Tunable Cellulose-Based Rheology Modifiers from a One-Step Homogeneous Synthesis

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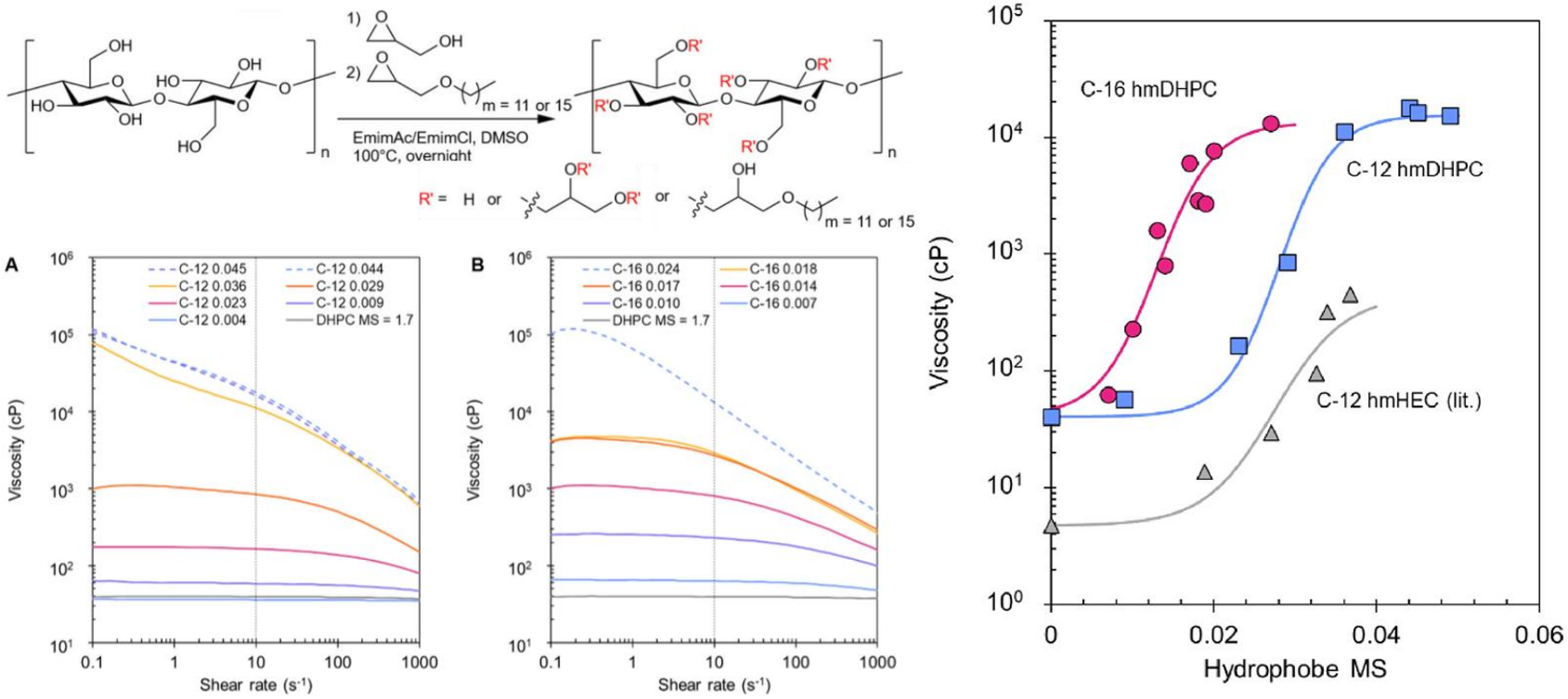
Cellulose ethers are widely used as viscosity modifiers in products ranging from pharmaceuticals and personal care formulations to paints, coatings, and detergents. Traditional synthesis relies on heterogeneous processing, which can limit reaction efficiency and control over material properties. Researchers from the University of Minnesota and The Dow Chemical Company developed a one-step homogeneous synthesis for water-soluble and hydrophobe-modified cellulose ethers using a binary ionic liquid system. The process enables efficient cellulose modification without added catalysts or post-reaction neutralization and produces cellulose ethers with solution viscosities spanning nearly four orders of magnitude. By controlling the degree of hydrophobe modification, the researchers created cellulose-based rheology modifiers with properties relevant to a broad range of commercial applications.

GlycoMIP supported characterization of the synthesized cellulose ether library through its specialized polysaccharide characterization capabilities and expertise. Accurate molecular weight and molecular weight distribution data for each material were essential for elucidating relationships among molecular weight, hydrophobe modification, and rheological performance.



Figures. Top Left: One-step homogeneous synthesis of water-soluble and hydrophobe-modified cellulose ethers using a binary ionic liquid system. **Bottom Left:** Shear viscosity as a function of shear rate for cellulose ethers containing (A) C-12 (dodecyl) and (B) C-16 (hexadecyl) hydrophobes. Increasing hydrophobe incorporation produces large increases in viscosity and pronounced shear-thinning behavior. **Right:** Solution viscosity at a shear rate of 10 s^{-1} for cellulose ethers modified with either C-12 or C-16 hydrophobes as a function of molar substitution (MS), the average number of hydrophobe groups attached per cellulose repeat unit. A commercial hydrophobe-modified hydroxyethyl cellulose (HEC) is included as a reference material (gray triangles).