

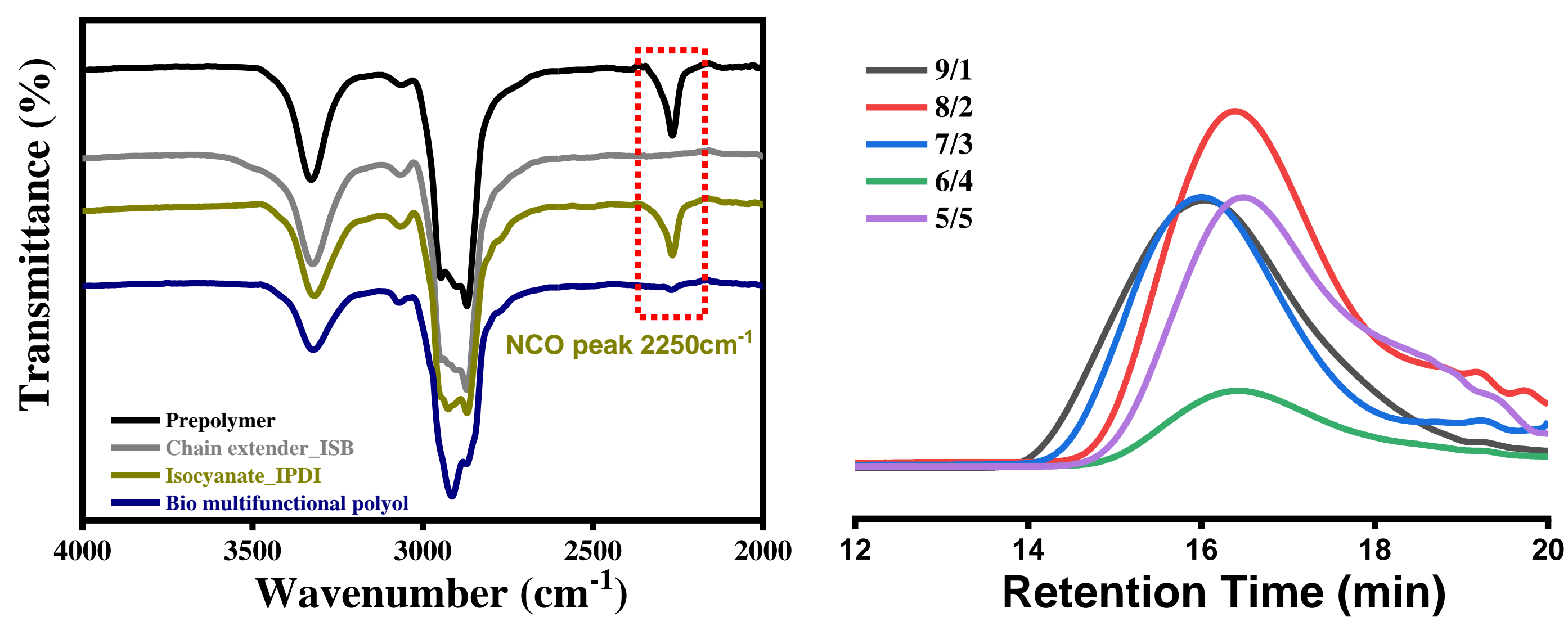
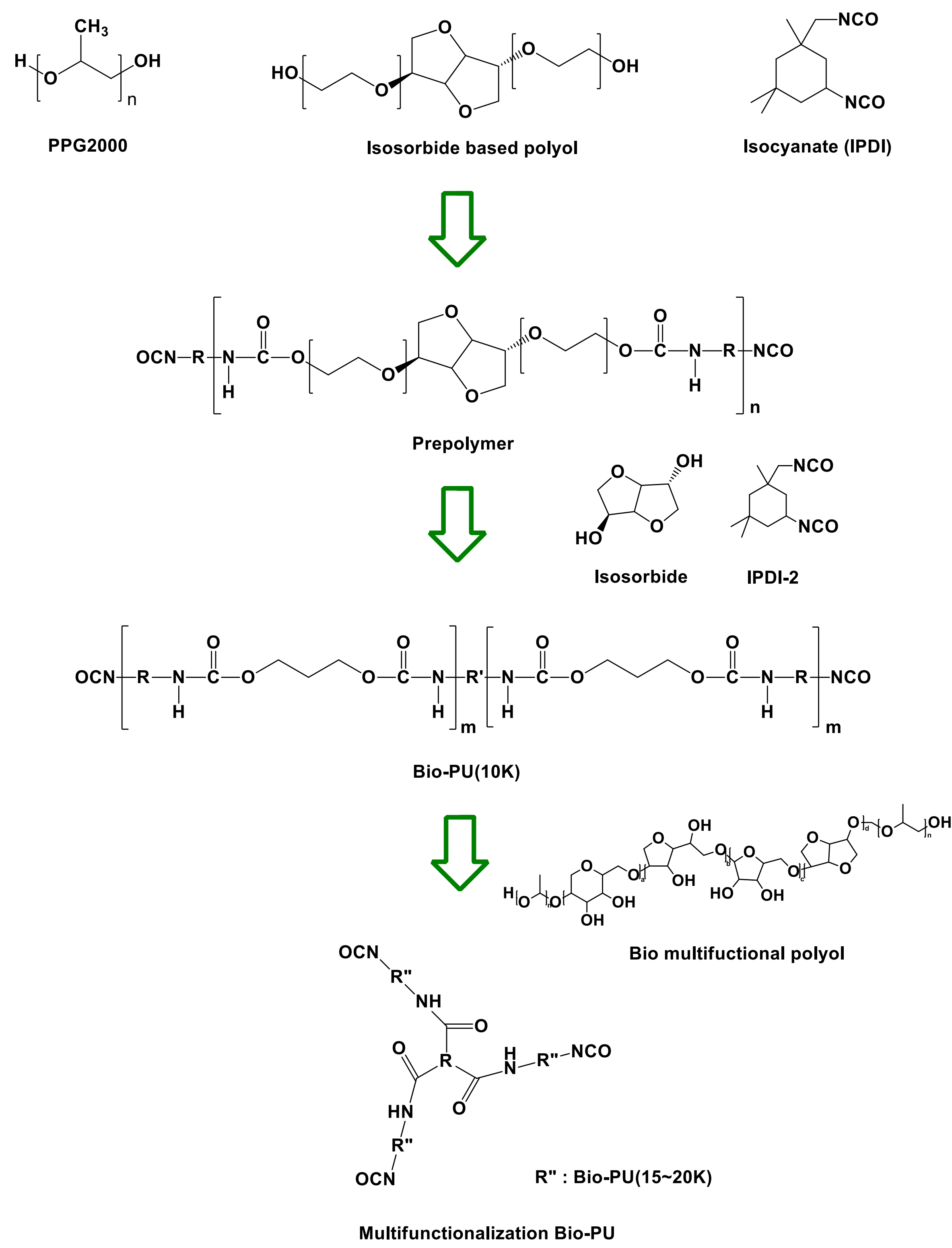
Study on the Characteristics of Bio-Based Adhesive Polymers as Alternatives to Petroleum-Based Polymers

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Abstract

The decline of petroleum resources and growing environmental concerns have highlighted the need for sustainable alternatives. This study aims to develop bio-based polyurethane (bio-PU) as a substitute for petroleum-based adhesives. To enhance its performance as a structural adhesive, multifunctional polyols derived from isosorbide were introduced to improve both mechanical strength and biocompatibility. The study investigated the mechanical properties by varying the hard-to-soft segment ratio of bio-PU from 9:1 to 5:5. FT-IR and GPC analyses confirmed the proper formation of molecular structures and the target molecular weight (about 15,000 g/mol). Shear strength was measured using a universal testing machine (UTM), and the optimal shear strength was observed at a hard-to-soft segment ratio of 7:3, demonstrating the adhesive's enhanced functionality. Furthermore, the incorporation of a core-shell rubber (CSR) structure improved impact strength and durability, with FE-SEM analysis confirming uniform spherical CSR particles with an average diameter of 3–6 μm. By adjusting the CSR content, diverse shear strength characteristics were achieved when mixed with epoxy. This study demonstrates the potential of bio-based polyurethane as a sustainable alternative to petroleum-based adhesives and highlights its applicability as an eco-friendly material.

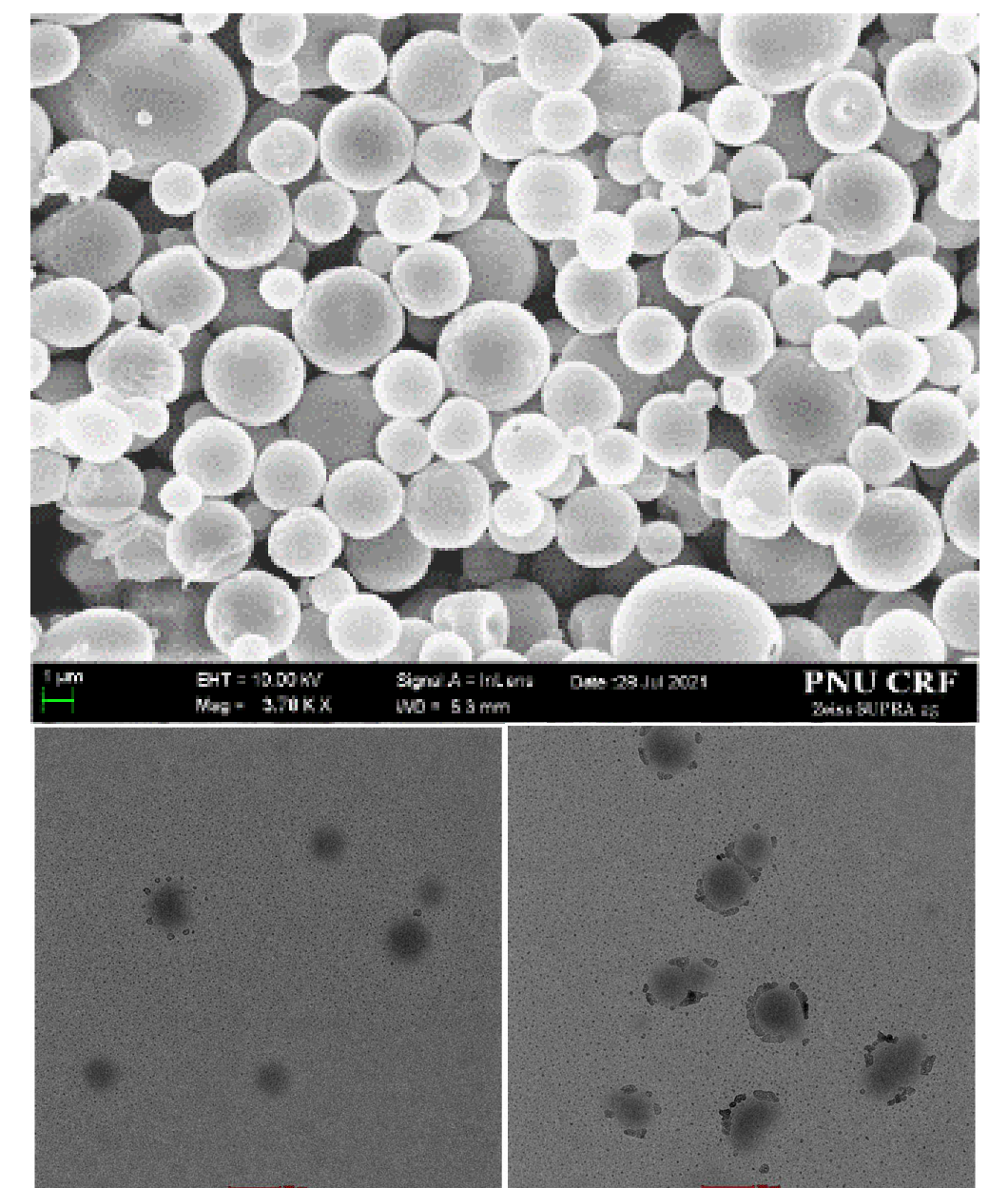
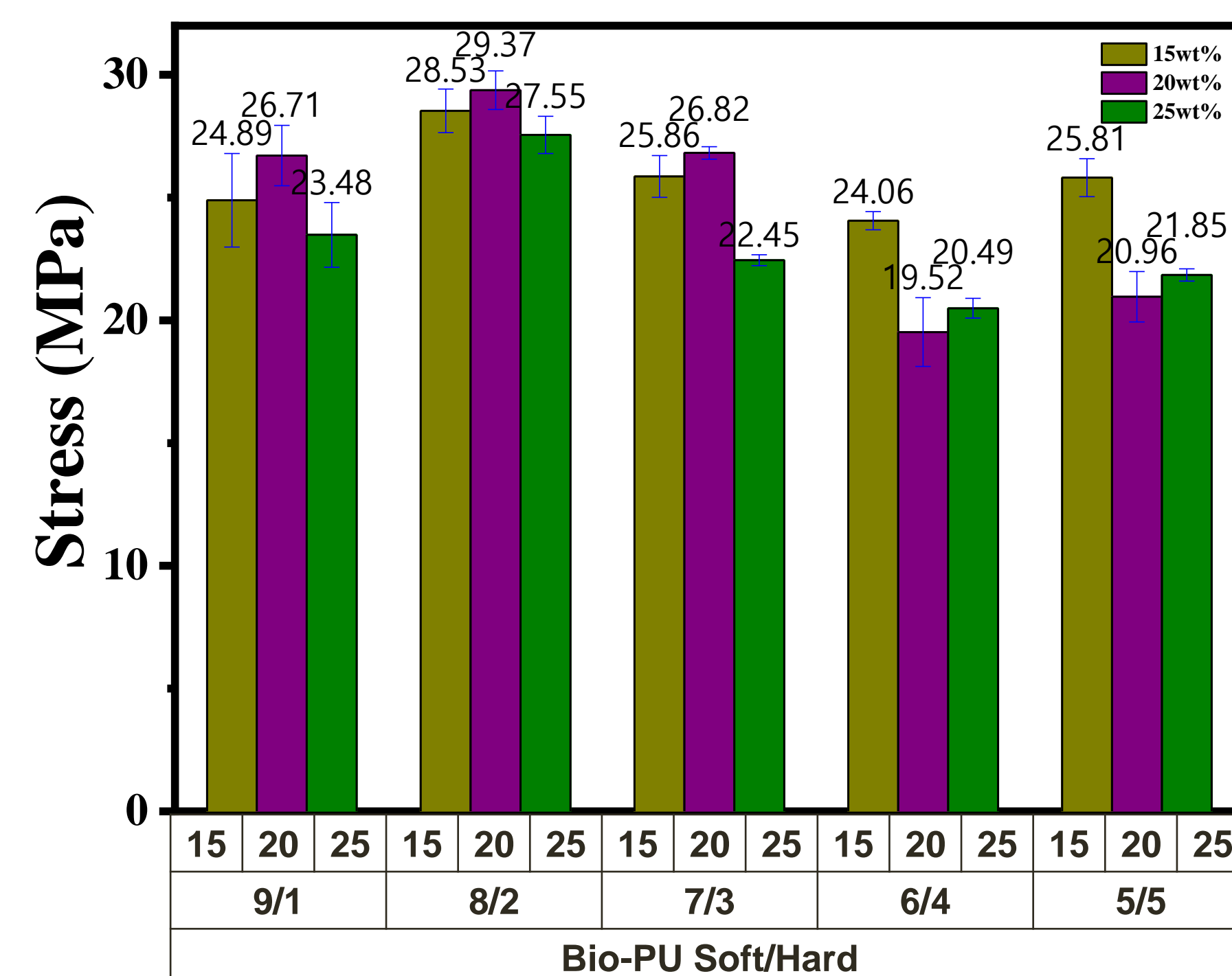
Experimental



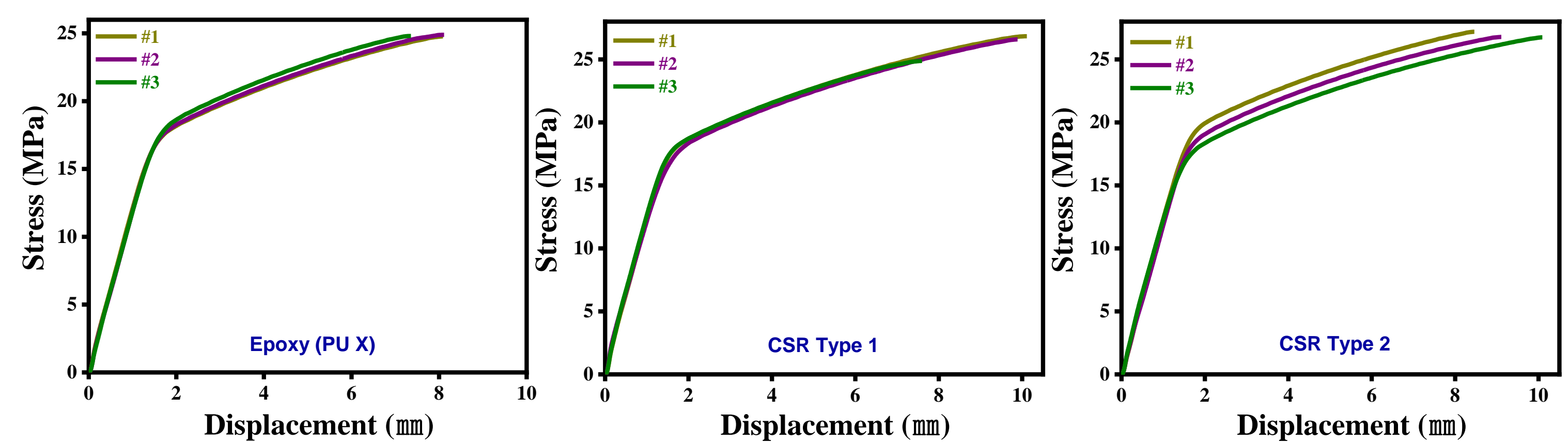
Result & Discussion

- The higher the hard segment ratio → the lower the shear strength and the lower the blending ratio with epoxy
- Polymerization of two types of CSR (Core Shell Rubber) with PU
→ FE-SEM: Measuring the shape of a regular sphere of 3-6 μm
- Shear strength → 5.12% and 8.42% increase, respectively

Shear Strength & FE-SEM



CSR → Shear Strength



Conclusion

- ✓ Successful synthesis of bio-based polyurethanes and core shell rubber
- ✓ Soft/Hard ratio (9/1, 8/2, 7/3) → Maximum shear strength at 20wt%
- ✓ Securing a constant pore size of 3-6 μm through spray drying of CSR
- ✓ Add an appropriate amount of two type CSR to epoxy → Maintain shear strength

Acknowledgement

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