



Determination of water uptake and diffusion coefficient of polymer/lignin composites



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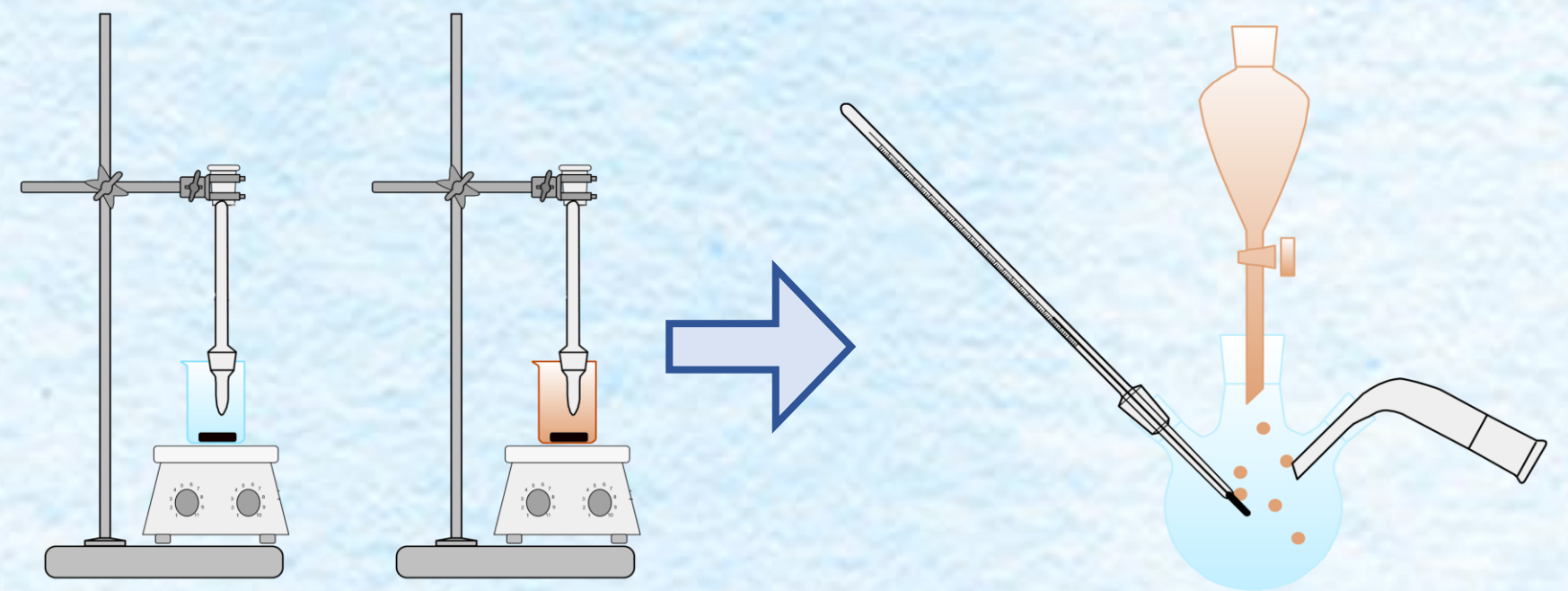
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Introduction

Although lignin is one of the most abundant natural polymers and possesses a wide range of properties, it is largely treated as waste. Utilizing lignin as a filler in the synthesis of polymer matrix-based composites represents a move toward more sustainable polymer production. In this study, lignin/polymer composites were synthesized using in-situ miniemulsion polymerization.

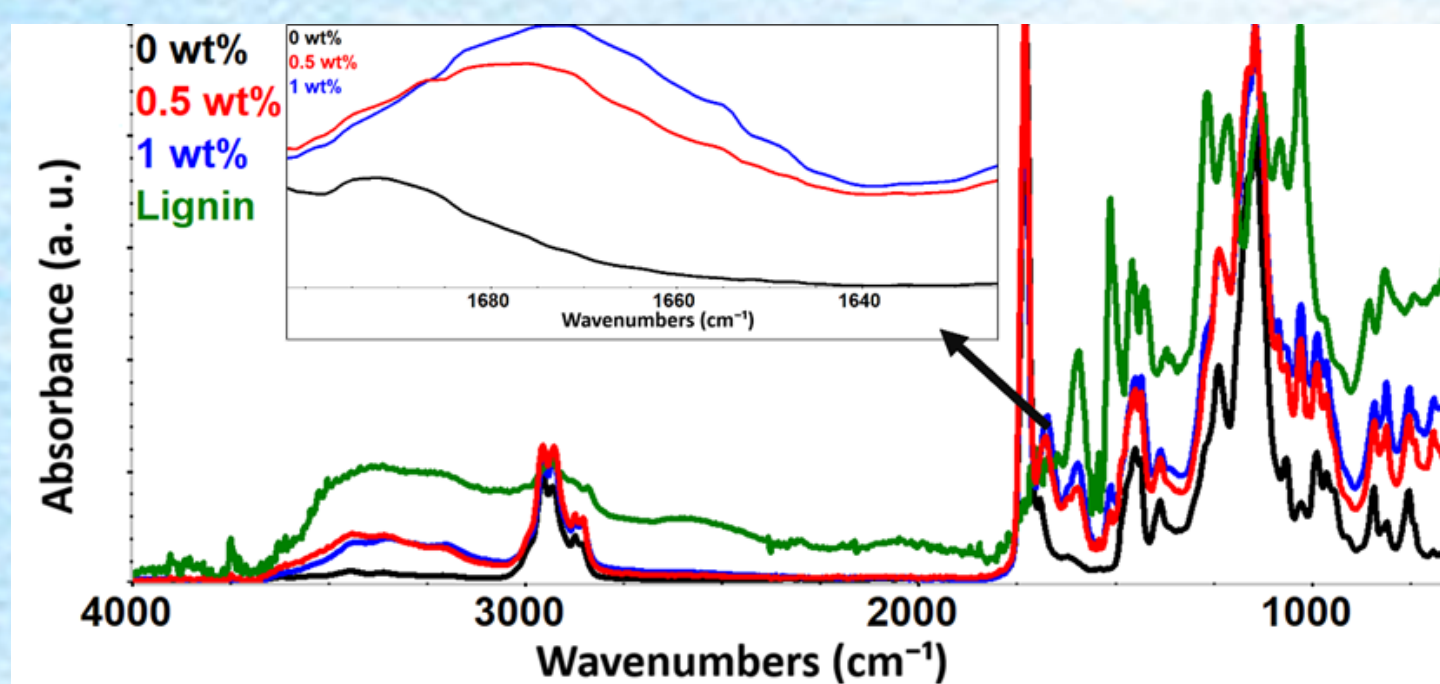
Method

In-situ emulsion polymerisation

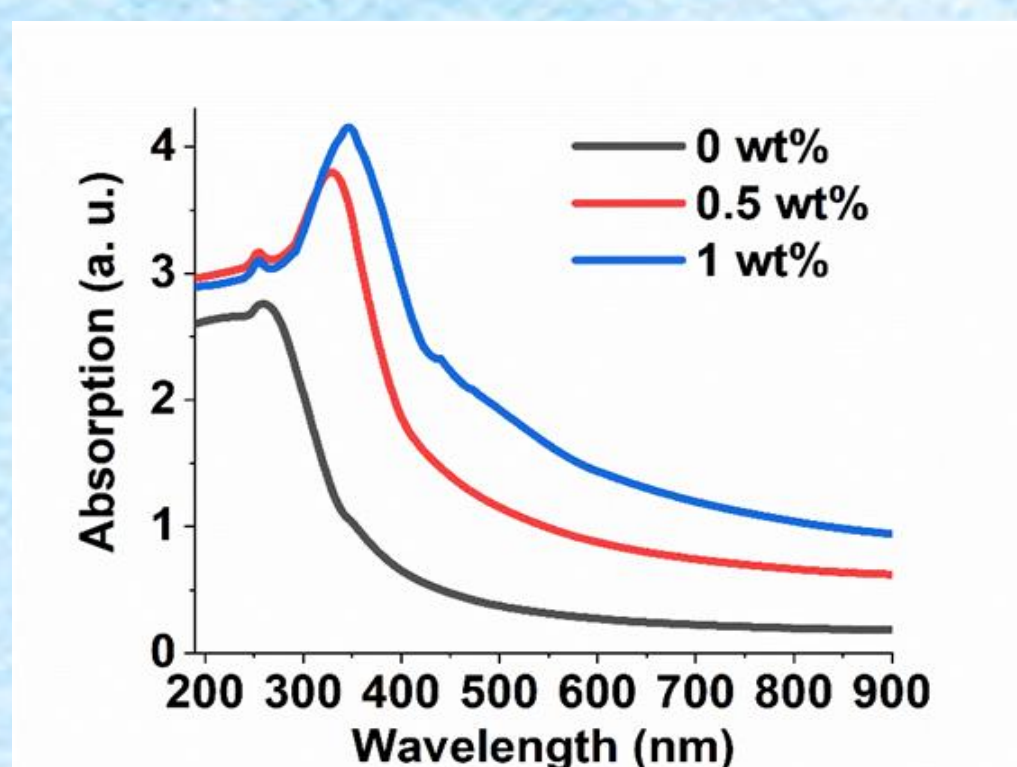


Monomer system → MMA, BA, AAm
Lignin → 0.5 and 1 wt% based on monomers

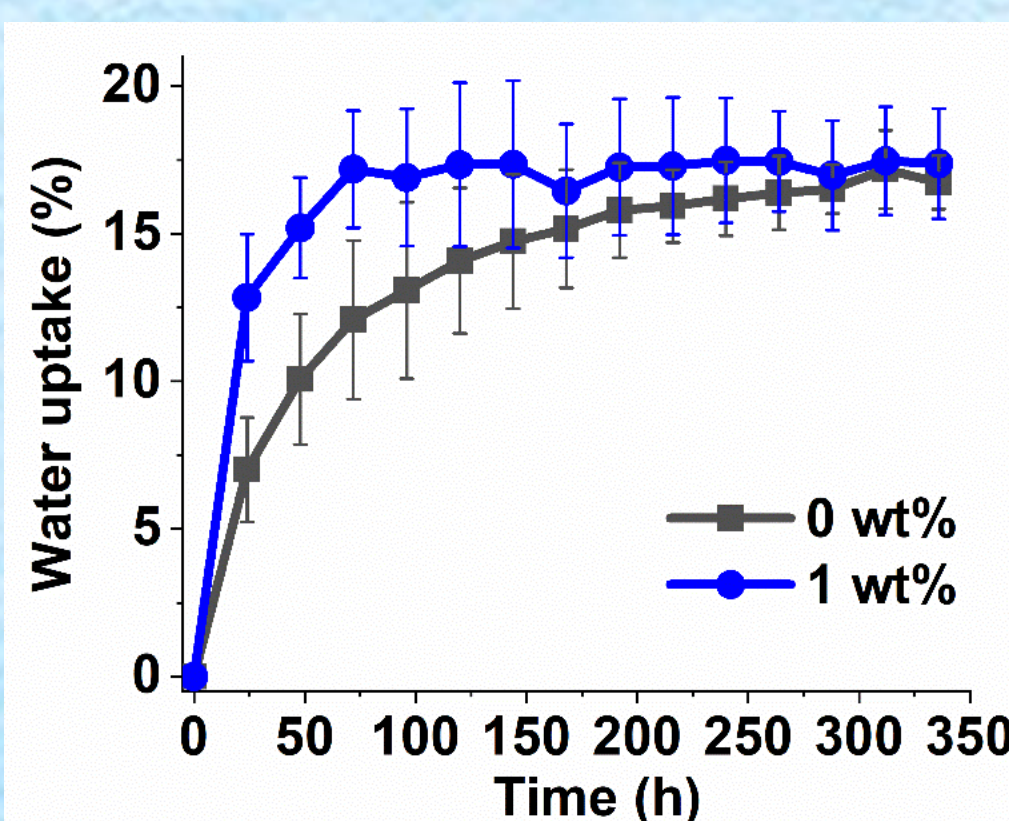
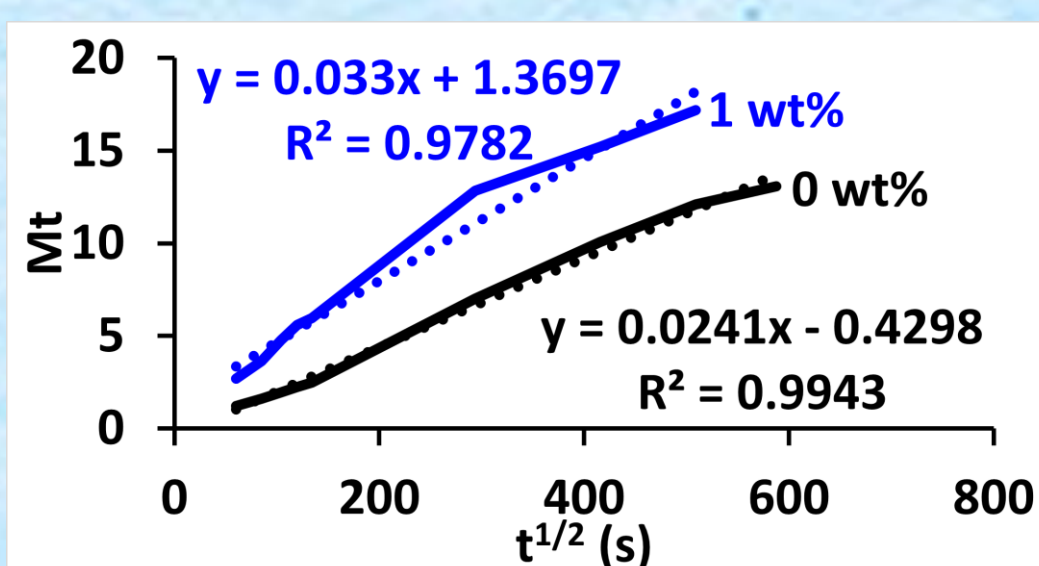
Results and discussion



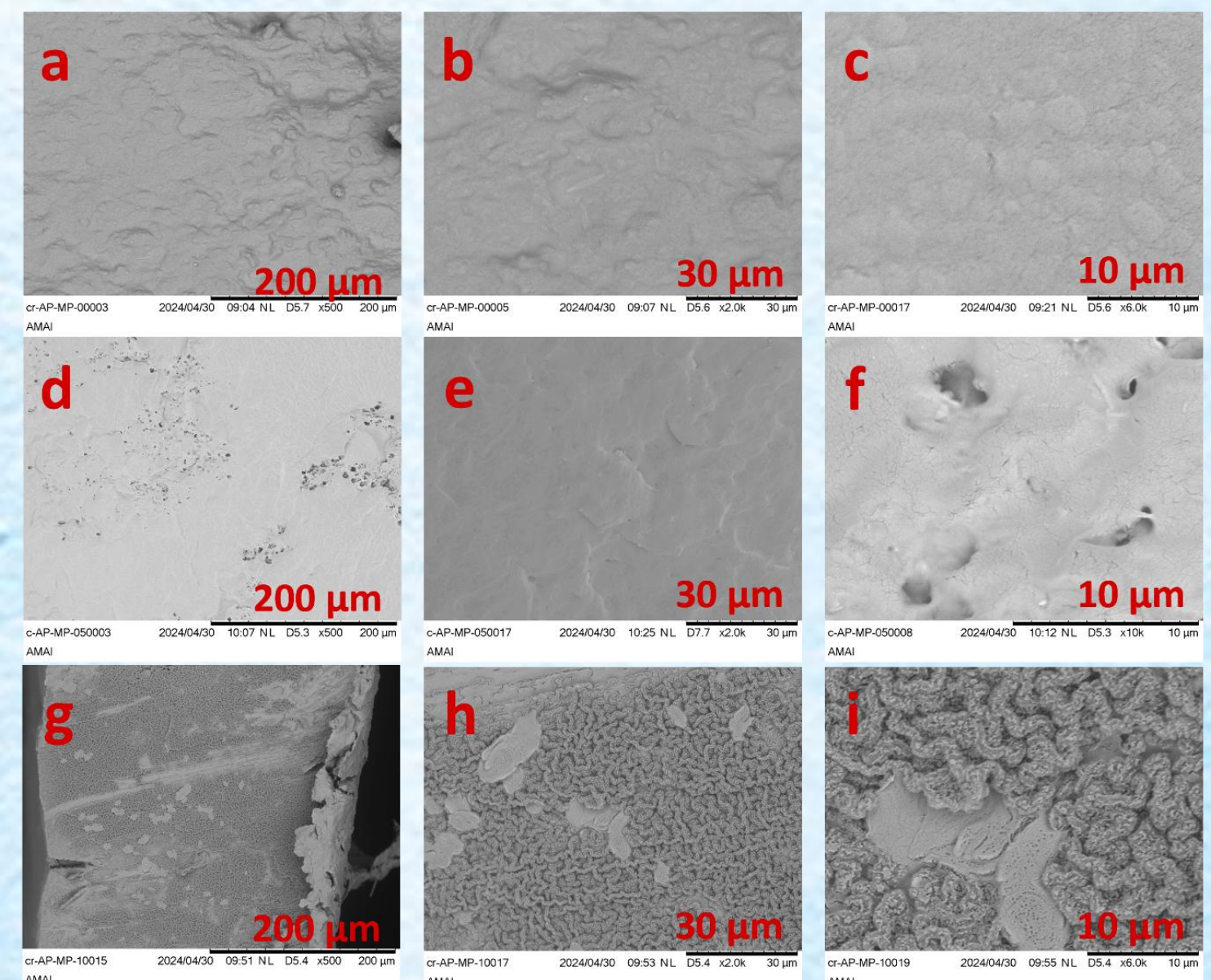
Successful incorporation of lignin



Enhanced UV-Vis absorption



Higher lignin content → improved dispersion



SEM microographies of neat polymer (a, b and c), the composite with 0.5 wt% lignin (d, e and f) and the composite with 1 wt% lignin (g, h, and i)

Faster saturation and improved water absorption stability

Conclusion

Waterborne lignin/polymer composites are a key step toward sustainable materials.

The incorporation of 1 wt% lignin offers improved hydrolytic stability with minimal lignin content.

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| Sample | Water diffusion coefficient (m ² /s) |
|----------------------|---|
| P(MMA/BA/AAm) | 2.226 * 10 ⁻¹¹ |
| 1wt% L/P(MMA/BA/AAm) | 1.375 * 10 ⁻¹¹ |