Supporting information

Synthesis of water soluble full biobased cellulose levulinate ester through the reaction of cellulose and alpha-Angelica lactone in the DBU/CO₂/DMSO solvent system

Min Pei,^a Xinwen Peng,^b Yuqing Shen,^a Yunlong Yang,^a Yuanlong Guo,^a Qiang Zheng,^a Haibo Xie,^{*a,c} Hui Sun^d

^aDepartment of Polymer Materials and Engineering, College of Materials and Metullurgy, Guizhou University, Guiyang, 550025, China;

^bSouth China Univ Technol, State Key Lab Pulp & Paper Engn, Guangzhou 510641, Guangdong, Peoples R China

°Sichuan University, State Key Laboratory of Polymer Materials Engineering, Chengdu 610065,

Sichuan, Peoples R China

^dBeijing Technol & Business Univ, Sch Mat Sci & Mech Engn



Figure S1 .¹H NMR spectrum levulinyl-esterification of cellulose with CLE-1 (DS_L=1.2, DS_{PL}=0.13) in DMSO_{d6}.



Figure S2 .¹H NMR spectrum levulinyl-esterification of cellulose with CLE-3 (DS_L=0.89, DS_{PL} =0.28) in DMSO_{d6}.



Figure S3 $.^1H$ NMR spectrum levulinyl-esterification of cellulose with CLE-4 (DS_L=0.59, DS_{PL}=0.13) in DMSO_d_{\circ}



Figure S4 $.^1H$ NMR spectrum levulinyl-esterification of cellulose with CLE-5 (DS_L=0.40, DS_{PL}=0.27) in DMSOd.



Figure S5 .¹³C NMR spectrum levulinyl-esterification of cellulose with CLE-5 (DS_L=0.40, DS_{PL} =0.27) in DMSO_{d6}.



Figure S6 .¹H NMR spectrum levulinyl-esterification of cellulose with CLE-7(DS_L=2.04, DS_{PL}=0.29) in DMSO_{d6}.



Figure S7 $^{.13}C$ NMR spectrum levulinyl-esterification of cellulose with CLE-7(DS_L=2.04, DS_{PL}=0.29) in DMSO_{d6}.



Figure S8.¹H NMR spectrum levulinyl-esterification of cellulose with CLE-8(DS_L=1.94, DS_{PL}=0.17) in DMSO_{d6}.



Figure S9.¹³C NMR spectrum levulinyl-esterification of cellulose with CLE-8(DS_L=1.94, DS_{PL} =0.17) in DMSO_{d6}.



Figure S10.¹H NMR spectrum levulinyl-esterification of cellulose with CLE-9(DS_L=0.93, DS_P=0.13) in DMSO_{d6}



Figure S11 .¹H NMR spectrum levulinyl-esterification of cellulose with CLE-11(DS_L=1.36, DS_{PL}=0.25) in DMSO_{d6}.



Figure S12 .¹H NMR spectrum levulinyl-esterification of cellulose with CLE-12(DS_L=0.48, DS_{PL} =0.05) in DMSO_{d6}.



Figure S13 .¹H NMR spectrum levulinyl-esterification of cellulose with CLE-13(DS_L=0.47, DS_{PL} =0.04) in DMSO_{d6}.



Figure S14.¹H NMR spectrum levulinyl-esterification of cellulose of CLE-14 (DS_L=1.72, DS_{PL}=0.27) in DMSO_{d6}.



Figure S15 HSQC spectrum levulinyl-esterification of cellulose with CLE-2 (DS_L =1.38) in $DMSO_{d6}$.



Figure S16 . HSQC spectrum levulinyl-esterification of cellulose with CLE-7 (DS_L=2.04, DS_{PL}=0.29) in DMSO_{d6}.



Fig. S17 The comparative WXRD analysis of cellulose and selected CLEs



Figure S18. GPC curve of levulinyl-esterification of cellulose. (CLE-2 : Mn=54000, Mw=114000, Poly: DPI=2.1)