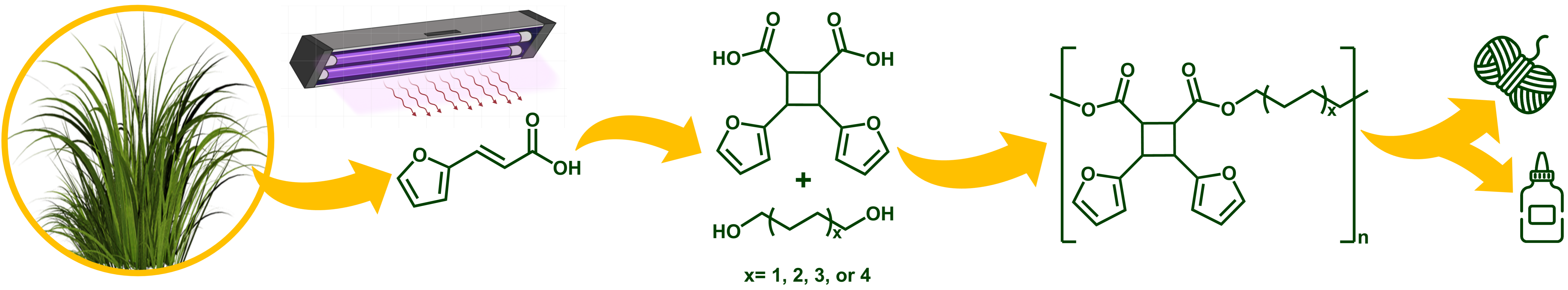


# SYNTHESIS OF SEMI-RIGID-BIOBASED POLYESTERS FROM RENEWABLE FURANIC CYCLOBUTANE DIACID

Luan Moreira Grilo<sup>1,2</sup>, Sara Faoro<sup>1,3</sup>, Beatriz Agostinho<sup>4</sup>, Andreia F. Sousa<sup>4</sup>, Nathanael Guigo<sup>5</sup>, Katja Loos<sup>1</sup>, Dina Maniar<sup>1</sup>, Talita Martins Lacerda<sup>2</sup>

<sup>1</sup>Macromolecular Chemistry and New Polymeric Materials, Zernike Institute for Advanced Materials, University of Groningen, The Netherlands.  
<sup>2</sup>Biotechnology Department, Lorena School of Engineering, University of São Paulo, Brazil.  
<sup>3</sup>Center for Education and Research on Macromolecules, CESAM Research Unit, University of Liege, Belgium.  
<sup>4</sup>CICECO-Aveiro Institute of Materials, Department of Chemistry, University of Aveiro, Portugal.  
<sup>5</sup>Institut de Chimie de Nice, Université Côte d’Azur, France.

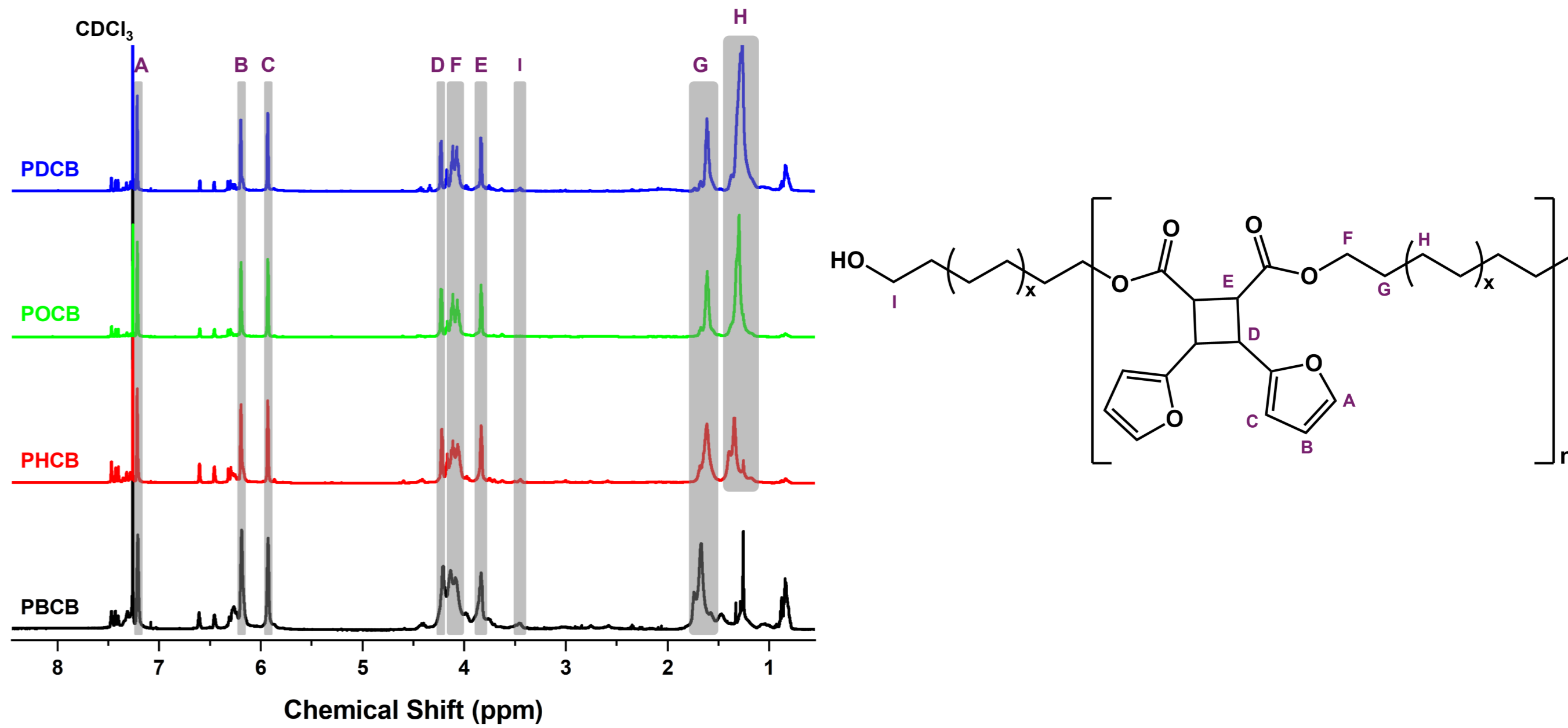
## Overview



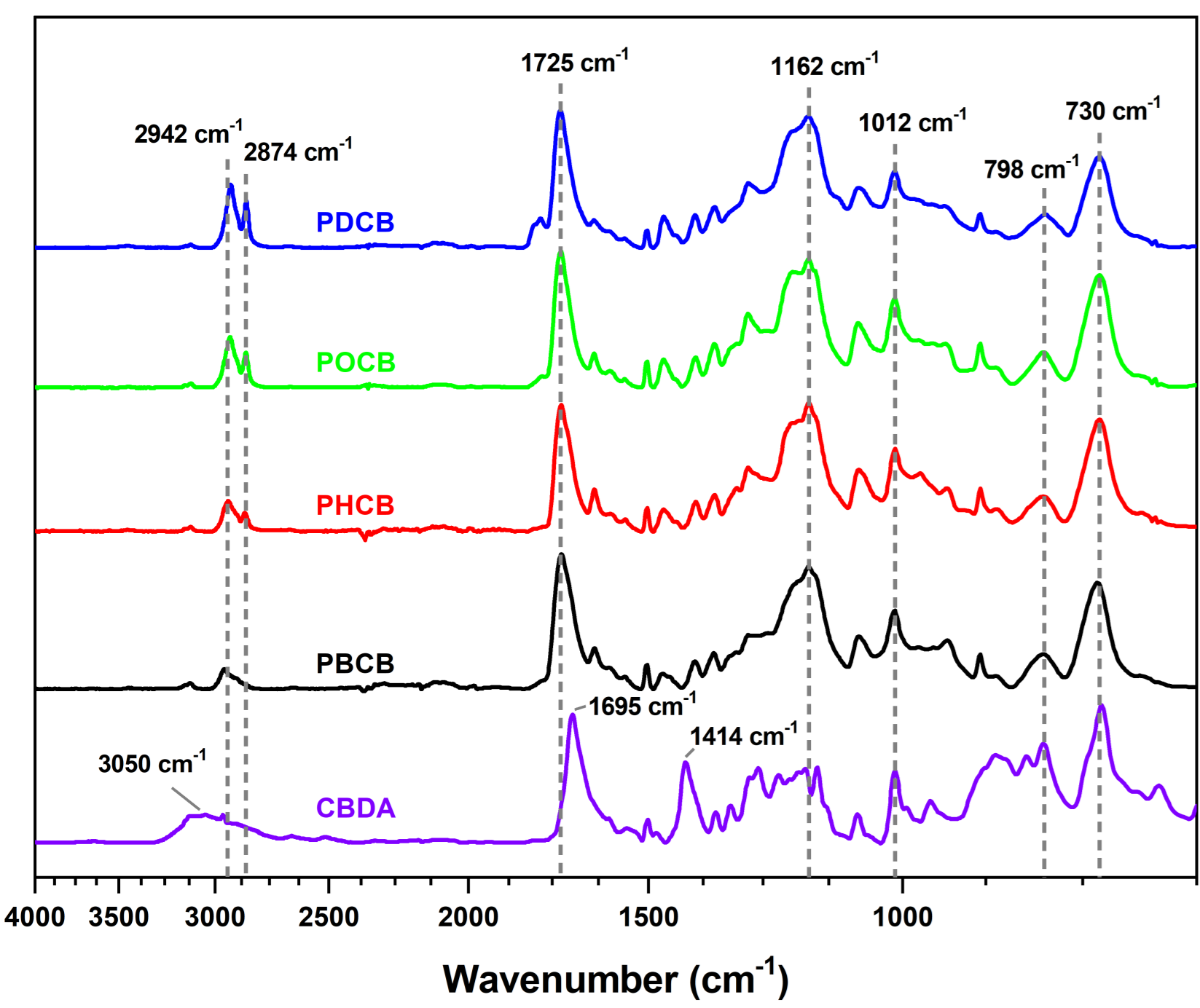
## Results & Discussion

Polyester	Sample code	Average yield (%)	$\overline{DP}_n$	$\overline{M}_n$ (g* $\text{mol}^{-1}$ )	$T_g$ (°C)	$T_{d5\%}$ (°C)	$T_{d10\%}$ (°C)	$T_{d50\%}$ (°C)	Char (%)
Poly(butylene cyclobutane-1,2-dicarboxylate)	PBCB	64.1	7	2 661	52	250	263	376	22.0
Poly(hexamethylene cyclobutane-1,2-dicarboxylate)	PHCB	43.1	10	3 960	18	261	277	362	21.8
Poly(octamethylene cyclobutane-1,2-dicarboxylate)	POCB	66.3	28	11 225	10	263	278	379	18.6
Poly(decamethylene cyclobutane-1,2-dicarboxylate)	PDCB	61.6	12	5 406	6	267	284	388	18.2

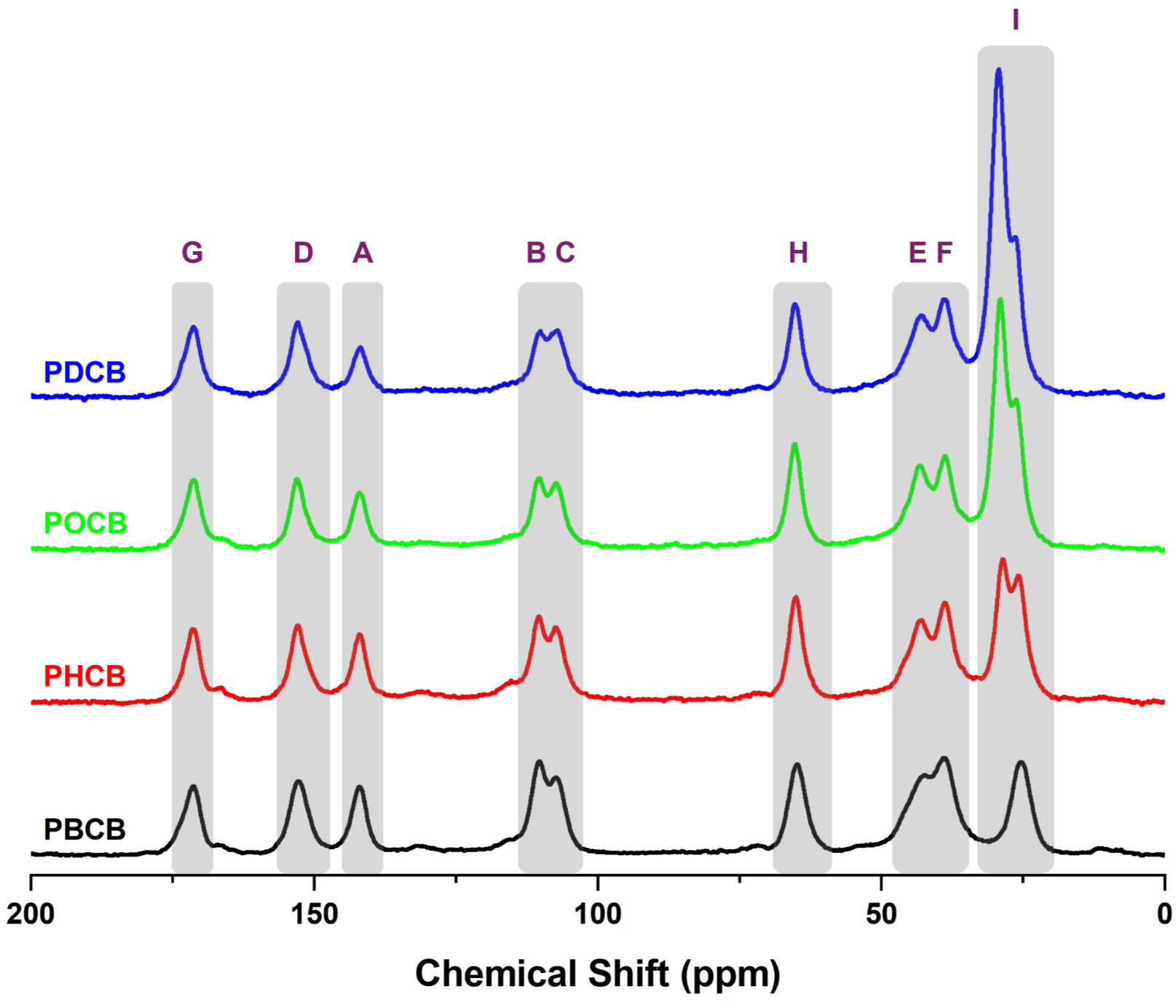
Properties summary of the synthesized polyesters



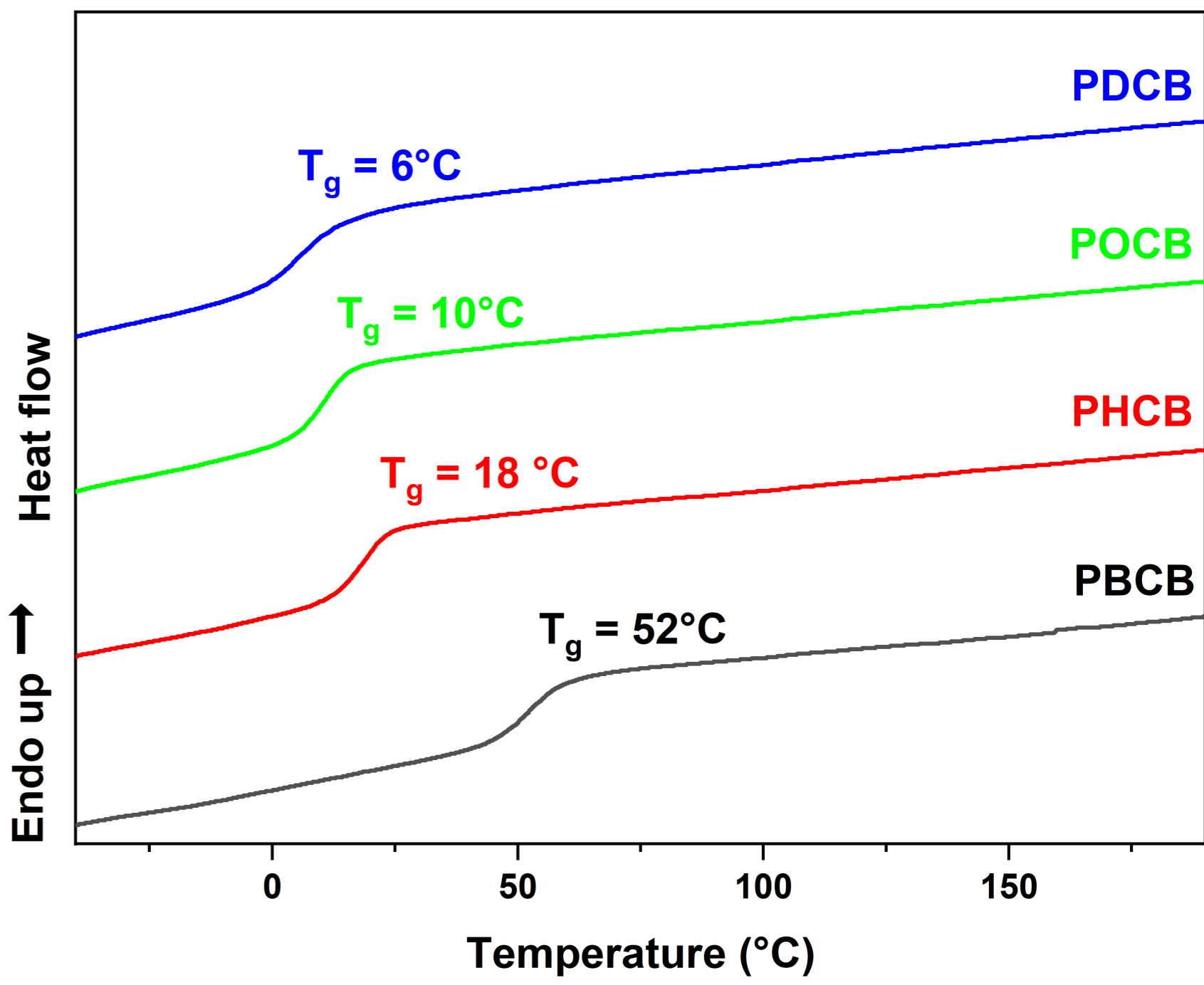
<sup>1</sup>H NMR spectra of the polyesters' soluble fractions



FTIR spectra of CBDA and its corresponding polyesters



<sup>13</sup>C CP/MAS NMR spectra of the polyesters



Polymers' DSC second heating curve

## Summary & Outlook

- 🎯 **CBDA was successfully polymerized with different diols:** Achieving yields up to 66% and  $\overline{M}_n$  up to 11 225 g/mol
- 🎯 **The synthesized polyesters displayed good thermal stability:**  $T_{d50\%}$  up to 388 °C and char-forming properties
- 🎯 **Tunable thermal transitions:**  $T_g$  varying from 6 to 52 °C depending on diol length
- 🎯 **The polyesters low solubility is an inherent feature of the materials:** <sup>13</sup>C CP/MAS NMR did not indicate crosslinking

## Outlook

- 🔍 **Further studies on these materials are necessary**  
To investigate their physical and mechanical properties, and  
To exploit their pendant furan groups for dynamic network formation

## References

Gandini, A. & Lacerda, T. M. **Furan Polymers and their Reactions**. Wiley (2023).  
Thiyagarajan, S. et al. **Green Chem.** 16, 1957–1966 (2014).  
Wang, Z. D. et al. **ACS Sustain Chem Eng.** 6, 8136–8141 (2018).  
Wang, Z. et al. **ACS Sustain Chem Eng.** 8, 8909–8917 (2020).

## Acknowledgements



university of  
 groningen

faculty of science  
 and engineering

zernike institute for  
 advanced materials



FAPESP