

## The Challenge

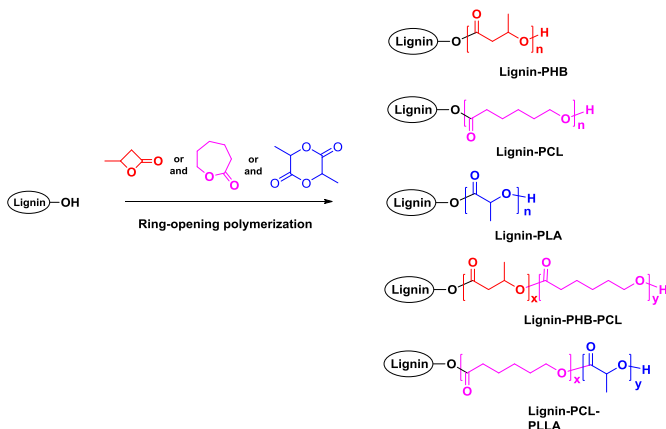
With plastic pollution one of the leading environmental issues, the quest for biodegradable plastics and substitutes for fossil fuel based products has become more pressing.

Green biomass such as lignin has been gaining attention as a potential substitute for fossil fuel based products. Lignin is a main constituent from plants and one of the most abundant natural polymers. It possesses many desirable properties. However, it is naturally brittle and incompatible with other polymer systems.

## About the Capability

IMRE scientists have developed a simple and convenient method to integrate lignin into green bioplastics with high performance properties.

The team synthesised various lignin-based polymers by solvent-free ring-opening polymerisation to overcome the brittle nature and poor dispersion of lignin in plastic composites.



*Synthesis of lignin-based bioplastics via solvent free ring-opening polymerisation*

## Key Features

- More ductile, less brittle
- High in tensile strength and toughness
- Anti-oxidative and anti-UV - neutralises free radicals and so reduces the 'aging' of the plastics under sunlight
- Renewable and biodegradable

## Potential Applications

- Reinforcement agents - Lignin copolymers can be used to improve mechanical properties of composite materials.
- Packaging materials
- Functional fillers or coatings

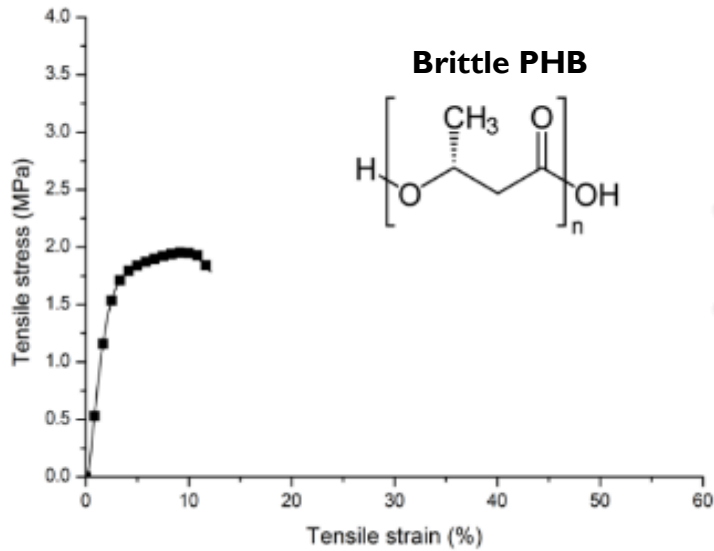
## Collaboration Opportunities

- With industries that could be part of the supply chain for lignin-based plastics:
  - those that generate large volumes of lignin as waste, e.g. pulp and paper mill industry, palm oil industry, to turn lignin into useful biodegradable products instead of just burning the lignin
  - agricultural industries to extract functional ingredients, besides lignin, from their waste products (e.g. coconut husks)
- With companies that deal with chemicals, plastic additives and packaging to use lignin as a green alternative to their traditional materials.

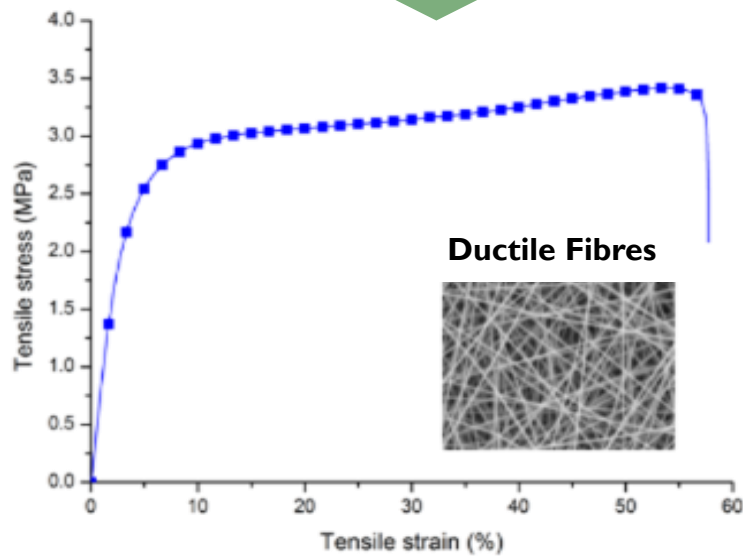
P.T.O.



## Performance Data



Lignin



Lignin copolymers improved the mechanical properties of poly(3-hydroxybutyrate) (PHB) plastics.

### References:

- Kai et al. Compos. Sci. Technol. 2018, 158, 26.
- Kai et al. ACS Sustain. Chem. Eng. 2017, 5 (7), 6016.
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