

# Impacts of Lignin Structures on the Lignin-grafted Polycaprolactone Copolymer, a new biomaterial

## Background

- Lignin-grafted-polycaprolactone (lignin-g-PCL) copolymers have a high application potential in plastic, composites, coating and the pharmaceutical industry. However, the effects of lignin chemical structural features on the ring opening polymerization of caprolactone to produce lignin-g-PCL have not been examined.

## Approach

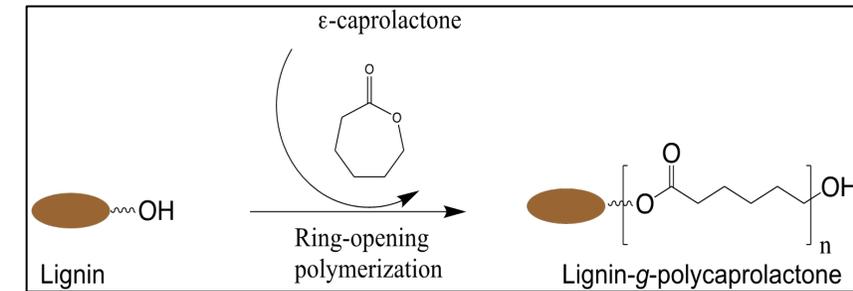
- Lignin-g-PCL copolymers were synthesized with lignin having various types of chemical structures generated from softwood (G-type), hardwood (G/S-type), and monocotyledonous angiosperm Vanilla orchid seeds (C-type).

## Outcomes

- All types of the studied lignins showing good reactivity to the copolymerization reaction regardless of their plant source and isolation methods.
- The molecular weight of the synthesized lignin-g-PCL copolymers were positively correlated with the content of aliphatic lignin hydroxyl groups, suggesting that the copolymerization reaction occurs preferentially at the aliphatic hydroxyls rather than the phenolic hydroxyls of lignin.
- Lignin copolymerization reduced the melting temperature and crystallinity of copolymer with the linear C-type lignin resulting in distinct thermal property as compared to the branched G- and G/S-type lignin.

## Significance

- This study demonstrated the influences of the lignin structure on the synthesis of lignin-grafted copolymer, providing potential route on lignin valorization in the form of synthesizing lignin-based copolymers for innovative applications.



Synthesis of lignin-g-PCL using different types of lignin sources: Kraft lignin (KL), organosolv pine lignin (OPL), organosolv poplar lignin (OPOPL), and organosolv Vanilla seed lignin (OVSL).

