

Electronic supplementary information

The DS of hydroxypropyl group in hydroxypropyl cellulose (HPC) is determined by ^1H NMR spectrometry in CDCl_3 (Fig. S1). The MS is determined by carbanilation of HPC with phenylisocyanate, where the methyl group from the terminal hydroxypropyl group is shifted downfield due to the electron withdrawing effect of the nearby carbanilate group. The integration of the original methyl peak in HPC is used to calculate DS and the ratio of the new methyl peak in HPC-carbanilate to the original methyl peak in HPC is used to calculate MS.

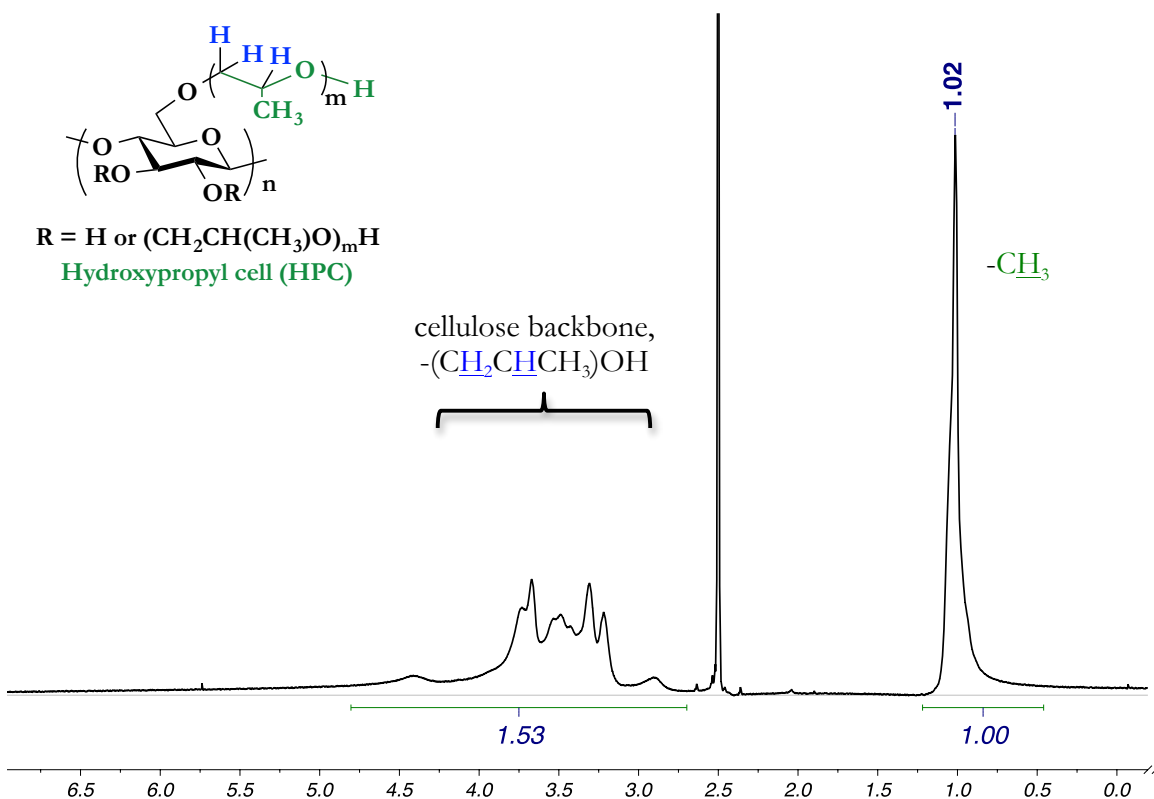


Fig. S1 ^1H NMR spectrum of hydroxypropyl cellulose (HPC).

$$\frac{3x}{7 + 3x} = \frac{1}{1.53}, x = 4.4$$

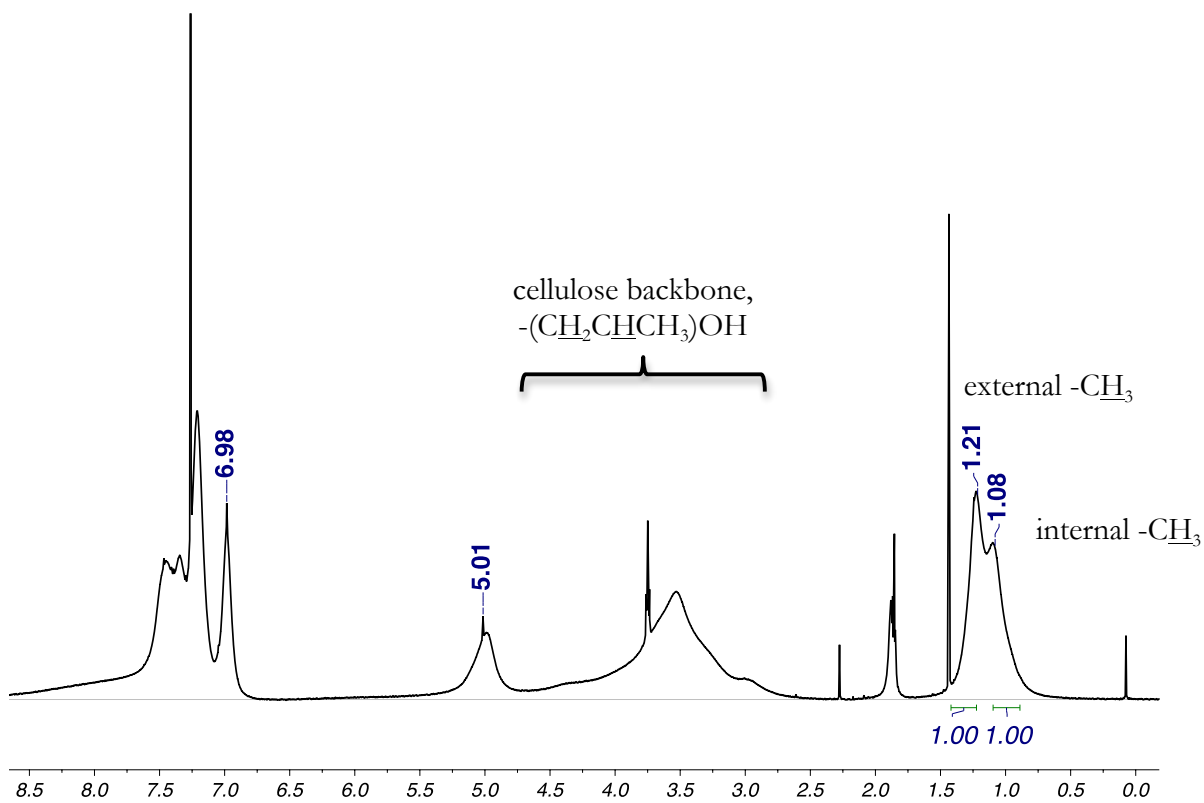
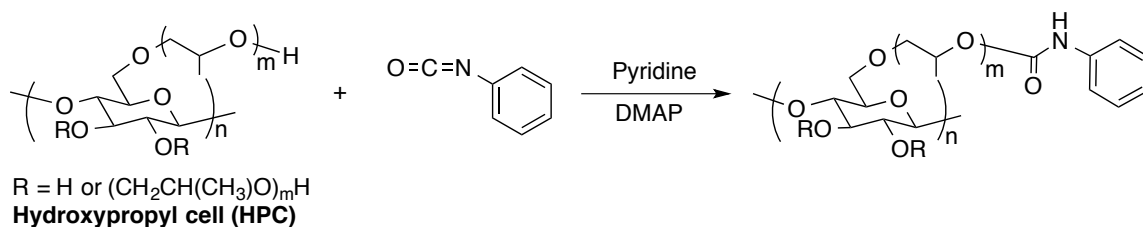


Fig. S2 ^1H NMR spectrum of HPC carbanilate.

$$\frac{I(\text{internal } \text{CH}_3)}{I(\text{terminal } \text{CH}_3)} = 1.0$$

$$DS = \frac{1}{2}MS = 2.2$$

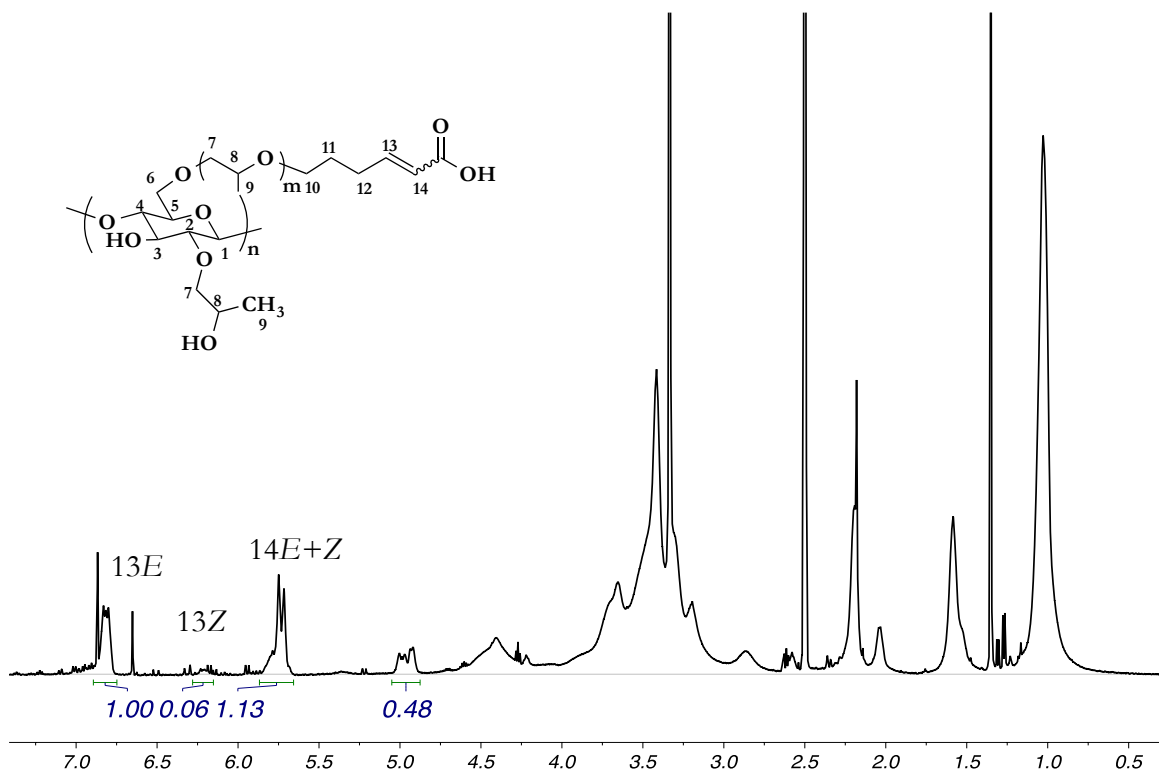


Fig. S3 ¹H NMR spectrum of incomplete CM product HPC-Pen106-AA.

CM conversion can be calculated as:

$$\frac{1.06}{1 + 0.48/2} = 85\%$$