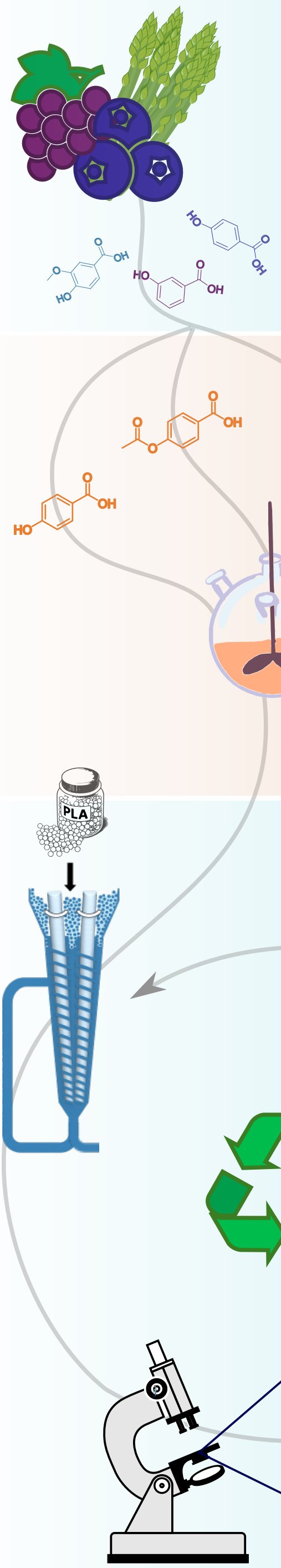
Melt-Recyclable Liquid Crystalline Polymers Composites Using Phenolic Acid monomers extracted from Local Green Waste

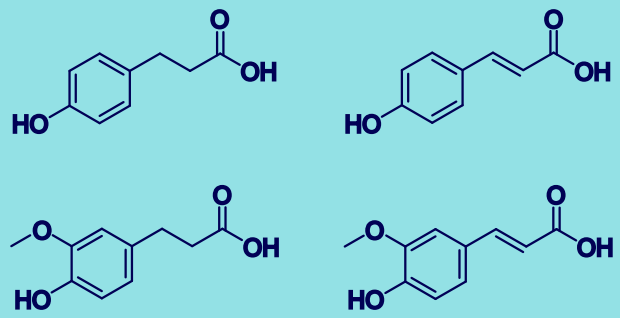
Filomena Cocco, Vincent Reinartz, Maryam Safari, Jules A.W. Harings

Aachen Maastricht Institute for Biobased Materials, Maastricht University



This project aims to develop fully melt-recyclable fibre-reinforced composites by exploiting the in-situ fibrillation of LCPs during melt processing.
Phenolic acids from local green waste are used as monomers, allowing control over LCP viscosity and fibril formation, key factors in tuning composite performance

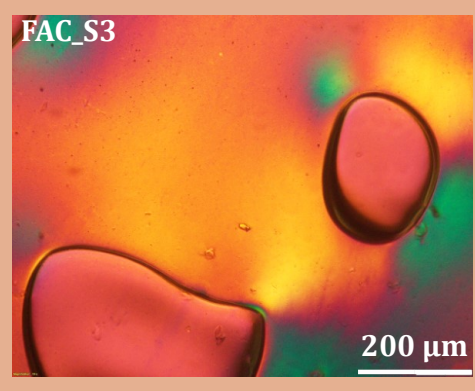
The focus is on how double bonds and functional groups, individually and in combination, affect the structural and mesogenic properties of liquid crystalline polymers, as well as how the chemical structure of LCP influences the mechanical properties of the final PLA/LCP product



To evaluate the influence of the synthesis pathway on key polymerization parameters, such as molecular weight, polymer density, yield, and overall process efficiency, three polymerization strategies are under investigation:

Steglich polycondensation
Acetyl-based polycondensation
Ester-based polycondensation

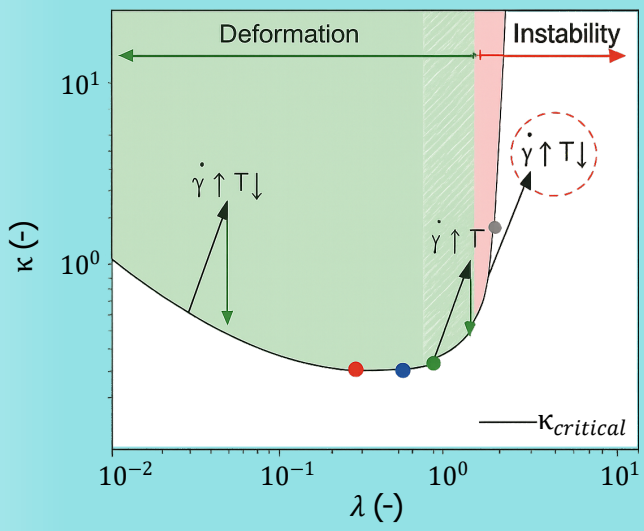
Sample	M_n	M_w	D
	[g/mol]	[g/mol]	[-]
FAC_E3	5.67×10^2	6.94×10^2	1.22
FAC_S3	5.18×10^3	1.22×10^4	2.36



Using LCP fibrils as self-reinforcing materials in recyclable polymers represents an innovative strategy for developing high-performance composites that can be fully reprocessed, as these fibrils, unlike conventional fibres, enable reshaping and direct reuse

However, LCP properties must be tailored to the polymer matrix according to the Grace plot:

$$\kappa = \frac{\eta_{matrix} * \dot{\gamma} * d}{\nu_{12}} \qquad \lambda = \frac{\eta_{LCP}}{\eta_{matrix}}$$



Future Outlook:

- Optimize polymerization routes to identify the impact of synthesis conditions and molecular weight on LCP properties
- Investigate the rheological behaviour to better control fibril formation during processing
- Assess recyclability and property retention over multiple melt-reprocessing cycles

Correspondence to:
Filomena Cocco

filomena.cocco@maastrichtuniversity.nl
www.amibm.org

Aachen Maastricht Institute for Biobased Materials (AMIBM)

Maastricht University

Brightlands Chemelot Campus
Urmonderbaan 22
6167 RD Geleen, The Netherlands