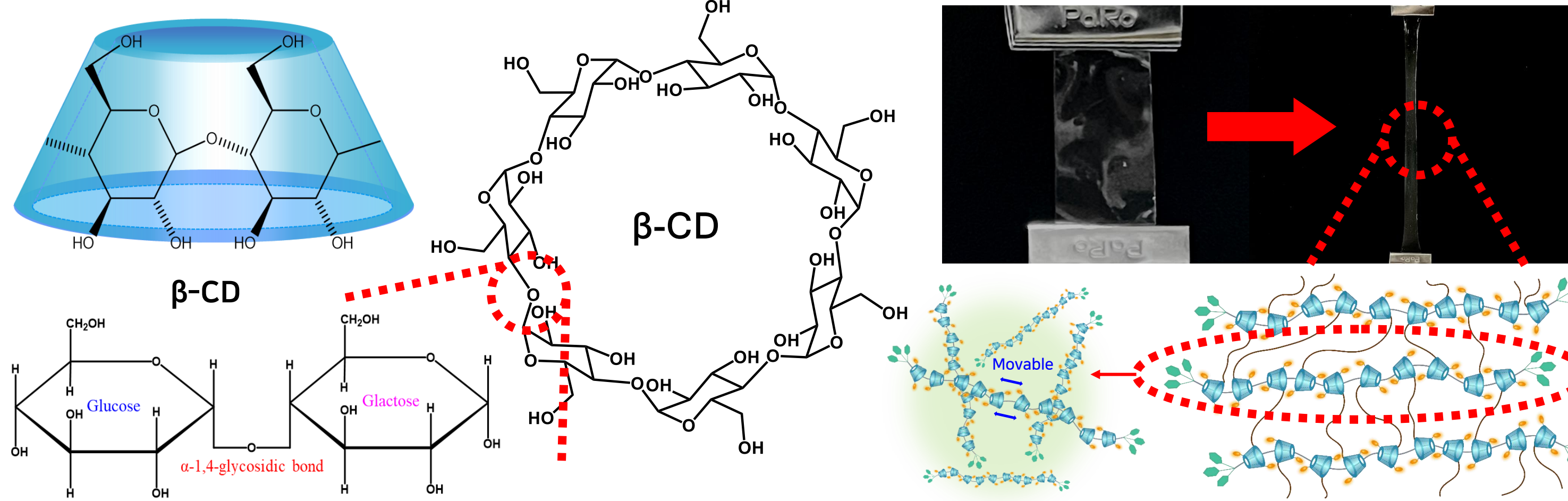
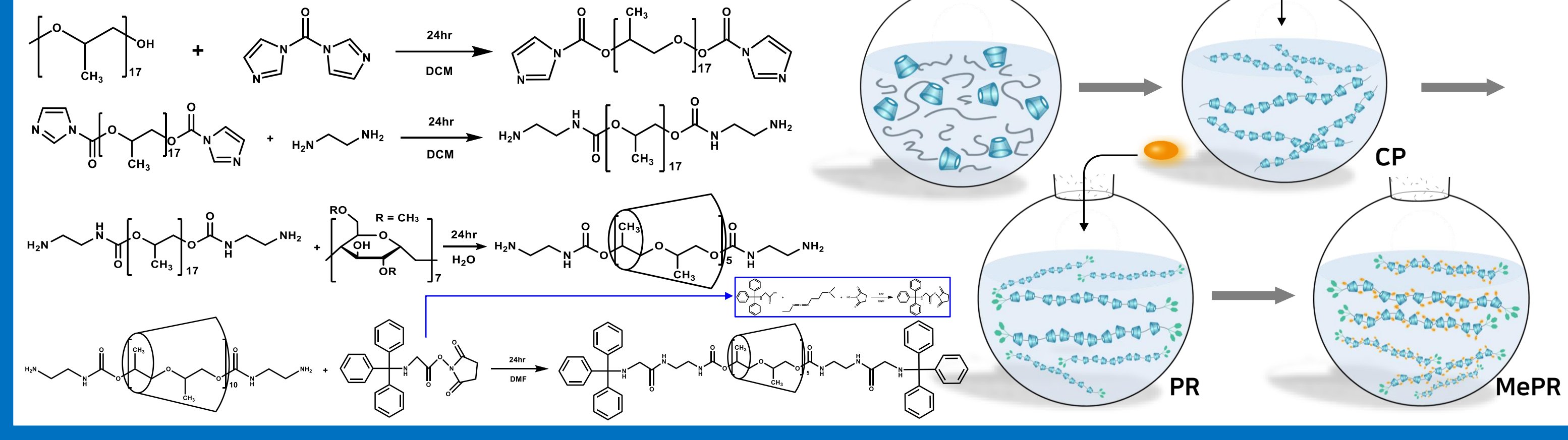


Abstract & Introduction

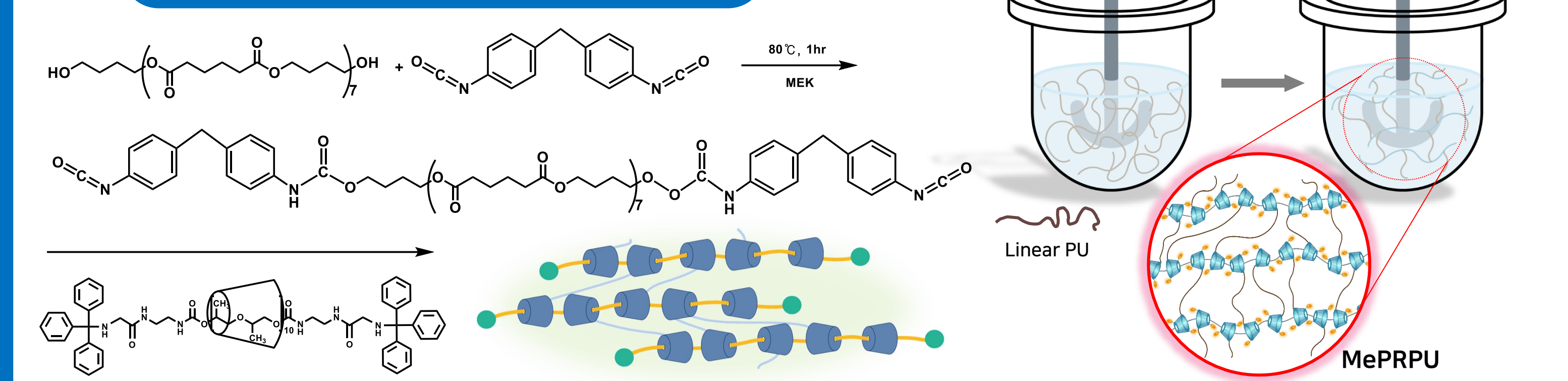
The study of physically strong and stretchable polymers is still a challenge. In this study, highly stretchable low covered movable slide-ring polymer film was synthesized by crosslinking poly(propylene glycol)-methyl- β -cyclodextrin polyrotaxane (MePR) with diisocyanate. Methylated polyrotaxane was synthesized from methylated β -cyclodextrin (Me- β -CD) and poly(propylene glycol) (PPG) with a molecular weight of 4000, and expected to have higher elongation properties than full covered polyrotaxane because of easier movement of ring structure along the main chain. The slide ring movement of crosslinked Me- β -CD on polyurethane backbone allows to stretch without deformation. These unique properties of the resulting polyurethane potentially act as flexible materials and create new opportunities for biomedical applications. The low covered polyrotaxane and polyurethane were characterized by FT-IR and ¹H-NMR spectroscopies. In addition, the elongation of polyurethane was shown through tensile strength measurement.



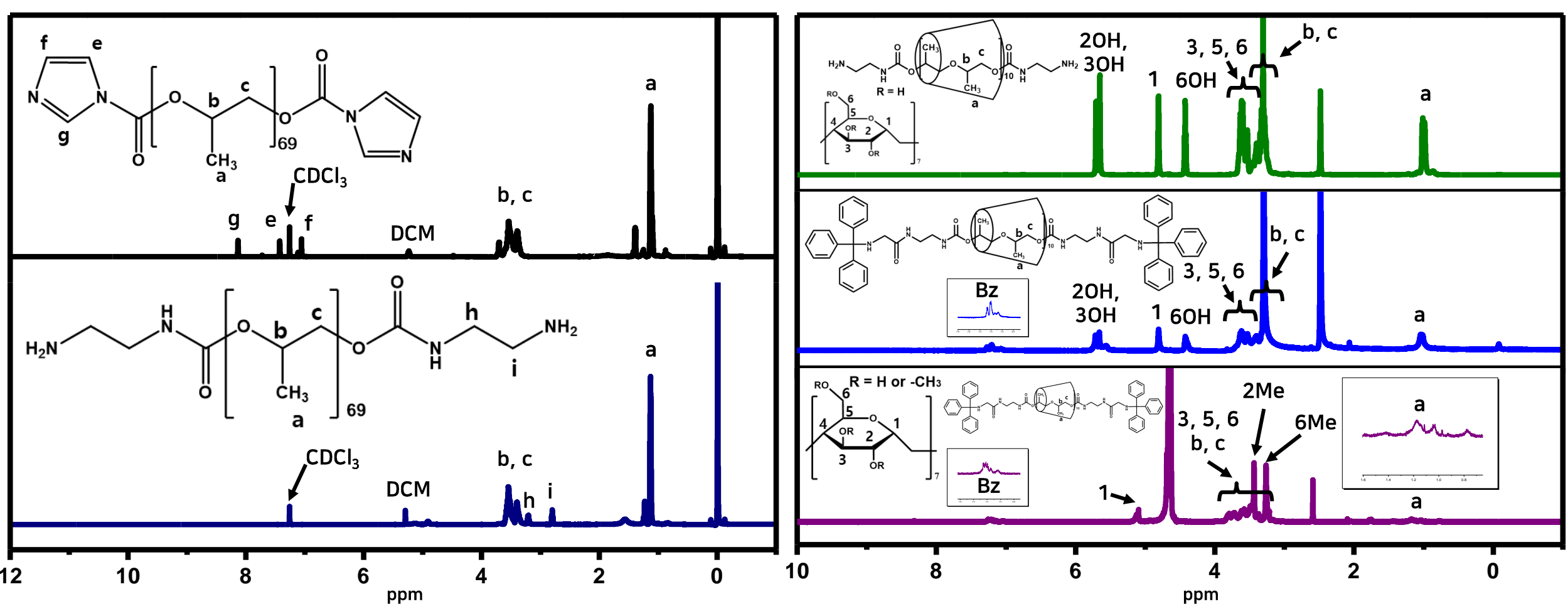
Experimental_MePR



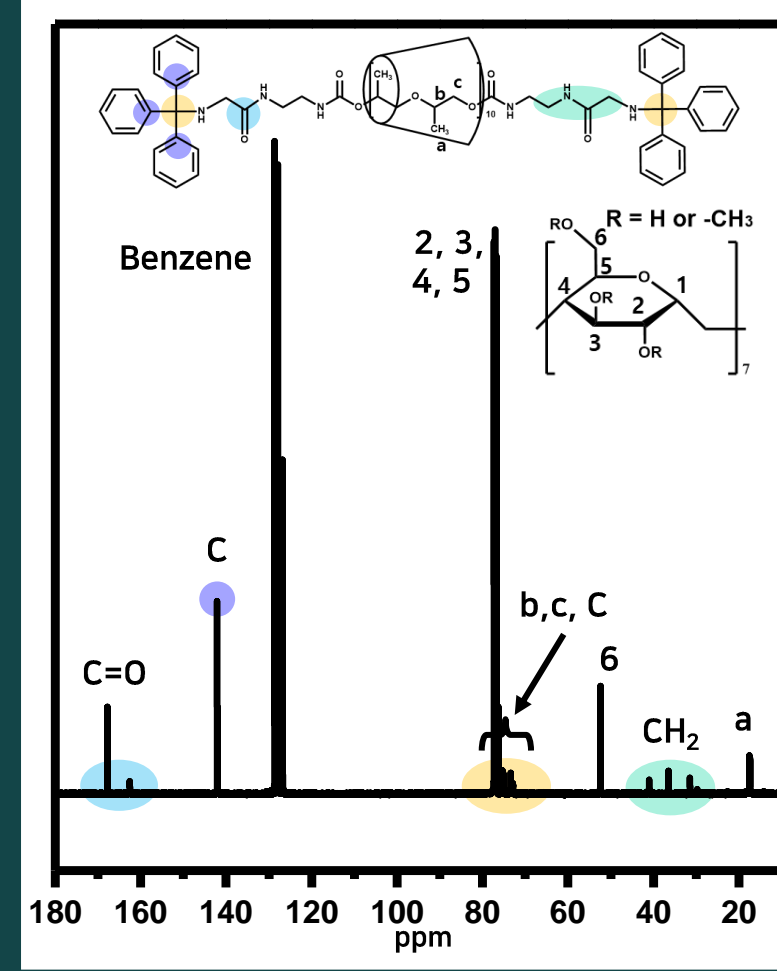
Experimental_MePRPU



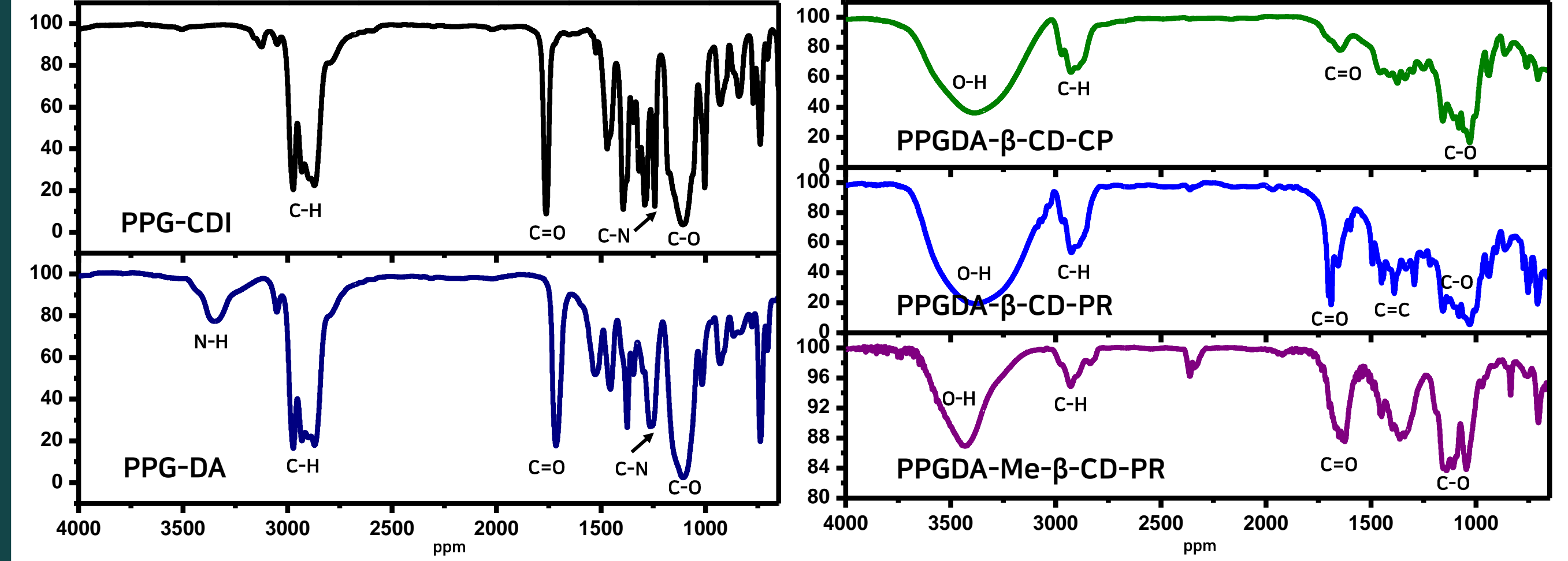
¹H-NMR of PR



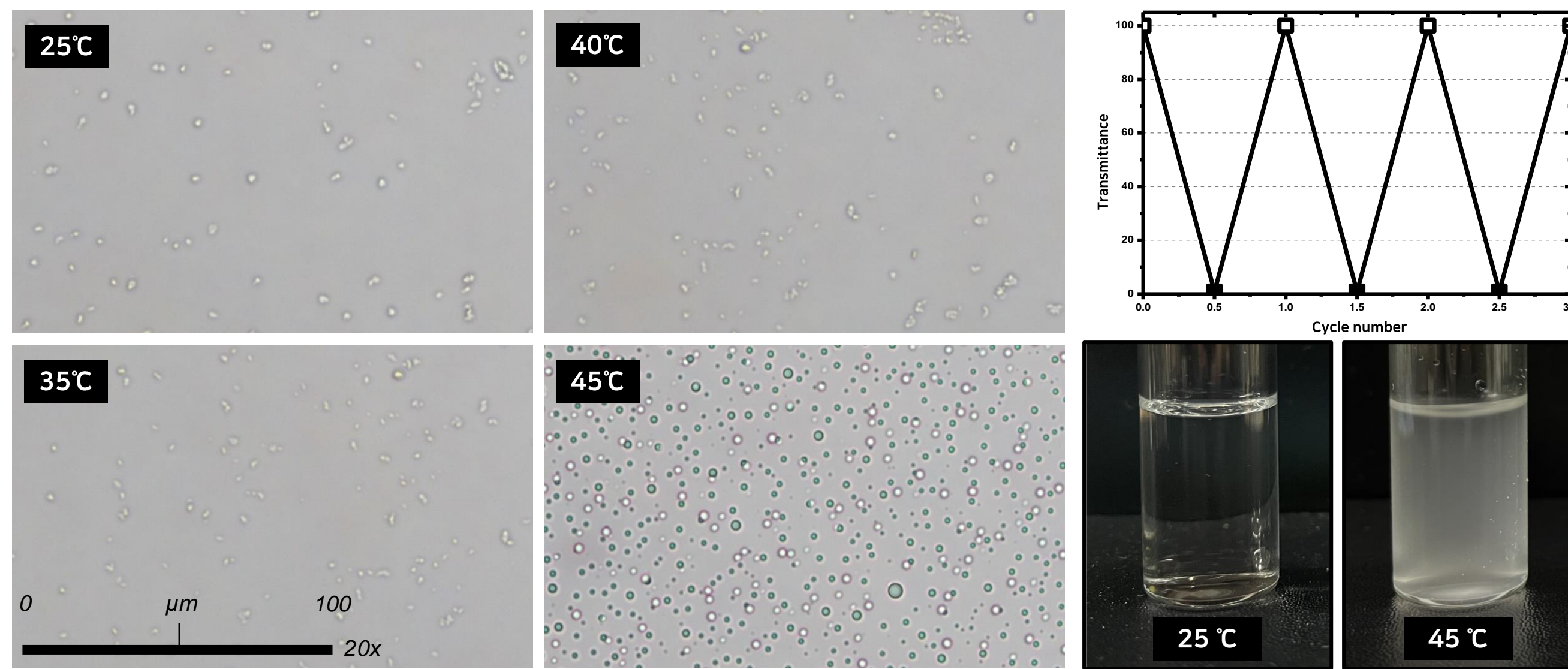
¹³C-NMR



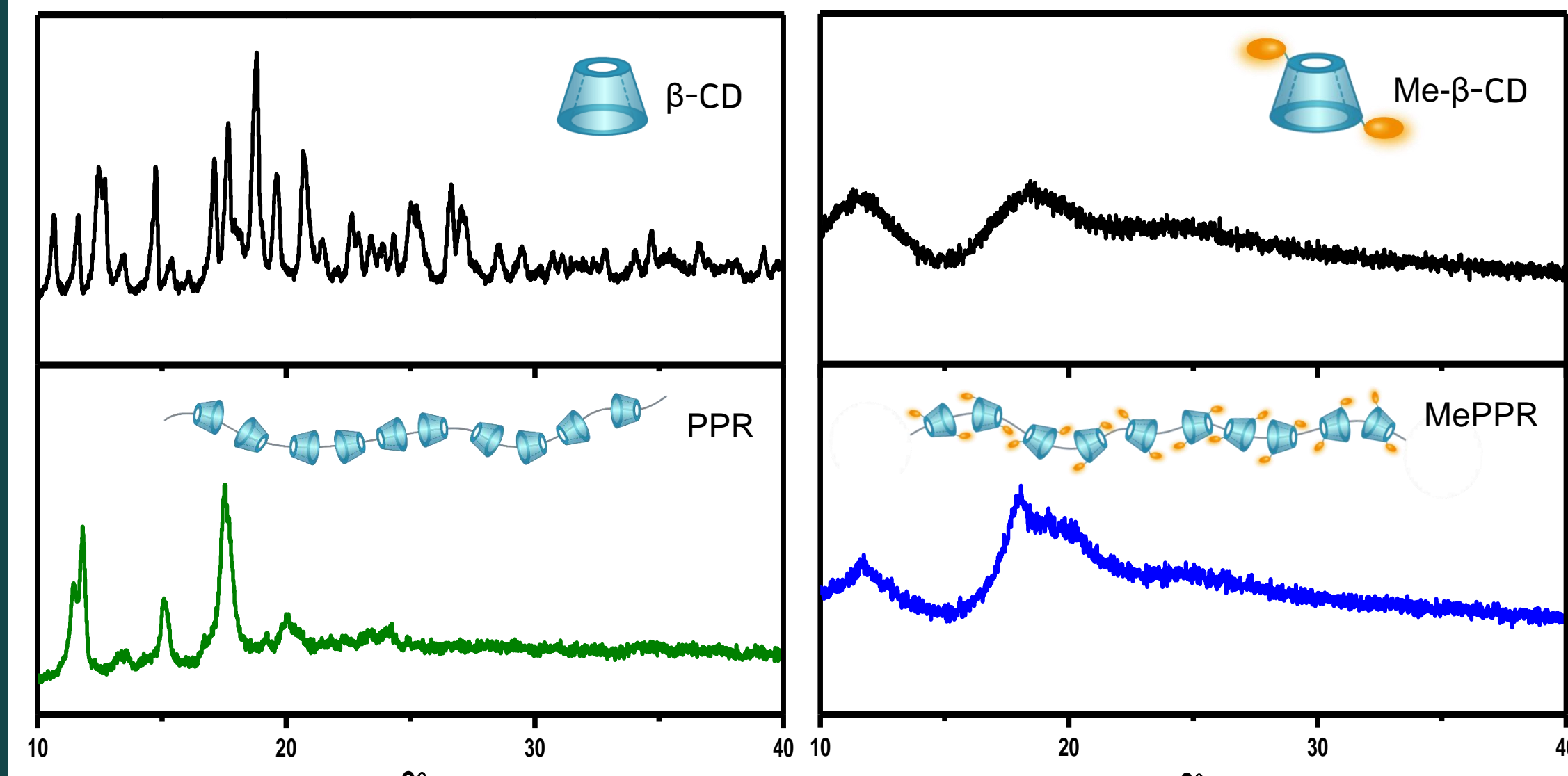
FT-IR of PR



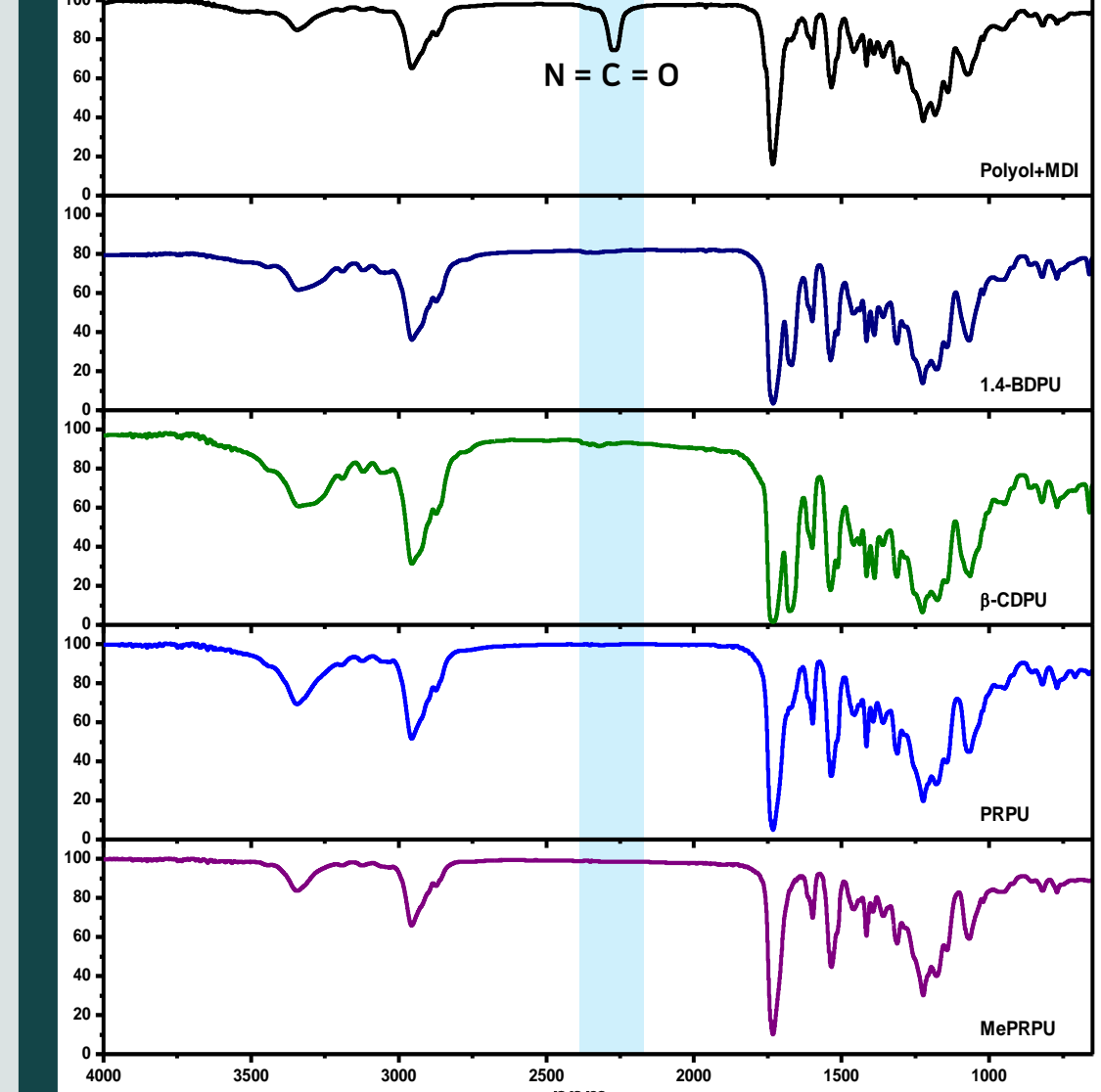
Phase Shift of PPR



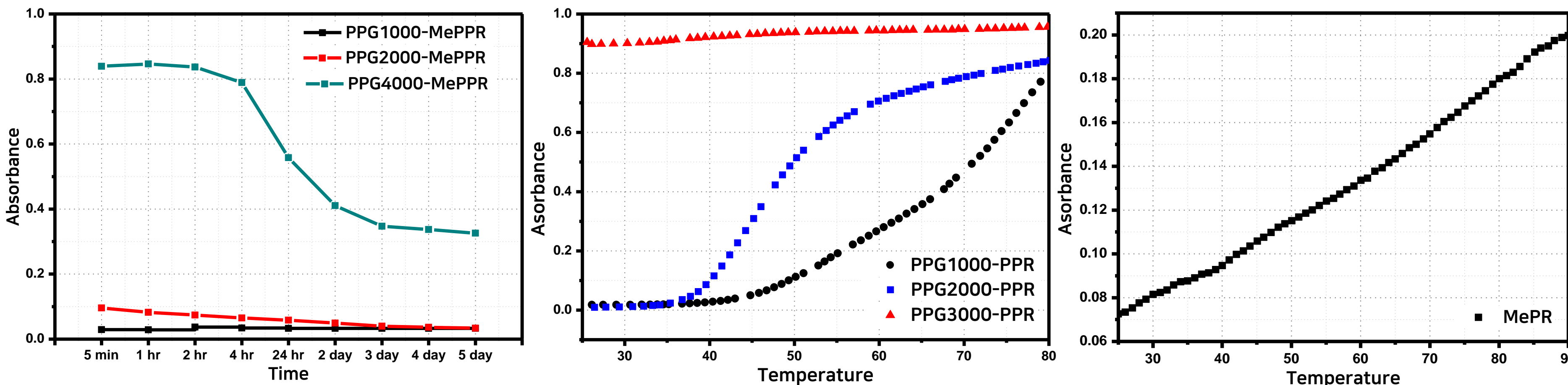
XRD of PR & MePR



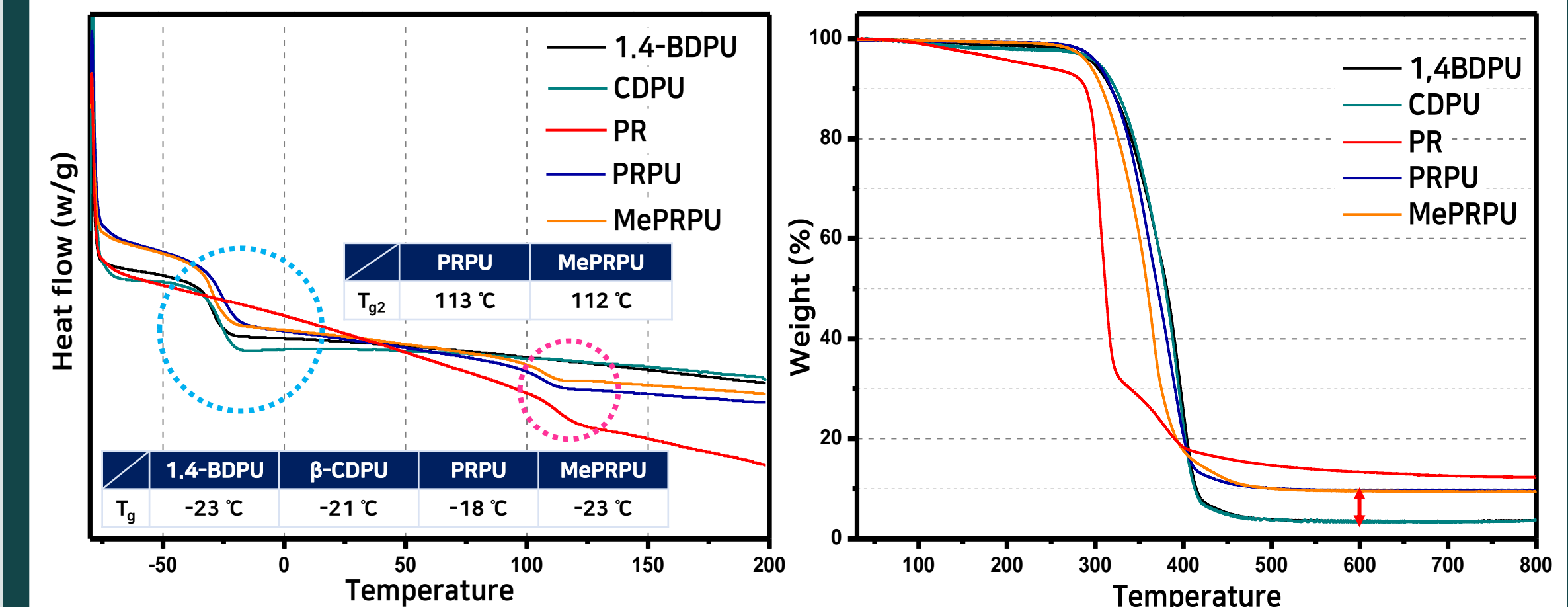
FT-IR of PU



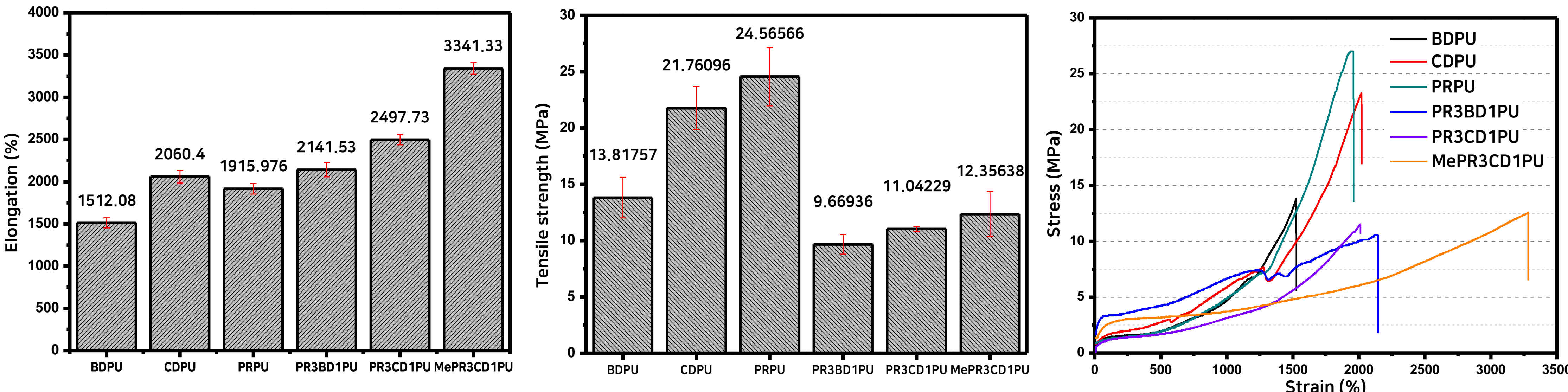
UV-vis of MePR & PPR



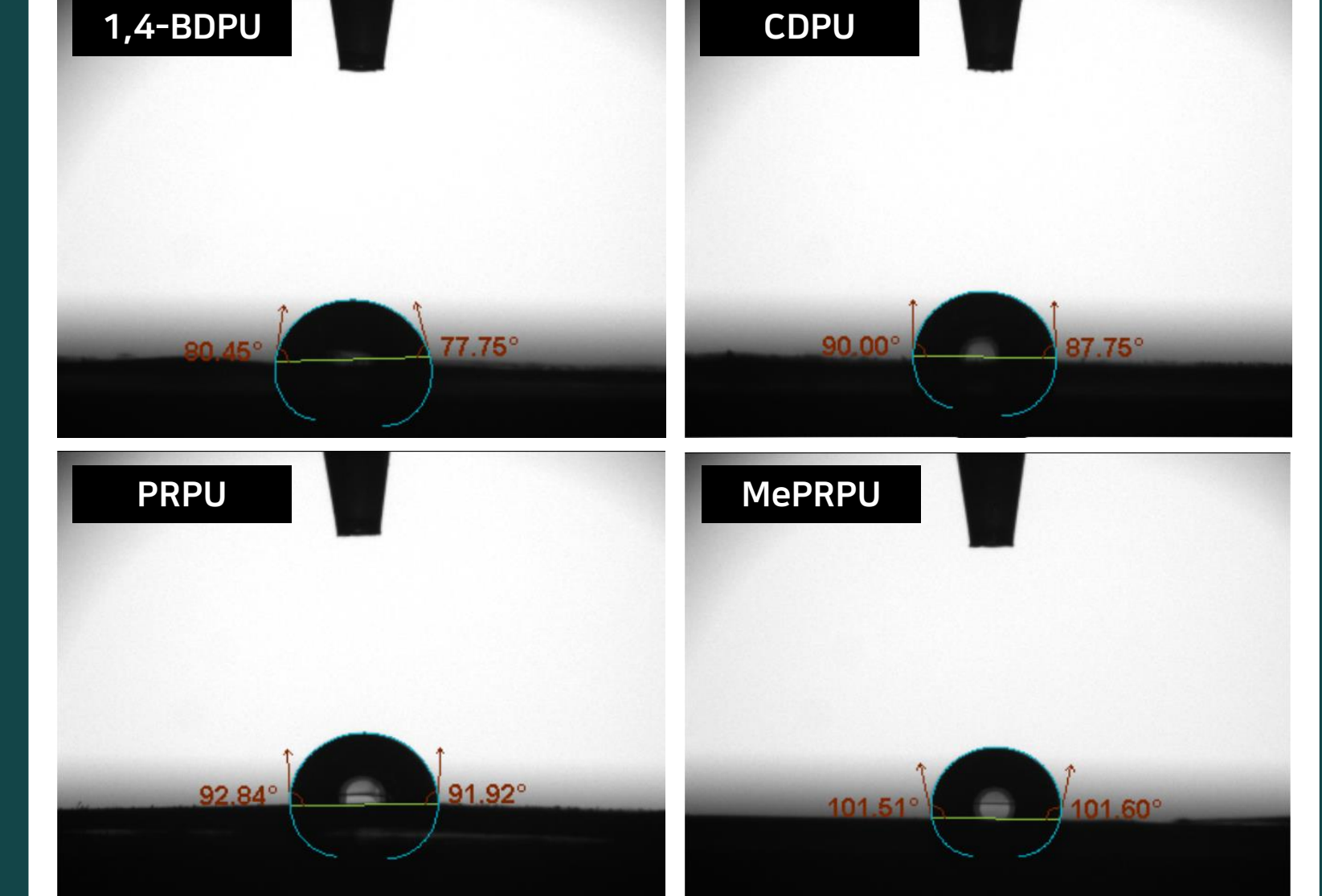
Thermal Characteristics



Strain & Stress of PU



Contact Angle



Conclusion... Polyrotaxane (PR) was successfully synthesized by combining PPG with a molecular weight of 4000 and β -CD. The formation of inclusion complexes with β -CD led to turbidity in the aqueous solution. The synthesis of PR was confirmed through characterization techniques such as ¹H-NMR, FT-IR, and UV-vis spectroscopy. Subsequently, the hydroxyl groups of PR were methylated to synthesize methylated polyrotaxane (MePR). MePR based on methylated β -CD and PPG demonstrated temperature-dependent reversible phase transitions within the LCST (lower critical solution temperature) range. Polyurethane (MePRPU) incorporating MePR exhibited superior elongation properties compared to polyurethane (BDPU) using 1,4-BD as a chain extender. The presence of PR in the polyurethane matrix was confirmed through TGA (thermogravimetric analysis) and DSC (differential scanning calorimetry) measurements.