

Electronic Supplementary Information (ESI)

From vapour to gas: optimising cellulose degradation with gaseous HCl

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Additional experimental

FTIR spectroscopy analyses. FTIR spectra were collected in the mid-infrared region by using a Bio-Rad FTS 6000 spectrometer (Digilab, Randolph, MA, USA) equipped with a MTEC PAC300 photoacoustic detector. Win-IR Pro V3.4 software (Digilab, Randolph, MA, USA) was used to baseline correct the FTIR spectra. The spectra were normalized relative to the antisymmetric bridge C-O-C stretch at 1161 cm^{-1} .

HMF (5-hydroxymethylfurfural) determination with HPLC. The content of furanic compounds (furfural and hydroxymethyl furfural (HMF)) and organic acids (formic acid, acetic and levulinic acid) in the liquid samples was determined by high performance liquid chromatography (HPLC) in a Dionex UltiMate 3000 device and UV/Vis spectroscopy. The HPLC system was equipped with a UV diode array detector and a Rezex™ ROA-Organic Acid H+ (8%) LC Column (7.8 mm × 300 mm). The UV detection wavelength was 210 nm and 280 nm for organic acids and furanic compounds, respectively. The column temperature was 55°C. The eluent was 0.0025 mol/L sulfuric acid with the flow of 0.5 mL/min. The samples were filtered through a 0.45 µm syringe filter before the analysis.

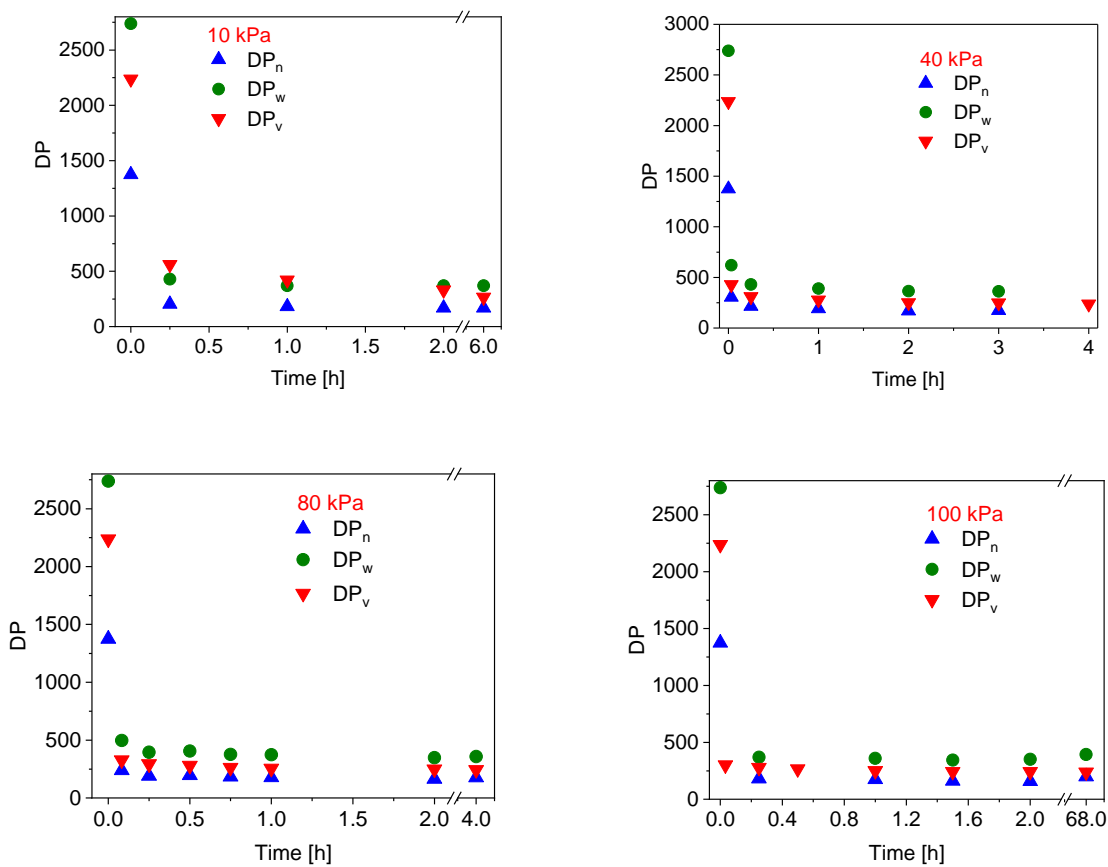


Fig. S1 Comparison between degree of polymerization determined with CED-viscosity (DP_v) and MMD-GPC equipment (DP_n and DP_w).

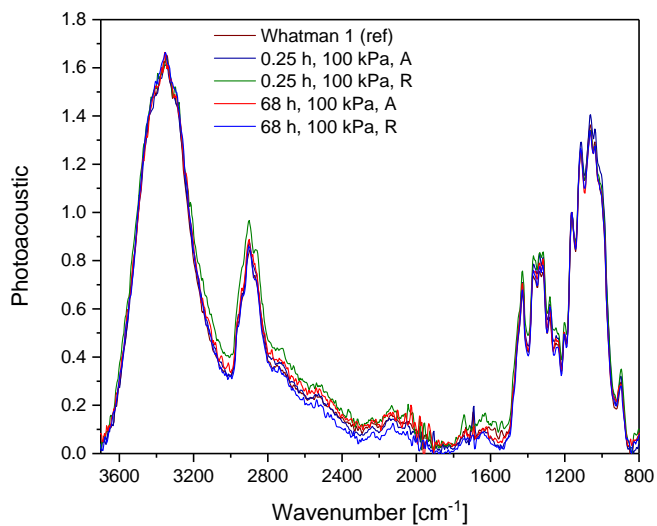


Fig. S2. The FTIR spectra of HCl degraded samples. **A** denotes acetone extraction, **R** denotes non-extracted sample. Acid hydrolysis was executed with HCl gas reactor.

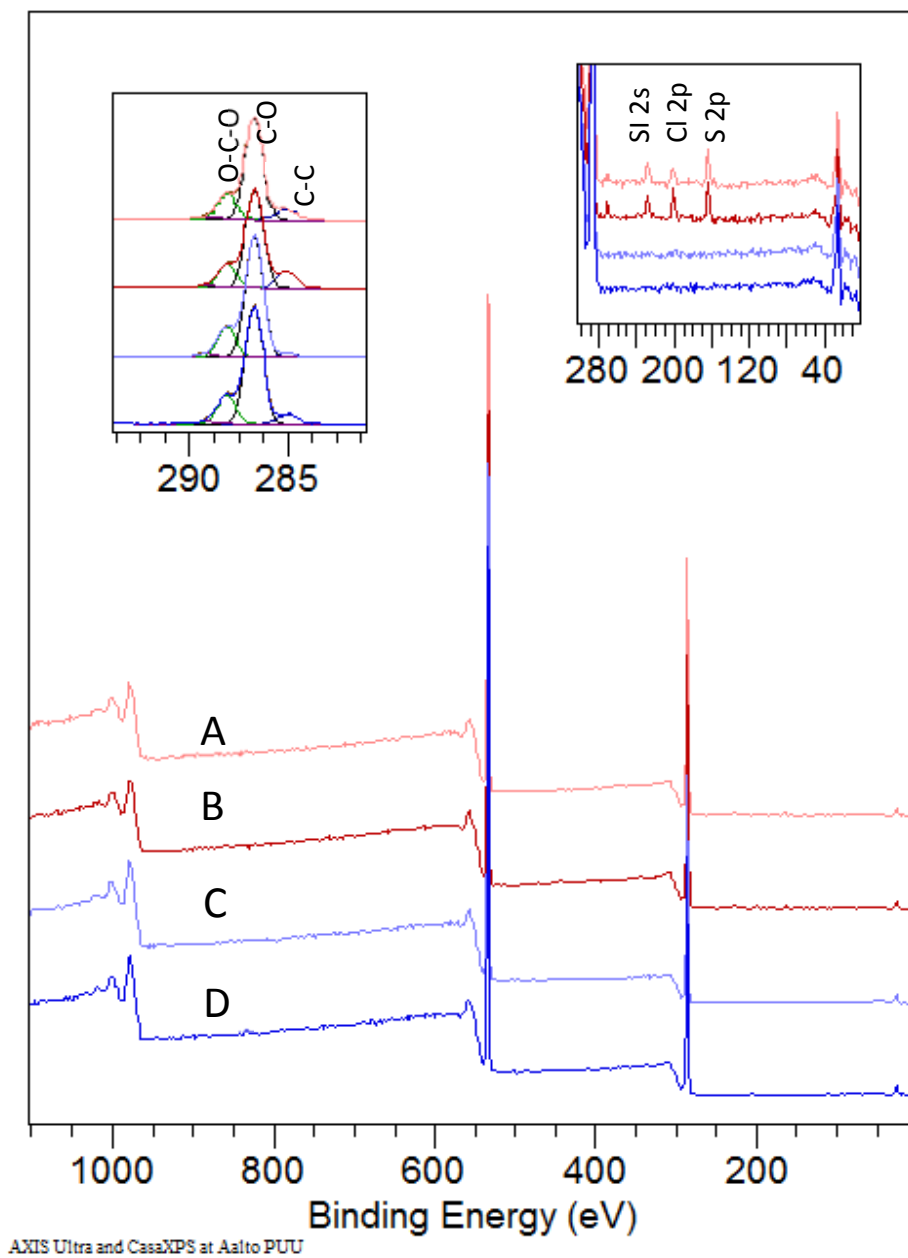


Fig. S3. XPS data. Acetone extracted (A) and non-extracted (B) samples with long HCl hydrolysis time (68h, 100 kPa HCl gas) and acetone extracted (C) and non-extracted (D) samples with short HCl hydrolysis time (0.25h, 100 kPa HCl gas).

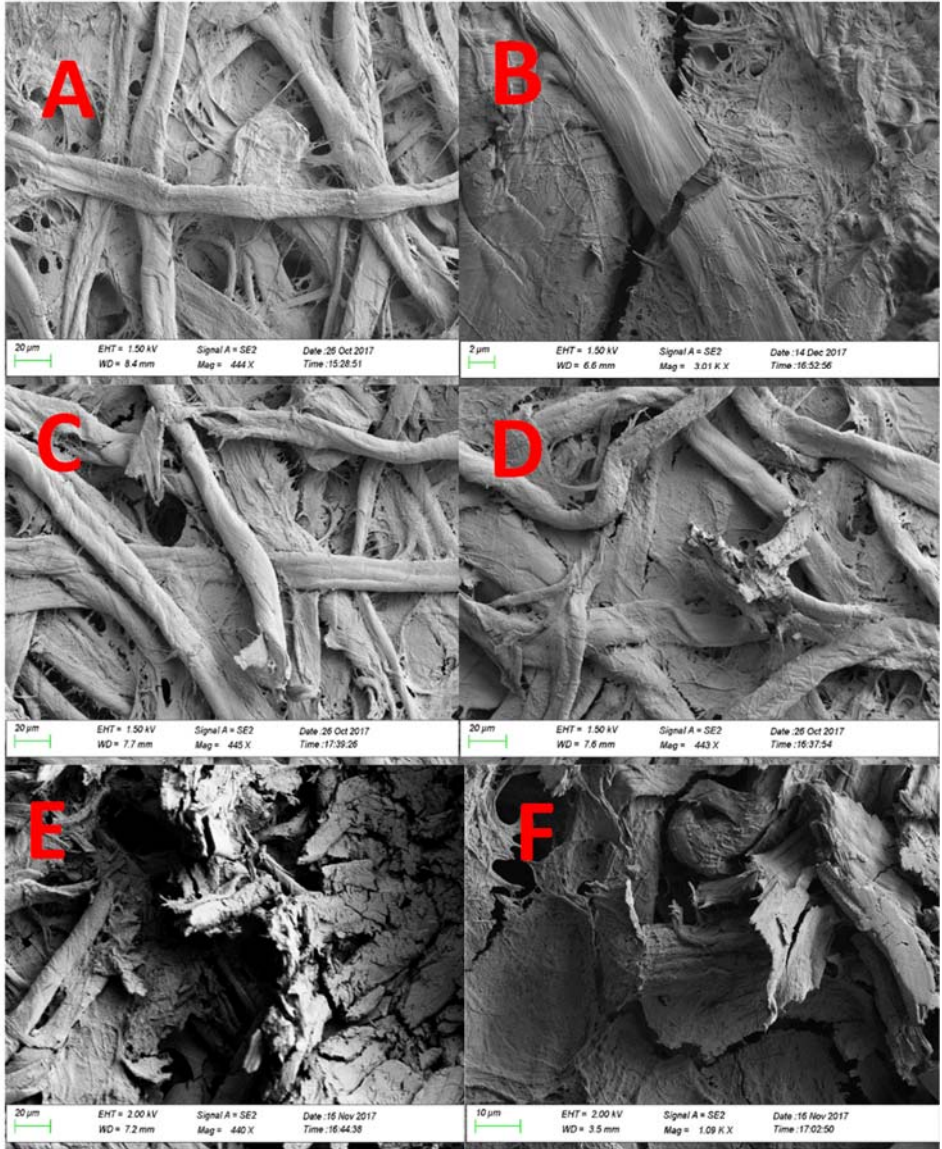


Fig. S4. SEM images of reference (A) and HCl degraded sample (B-F) with intense conditions (B- 100 kPa, 2h, C-D 100 kPa, 68 h and E-F 100 kPa, 281h).

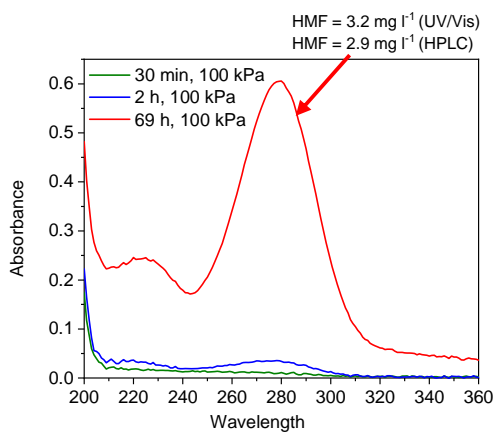


Fig. S5. UV/Vis spectra of filtrates after cellulose cotton linter hydrolyses. HMF concentration was determined according to method of Zhang ².

Supporting information references

- [1] N. Abidi, L. Cabrales and C. H. Haigler, *Carbohydr. Polym.*, 2014, **100**, 9-16.
- [2] J. Zhang, J. Li, Y. Tang and G. Xue, *The Scientific World Journal*, 2013, **2013**, 506329-506334.