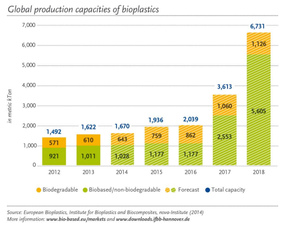
Phosphorus-containing flame retardant in building applications with flame retardancy, thermal stability and processability

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BACKGROUNDS

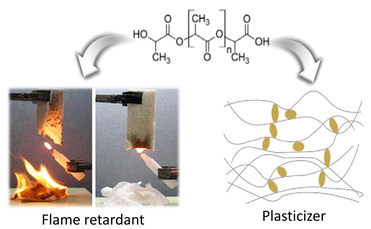
Trend of bioplastic

- ✓ PLA is one of the most promising bio-plastic as a substitute of petroleum-based plastics because it is eco-friendly and can be produced from sustainable resources
- ✓ However, the brittleness and the flammability of PLA restrict several applications



Objectives

- ✓ Preparation of a polymeric phosphorus flame retardant
- ✓ Enhancement on flame retardancy of PLA
- ✓ Improvement on brittle property of PLA

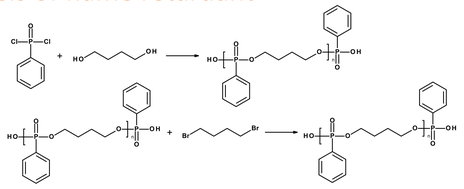


EXPERIMENTAL

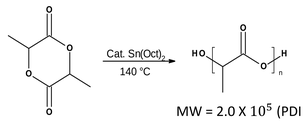
Synthesis of flame retardant

PBPP1 (n = 2)

PBPP2 (n = 5)



Polymerization of L-lactide



MW = 2.0 X 10^5 (PDI = 1.26)

Formulation of specimens

Sample	PLA (wt%)	PBPP2 (wt%)
PLA-0	100	-
PLA-1	99	1
PLA-3	97	3
PLA-5	95	5

Plasticizing effect

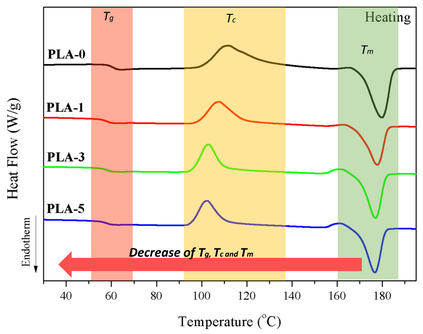


Figure 5. The melting behaviors of the specimens on DSC thermograms

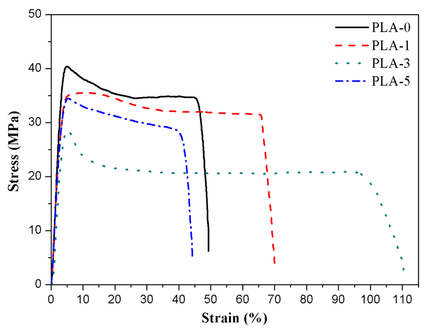
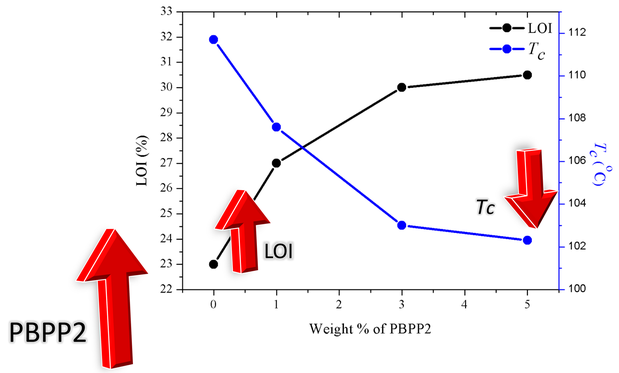
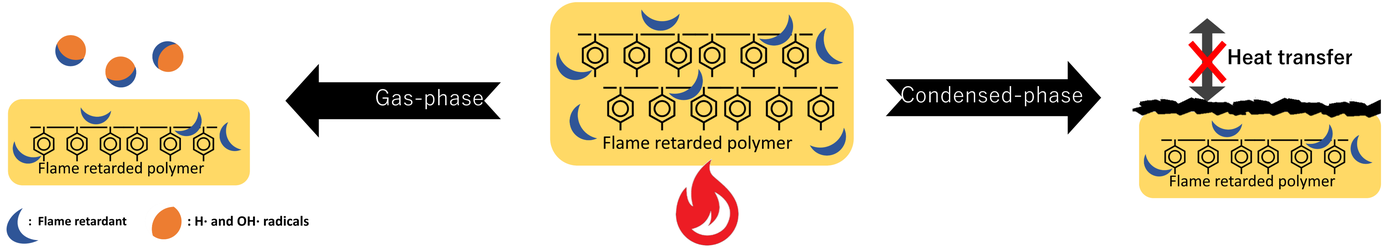


Figure 6. Tensile properties of the specimens

Summary



Flame retarding mechanism



RESULTS

Preparation of specimens

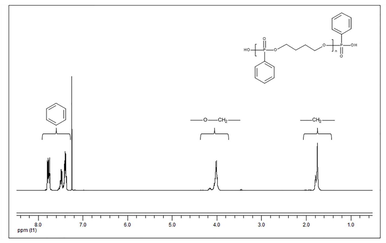


Figure 1. ^{1}H NMR spectra of flame retardant (PBPP2)

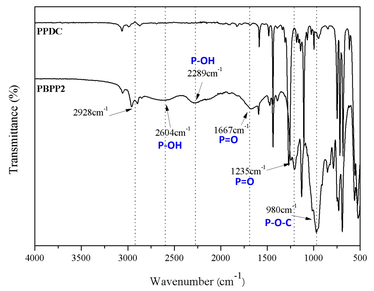


Figure 2. FTIR spectra of PBPP2

Flame retarding effect

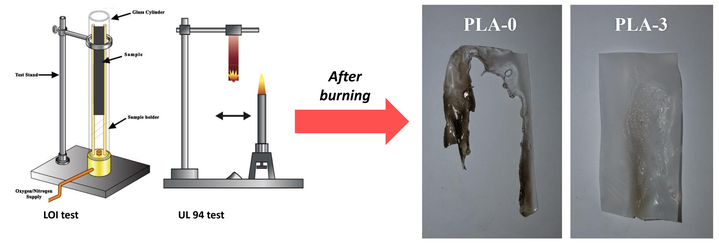


Figure 3. Photographs of PLA-0 and PLA-3 after burning

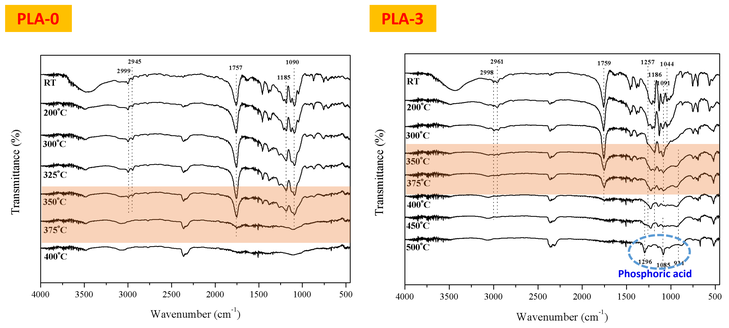


Figure 4. RT-FTIR spectra of PLA-0 and PLA-3

CONCLUSION

- ➢ Synthesis and characterization of a phosphorus flame retardant, PBPP2
- ➢ The increment of LOI and the achievement of V-0 for PLA-3
- ➢ The decline of *Tg*, *Tc* and *Tm*, and the increase of the elongation of PLA-3 compared to PLA-0
- ➢ Confirmation of act simultaneously served as flame retardant and plasticizer on PLA