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Impact of Different Synthetic Routes on Cellulose-based Liquid Crystals Thermotropic and Lyotropic Systems

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The derivatization of cellulose into more processable materials can be achieved by weakening the inter- and intramolecular hydrogen bonds between its polymer chains. It is well established that several cellulose derivatives exhibit lyotropic and thermotropic liquid crystalline phases, in which the degree of substitution ($\overline{DS}$) and the average molecular weight ($\overline{M_w}$) are key parameters governing the material properties [1,2].
In this work, we investigate the impact of different synthetic routes on the preparation of hydroxypropylcellulose esters (n = 2 to 6) with varying degrees of esterification ($\overline{DA}$) [3]. The susceptibility of polysaccharide glycosidic bonds to cleavage under certain reactive conditions (e.g., acidic media) plays a significant role during the derivatization of these polymers. Depending on the synthetic route employed and the selected acyl residue, it is possible to tailor the resulting products, particularly with respect to their $\overline{M_w}$ and $\overline{DA}$.

A comprehensive physical, chemical, and optical characterization of all materials will be presented. The correlations established between the thermotropic cellulose derivatives features and the synthetic routes employed will be used to develop a predictive framework for selecting reaction conditions to tune material characteristics toward targeted end-use applications. These findings are intended to guide the subsequent crosslinking step, with the aim of preserving liquid crystalline order within the crosslinked network and obtaining elastomeric liquid crystalline materials.

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