Introduction

Title: Development and evaluation of waste collection and sorting systems for bioplastics.

Objective 1:

- Define source separation systems for future waste streams and make proposals for adaptation of existing collection systems.

Objective 2:

- Examine the sortability eco-designed plastics and understand the influence of impurities and surface-active substances on sensors.

PhD research topic – Background about bioplastics

Three types of bioplastics

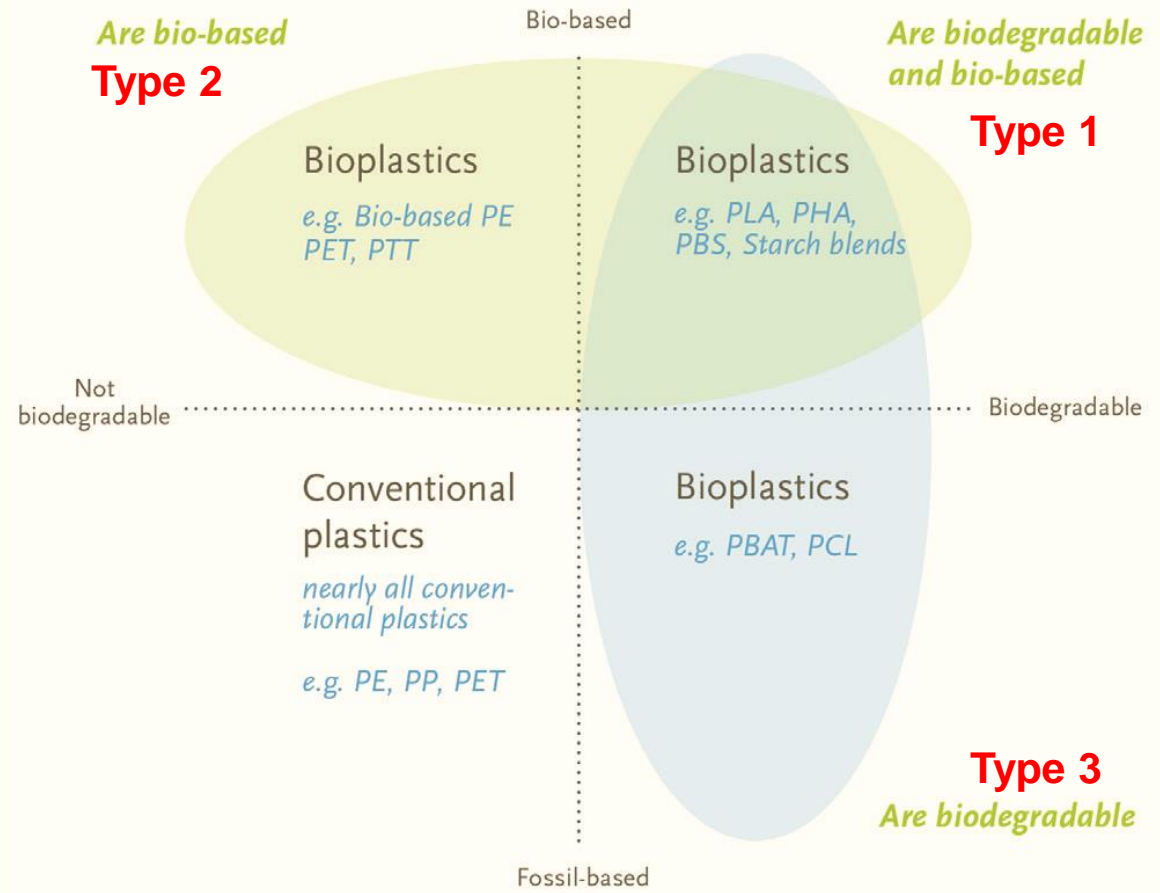


Image Source: European Bioplastics, 2020

PhD research topic – Background about bioplastics

Which biodegradable plastics
do I focus on in my PhD?

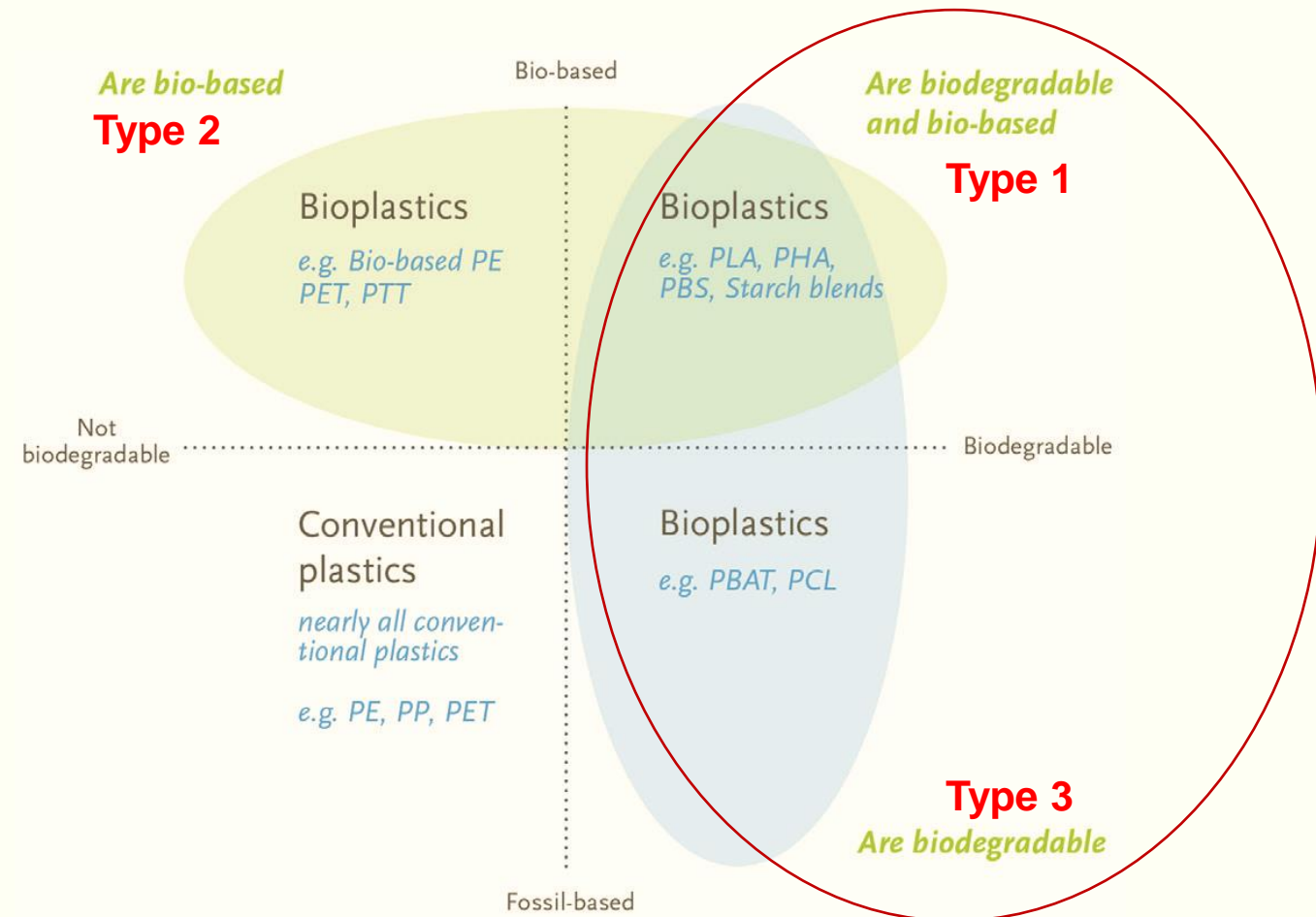


Image Source: European Bioplastics, 2020

Challenges in biodegradable plastics waste management

NIR sorting of biodegradable plastics

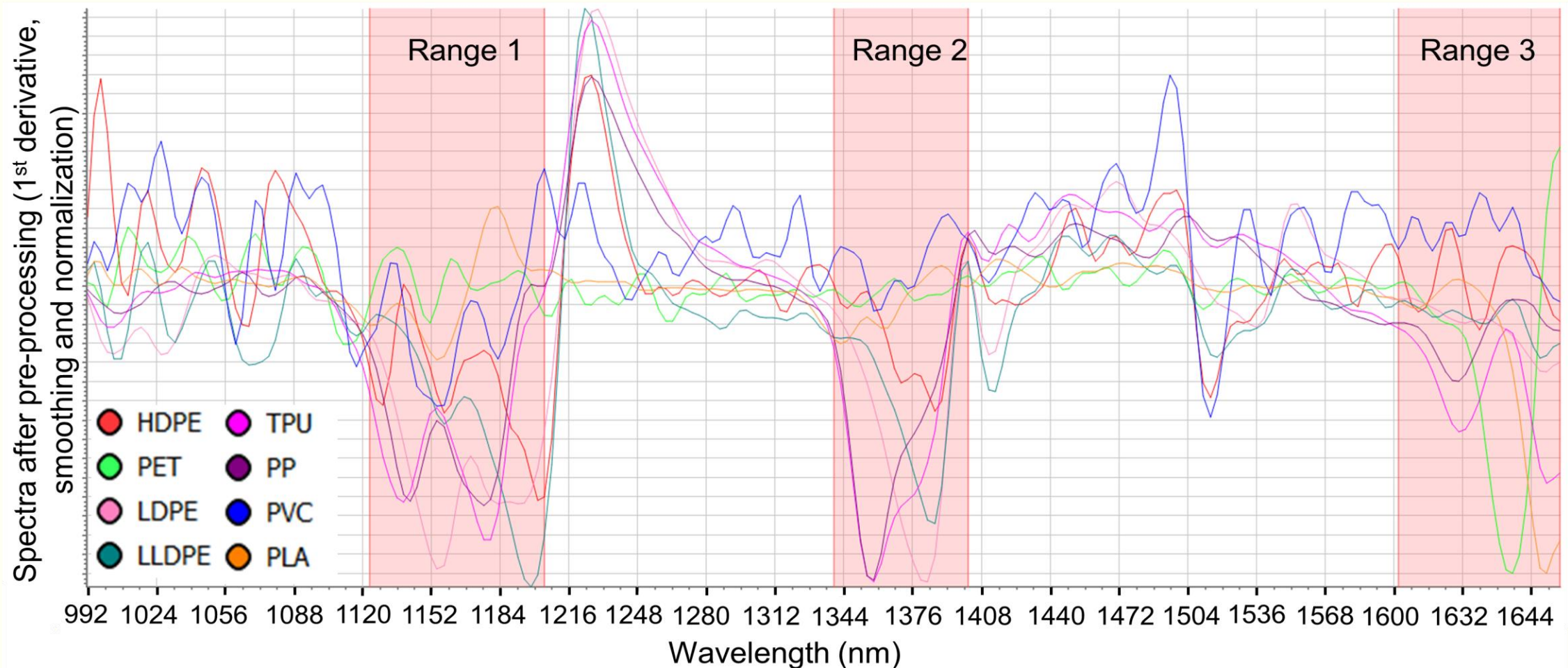
NIR sorting of PLA: Research questions

Comparing PLA spectrum with spectra of seven conventional plastics.

How does a change in grade and thickness affect the PLA spectrum?

Can PLA products be detected using a recipe made from virgin PLA?

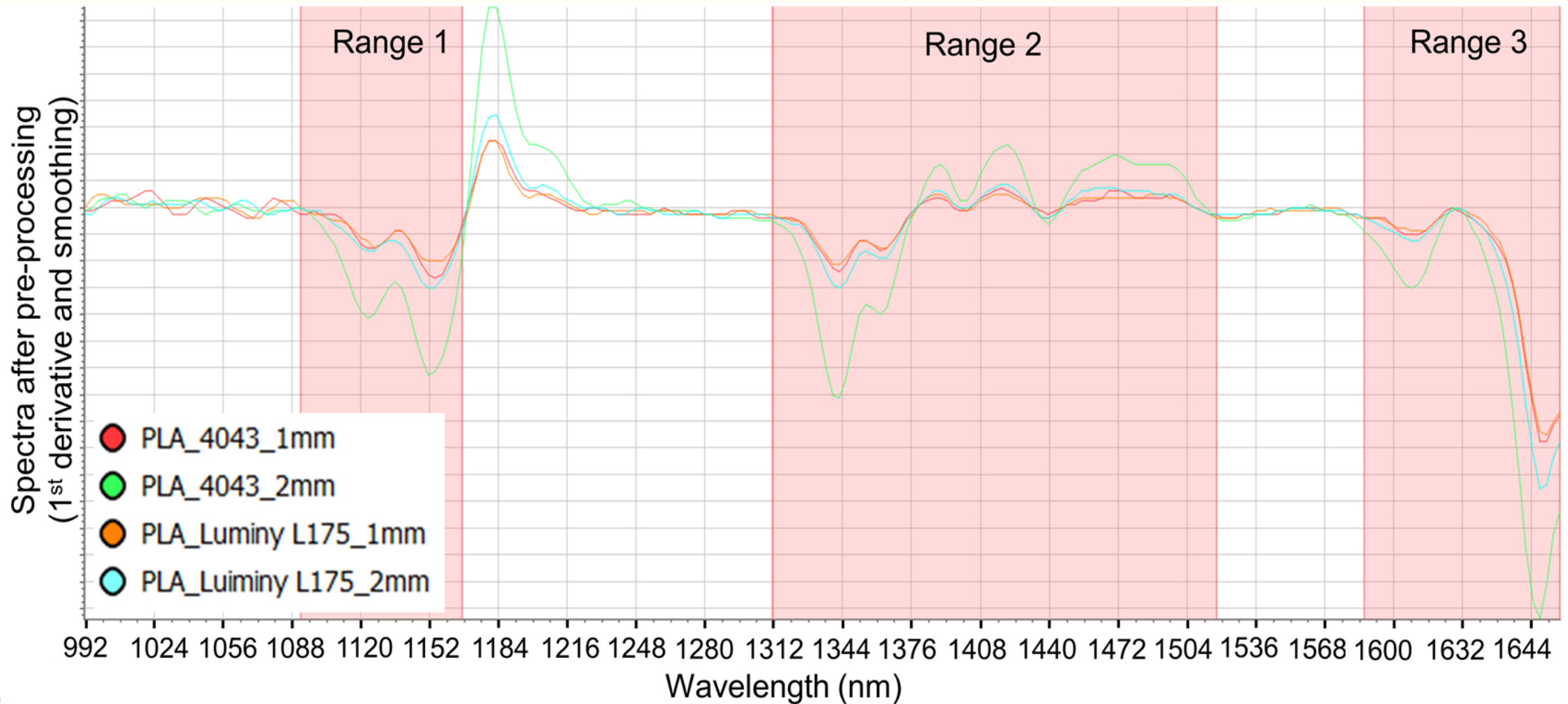
NIR sorting of PLA: Comparing PLA spectrum with spectra of seven conventional plastics



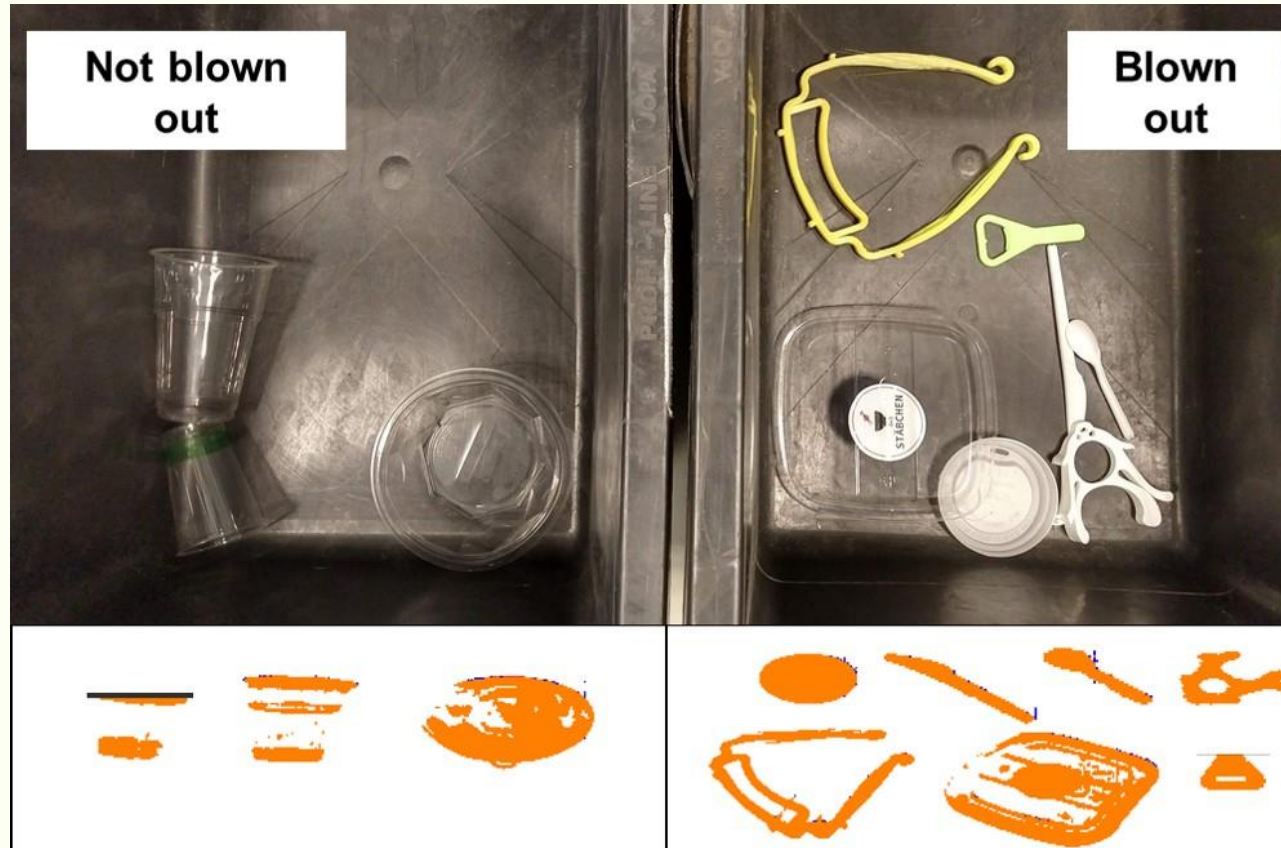
NIR sorting of PLA: Comparing PLA spectrum with spectra of seven conventional plastics



NIR sorting of PLA: How does a change in grade and thickness affect the PLA spectrum?

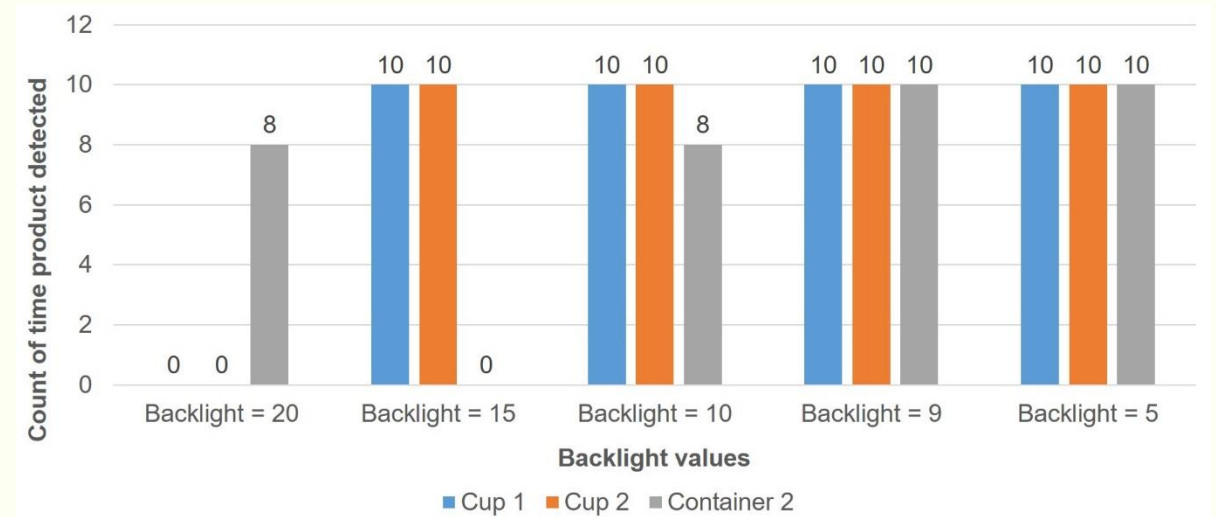
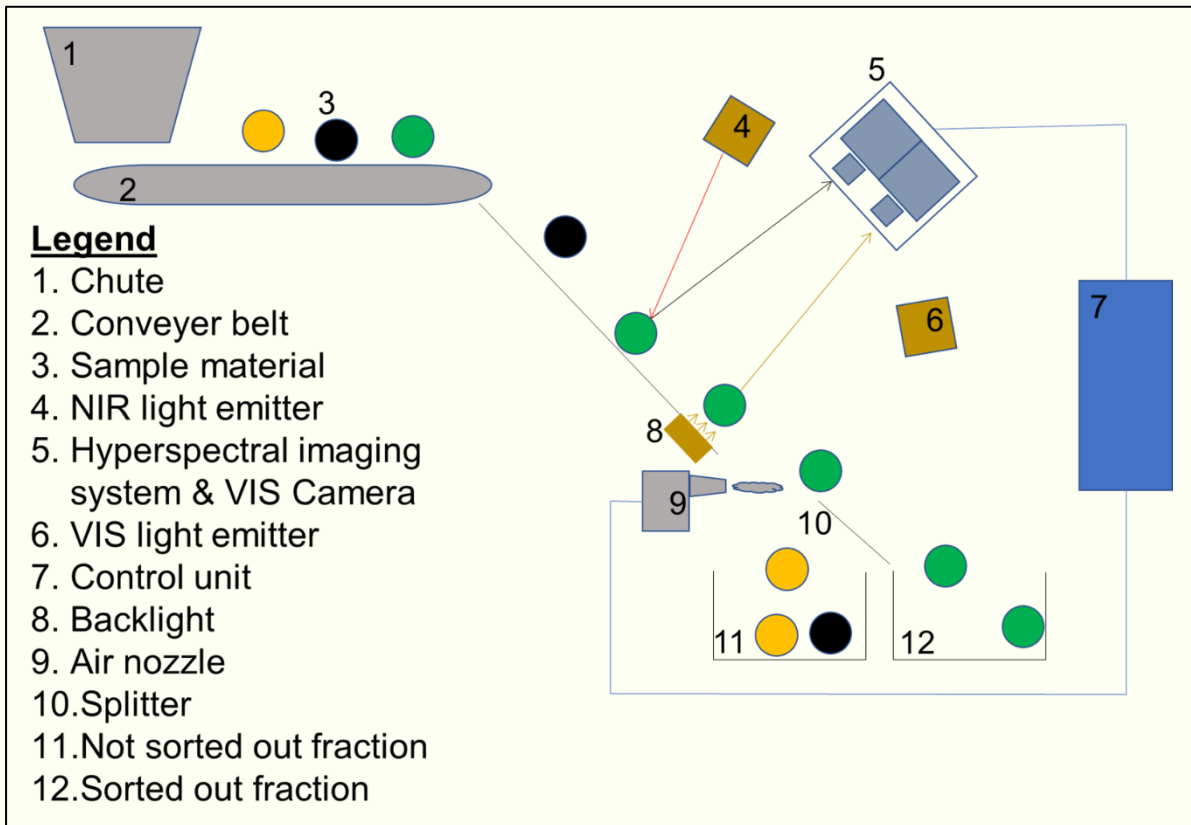


NIR sorting of PLA: Can PLA products be detected using a recipe made from virgin PLA?



All were detected!

NIR sorting of PLA: Can PLA products be detected using a recipe made from virgin PLA?



NIR Sorting of PLA: Status (Paper 2)

Status: Published.


NEAR-INFRARED IDENTIFICATION AND SORTING OF POLYLACTIC ACID

+ Namrata Mhaddolkar, Gerald Koinig and Daniel Vollprecht

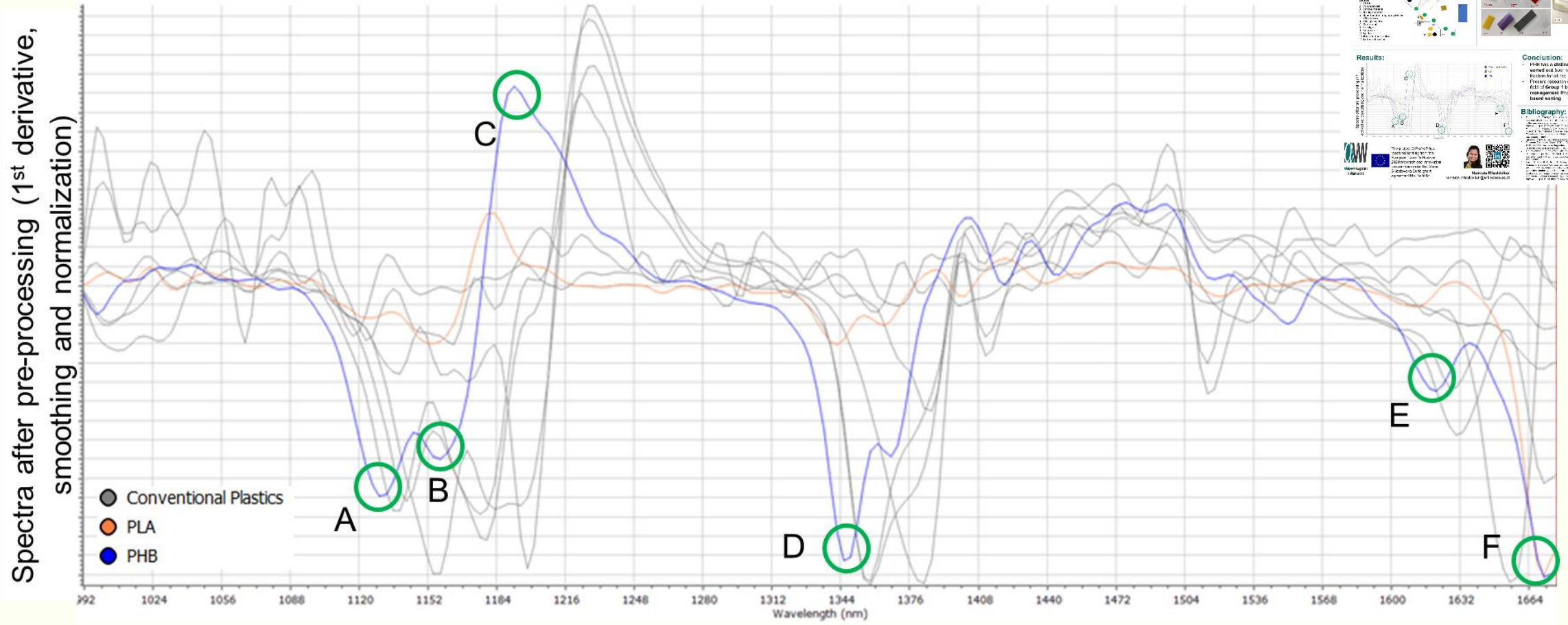
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DOI [10.31025/2611-4135/2022.15216](https://doi.org/10.31025/2611-4135/2022.15216) 

NIR sorting of PHB



Evaluation of a near-infrared sorting system for bio-based and biodegradable plastics

Namrata Mhaddolkar, Daniel Vollprecht
 MONTAN UNIVERSITÄT LEOBEN, TU Braunschweig, C-PlaNeT, Fraunhofer IPA

Summary:

- EBET Circular Plastics Network to Train (C-PlaNeT) project.
- Research is focused on improving capture of Group 1 Bioplastics via waste collection and sorting.

Introduction:

- New infrared (NIR) spectroscopy technology vastly used in waste sorting¹.
- Collection needs to increase gradually^{2,3}.
- Currently, Group 1 bioplastics are indistinguishable⁴.
- Academy research on sorting of this group is in progress.
- Research Question:** Whether the NIR spectrum of polypropylene, polyethylene, polyamide, polyurethane and PHB can be distinguished, and whether they should be sorted out as separate plastic fractions.

Equipment used:

NIR Sorter in SUEZ

Samples used:

3 Bioplastic Groups

- Group 1: PHB, PLA, PCL
- Group 2: PBAT, PCL, PHA
- Group 3: PCL, PHA

Results:

PHB has a distinct spectra & was sorted out by NIR sensor. PHB is not in waste. PHB is not in waste. PHB is not in waste.

Conclusion:

PHB has a distinct spectra & was sorted out by NIR sensor. PHB is not in waste. PHB is not in waste. PHB is not in waste.

Bibliography:

1. Top and C. P. (2018) The impact of the circular economy on the waste management of bioplastics. *Waste Management & Research*, 36(1), 1-10.

2. Namrata Mhaddolkar, Daniel Vollprecht, Fraunhofer IPA, TU Braunschweig, C-PlaNeT, Fraunhofer IPA

Identifying consumer confusion



Industrial secondments: Saubermacher Dienstleistungs AG (1)

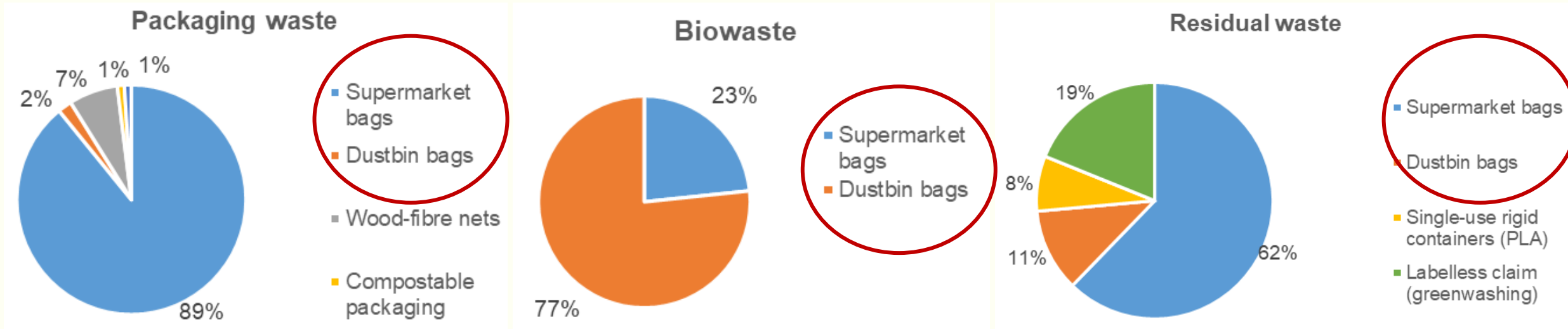
What kind of biodegradable plastic products are found in the three waste streams – packaging waste, biowaste, and residual waste in an Austrian urban area?

- Visual identification method used for hand-sorting: Compostability labels and PLA resin identification number (7).



Industrial secondments: Saubermacher Dienstleistungs AG (2)

Results:




Industrial secondments: TOMRA Sorting GmbH (1)

What kind of biodegradable plastic products are found in the three waste streams – packaging waste, biowaste, and residual waste in a German urban area?

Virgin biopolymers (Group 1)
used for identifying market-
available biodegradable
plastic products (Group 2)
using FTIR Spectroscopy.

Biodegradable plastics sorted
from 3 waste streams using
this NIR recipe, and rejects
were hand-sorted using visual
identification method.



Database using these Group 1
and Group 2 plastics used for
training the NIR sorter at
TOMRA.

Industrial Secondments: TOMRA Sorting GmbH (2)

Results:



Thus, indicating consumer confusion!

LCA Model

Status: Underwork
(Paper 4).

Geographical scope: Austria.

Using Easetech software (DTU).

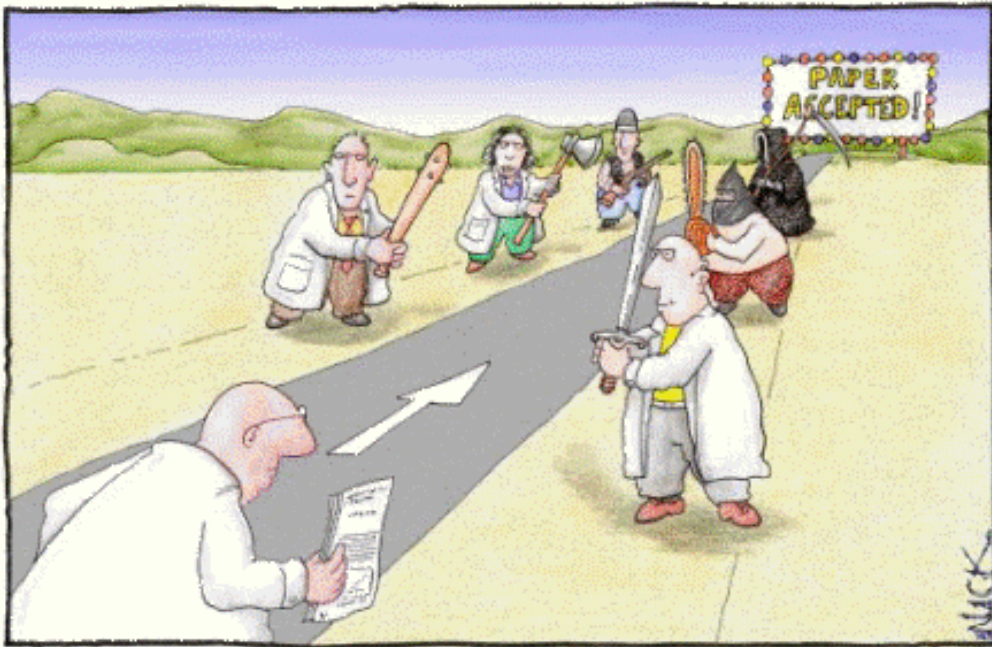
Effect of contamination on spectra

Status: Underwork
(Paper 5).

Concluding remarks

Next steps

1. Publishing the papers



Most scientists regarded the new streamlined peer-review process as 'quite an improvement.'

Image Source: blogsmedia.lse.ac.uk

2. PhD Defense!

How it feels when you write your PhD thesis 😊



Image Source: thephdhub.com



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Vielen Dank!



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