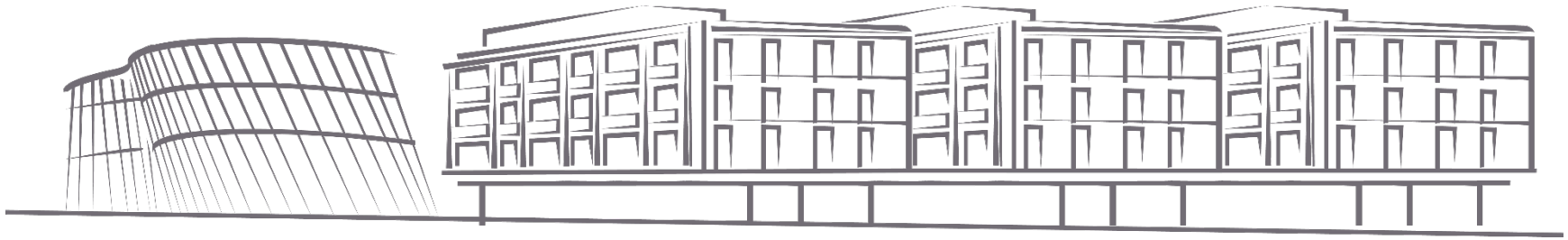
CORFU2022
15-18 JUNE

University of Ljubljana
Faculty of Chemistry and Chemical Technology

Aquatic hazard assessment of Bakelite microplastics

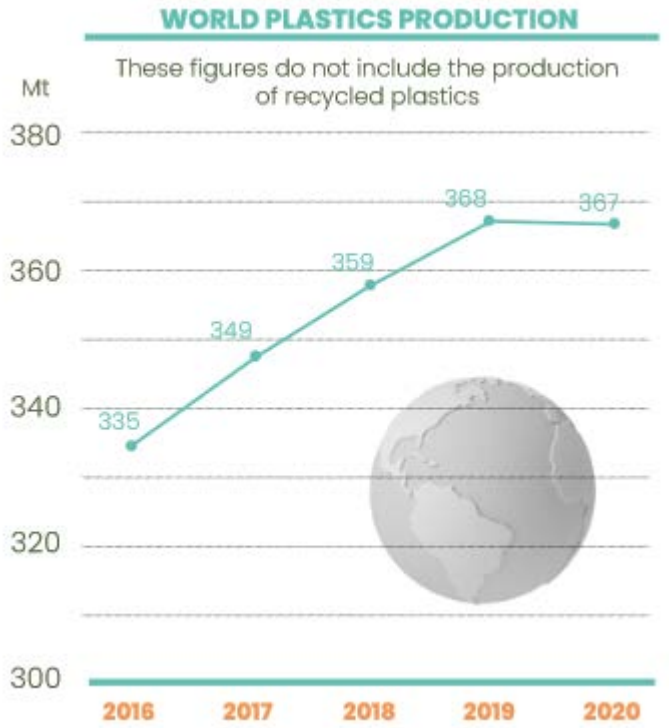
Gabriela Kalčíková, Ula Rozman, Barbara Klun

Corfu, 17. 06. 2022



Introduction

- Intensive development of plastic industry over last 70 years
- 367 millions ton of plastics produced globally in 2020
- 40.5% used for packaging
- Global pollution of the environment by plastics
- Focus of environmental research: PE, PP, PS



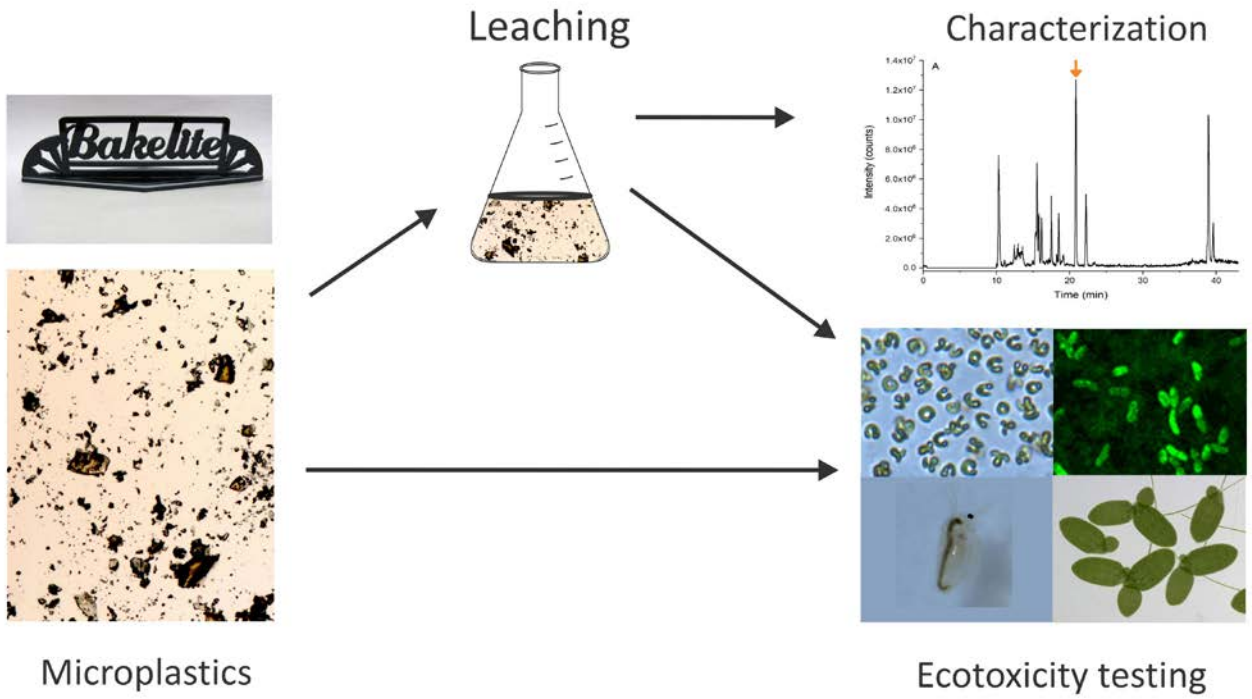
Plastics – the fact sheet 2021

Introduction

- Effects of industrial plastics is understudied
- Bakelite – phenol formaldehyde resin – the first synthetic plastics
- Produced over 100 years – waste management?
- Intensively used in automotive industry and for coatings
- Generation of microplastics

Aim of the study

The assessment of the aquatic ecotoxicity of Bakelite in form of small fragments used in automotive industry.



(Klun et al., 2022)

Results

Characterization

Table 1. The main characteristics of Bakelite microplastics

Parameters	Microplastics
Specific surface area (cm^2/g)	249
Mean number of particles per mg of microplastics	$1.5 \cdot 10^6$
Mean value of number particle size distribution (µm) (mean ± SD, n = 3)	7.64 ± 3.48

(Rozman et al., 2021)

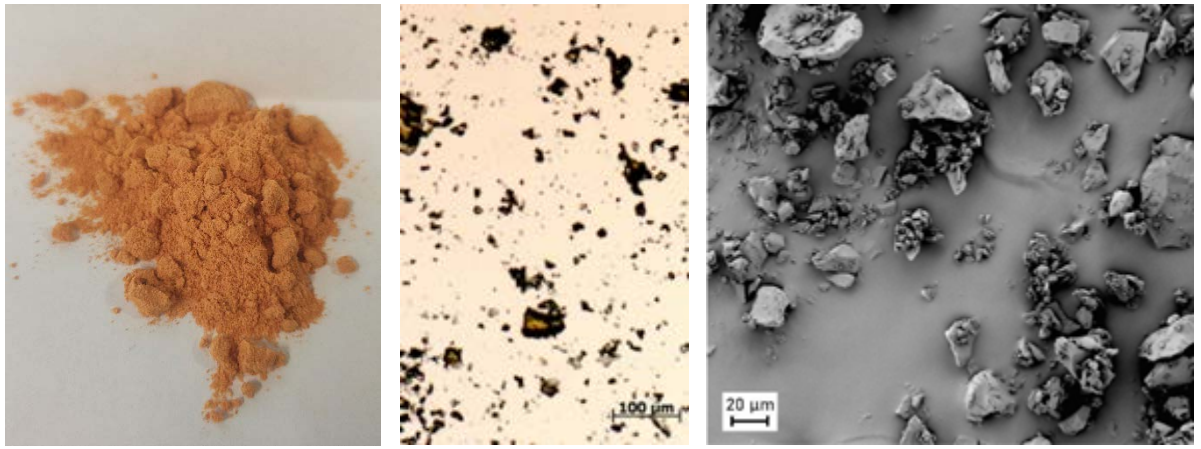


Figure 1. A picture of Bakelite microplastics (left), an image from an optical microscope (middle) and SEM image (right)

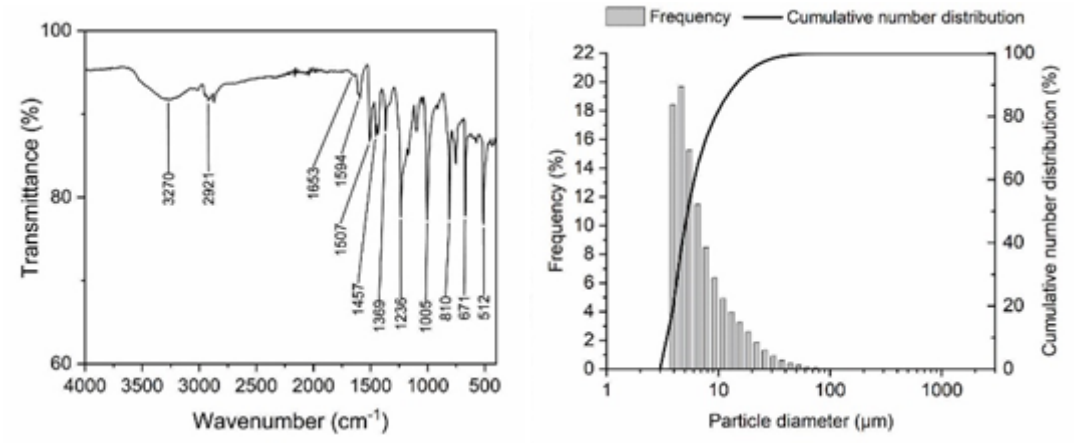


Figure 2. Fourier-transform infrared spectroscopy (FT-IR) spectrum of Bakelite microplastics (left) and particle size distribution (right).

(Klun et al., 2022)

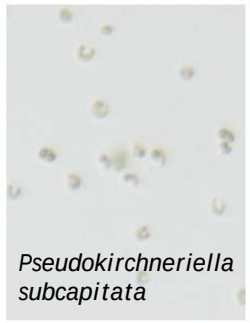
University of Ljubljana
Faculty of Chemistry and Chemical Technology

Results

Ecotoxicity testing


Daphnia magna


Lemna minor


Pseudokirchneriella subcapitata

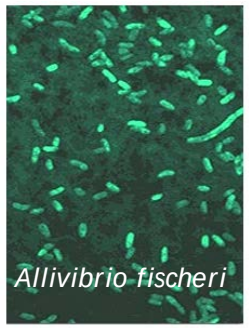

Allivibrio fischeri

Table 2. The effects of 100 mg/L Bakelite microplastics and its leachates on test organisms.

Organism	Exposure time	Inhibition (%)	
		Bakelite microplastics	Leachate
Daphnia magna **Mobility**	24 h	16 ± 2	100 ± 0
Lemna minor **Specific growth rate**	168 h	0 ± 0	0 ± 0
Root length	168 h	42 ± 7	31 ± 4
Allivibrio fischeri **Bioluminiscence**	30 min	12 ± 0	29 ± 1
Pseudokirchneriella subcapitata **Specific growth rate**	96 h	44 ± 10	11 ± 5

(Klun et al., 2022)

No metals

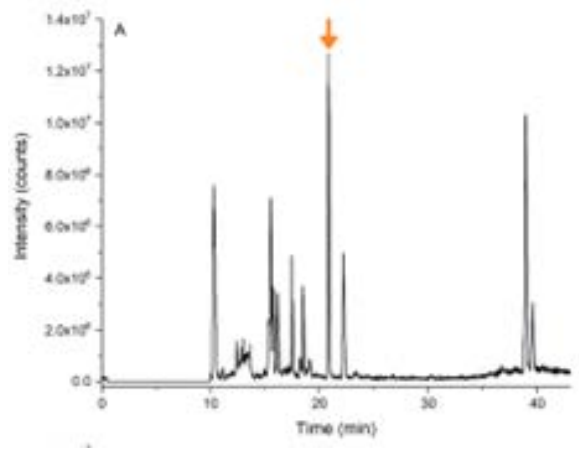


Figure 3: The total ion chromatogram (TIC) of precursor scan experiments of dansylated leachates.

Phenol and phenol-like compounds

Results

Ecotoxicity testing

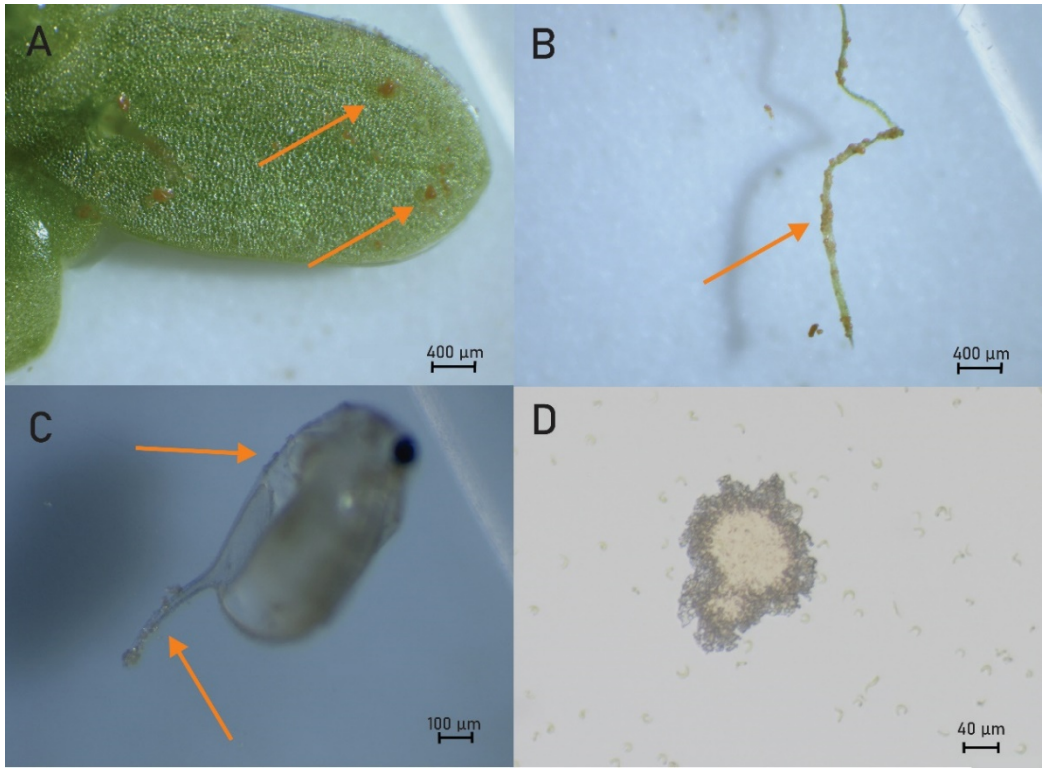


Figure 4: Bakelite microplastics adhered to (A) fronds and (B) roots of *L. minor*, (C) to body of *D. magna* and (D) overgrown by algae *P. subcapitata*.

(Klun et al., 2022)

Bioadhesion of Bakelite microplastics

Conclusions

Bakelite can leach hazardous compounds, especially phenol and phenol-like compounds.

Bakelite can adhere to aquatic organisms.

The waste management of Bakelite is important for reduction of its environmental impact.

Thank you for your attention!

University of Ljubljana
Faculty of Chemistry and Chemical Technology

arrs
SLOVENIAN RESEARCH AGENCY

Ula Rozman

Barbara Klun

PLASTI-C WETLAND

PLANT ERASTICS

PRIORITY

https://planterastics.fkkt.uni-lj.si/

https://www.facebook.com/planterastics

@Planterastics