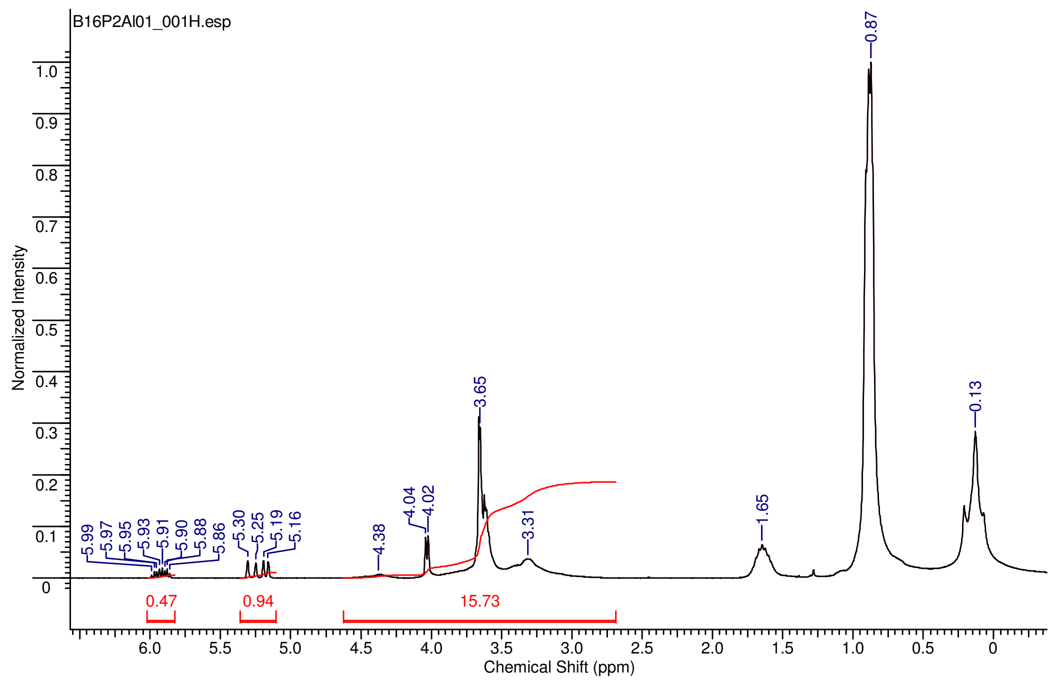


Figure S1. $^{1}$H NMR spectrum of product **5a**

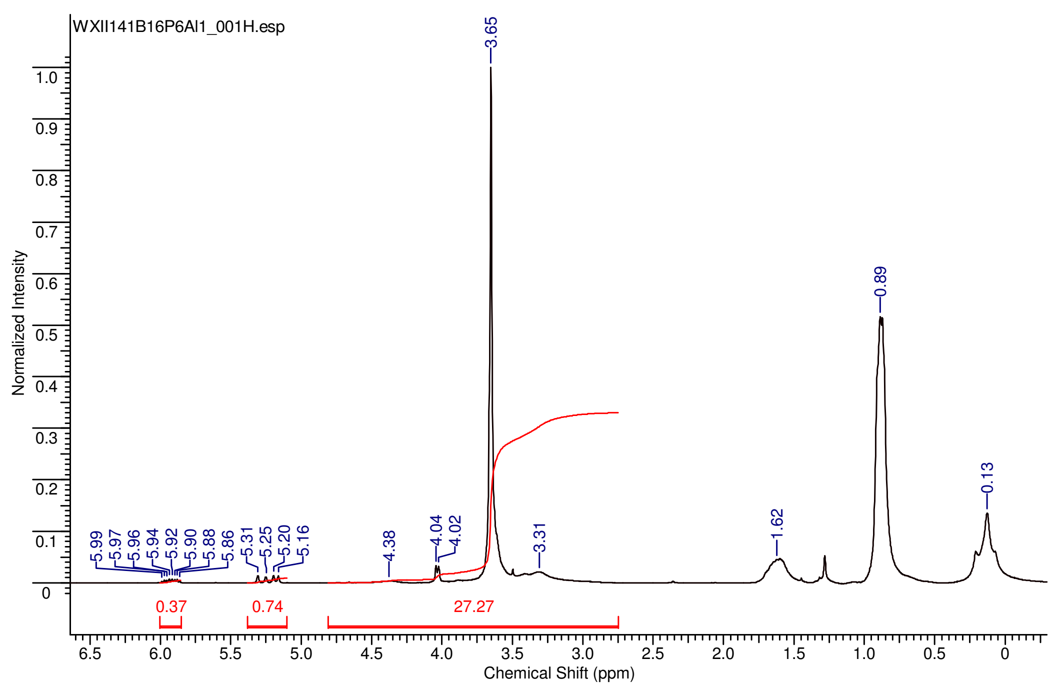


Figure S2. $^{1}$H NMR spectrum of product **5b**

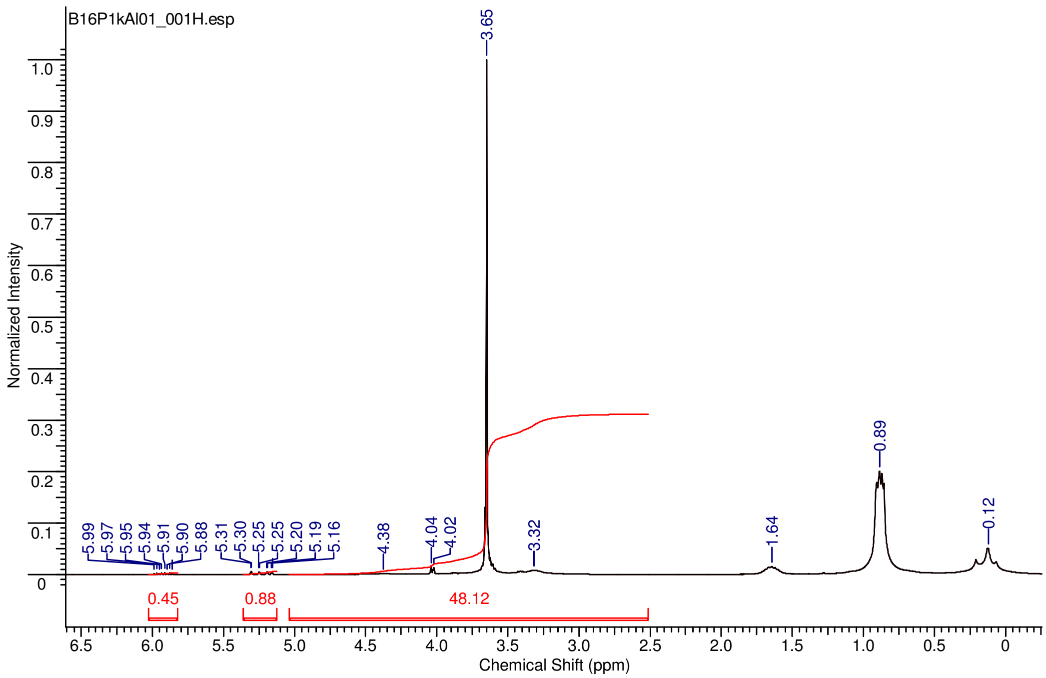


Figure S3. $^{1}$H NMR spectrum of product **5c**

## Calculation of DS of allyloxypoly(ethylene glycol) according to the $^{1}$H NMR spectra of 3-*O*-allyloxypoly(ethylene glycol)-2,6-di-O-TDMS cellulose

Number of protons having chemical shift between 5.86 ppm and 5.99 ppm = DS×1

Number of protons having chemical shift between 2.50 pm and 5.00 ppm = DS×($H_{AGU}$+2+$H_{PEG}$)+(1-DS)×$H_{AGU}$

where, $H_{AGU}$ is number of protons on one anhydroglucose unit of cellulose chain, $H_{AGU}$=7

2 is number of protons of allyloxy group showing a doublet at 4.03 ppm

$H_{PEG}$ is number of methylene protons of the oligomeric poly(ethylene glycol), $H_{EG4}$=16.5, $H_{EG13}$=52.9, $H_{EG22}$=89.3

$$\frac{Integral_{5.86\sim5.99\,ppm}}{Integral_{2.50\sim5.00\,ppm}} = \frac{DS\times 1}{DS\times\left(H_{AGU}+2+H_{PEG}\right)+\left(1-DS\right)\times H_{AGU}}$$

$$\frac{Integral_{5.86\sim5.99\,ppm}}{Integral_{2.50\sim5.00\,ppm}} = \frac{DS}{DS\times\left(7+2+H_{PEG}\right)+\left(1-DS\right)\times 7}$$

$$\frac{Integral_{5.86\sim5.99\,ppm}}{Integral_{2.50\sim5.00\,ppm}} = \frac{DS}{7+DS\times\left(2+H_{PEG}\right)}$$

$$DS = \frac{7}{\frac{Integral_{2.50\sim5.00\,ppm}}{Integral_{5.86\sim5.99\,ppm}}-(2+H_{PEG})}$$

$$DS_{5a} = \frac{7}{\frac{15.73}{0.47}-(2+16.5)} = 0.47$$

$$DS_{5b} = \frac{7}{\frac{27.27}{0.37}-(2+52.9)} = 0.37$$

$$DS_{5c} = \frac{7}{\frac{48.12}{0.45}-(2+89.3)} = 0.45$$