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Supporting Information

Paper reinforced with regenerated cellulose: Sustainable and fascinating material with good mechanical performance, barrier property and shape-retaining in water

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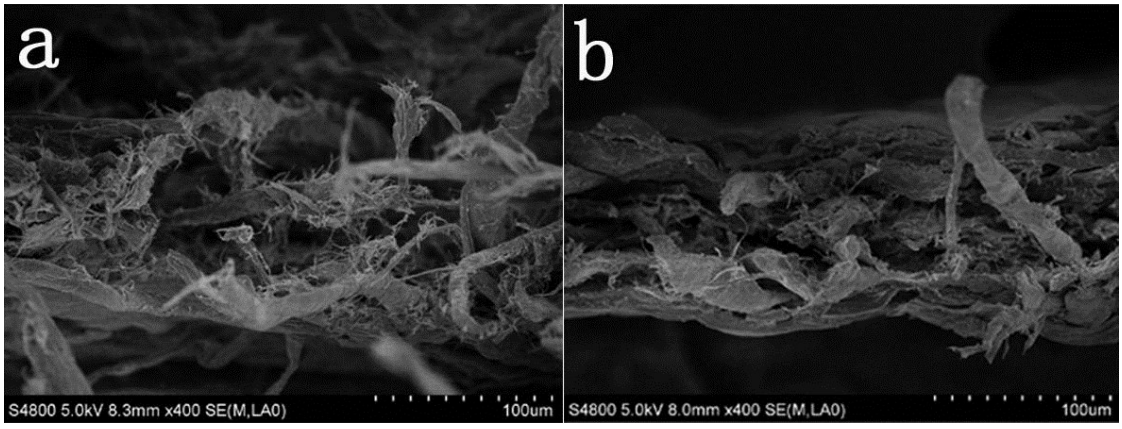


Figure S1. SEM images of the cross sections of the (a) origin paper, (b) RCP-4.

Sample	Toughness MJ/m^3	Tensile strength (M Pa)	Elastic modulus (M Pa)	Elongation at break (wt%)
RCP-0	0.3±0.05	20±3	700±300	3±1
RCP-1	1.8±0.2	27±4	900±250	9±1
RCP-2	7±0.15	50±7	1000±300	18±3
RCP-3	5±0.3	60±8	1300±200	11±2
RCP-4	6.5±0.2	75±5	1900±100	10±2

Table S1. Mechanical properties of composite paper at 50 RH.

Sample	Toughness MJ/m^3	Tensile strength (MPa)	Elastic modulus (MPa)	Elongation at break (wt%)
RCP-0	0.028±0.02	1±0.2	24±10	3±1
RCP-1	0.19±0.01	4±2	50±8	9±1
RCP-2	0.94±0.02	10±1	100±20	13±2
RCP-3	0.75±0.03	12±1	100±10	10±2
RCP-4	0.75±0.02	13±1	110±15	10±2

Table S2. Wet strength of the composite paper.

Sampl	RC Conten(%)	Tensile strength (MPa)	Elastic modulus (MPa)	Elongation at break (wt%)
RP-0	0	20±3	700±300	3±1
RP-1	2.21	23±1	700±50	10±1
RP-2	9.38	39±1	800±100	14±3
RP-3	15.32	47±2	1400±80	15±1
RP-4	19.86	54±3	1700±100	12±2

Table S3. Mechanical properties of composite paper at 50 RH.

Sample	RC content(%)	Tensile strength (MPa)	Elastic modulus (MPa)	Elongation at break (wt%)
RP-0	0	1±0.2	24±10	3±1
RP-1	2.21	6±1	60±10	9±1
RP-2	9.38	8±1	90±10	11±3
RP-3	15.32	10±1	100±10	10±1
RP-4	19.86	11±1	110±10	10±2

Table S4. Wet strength of the composite paper without ECH.

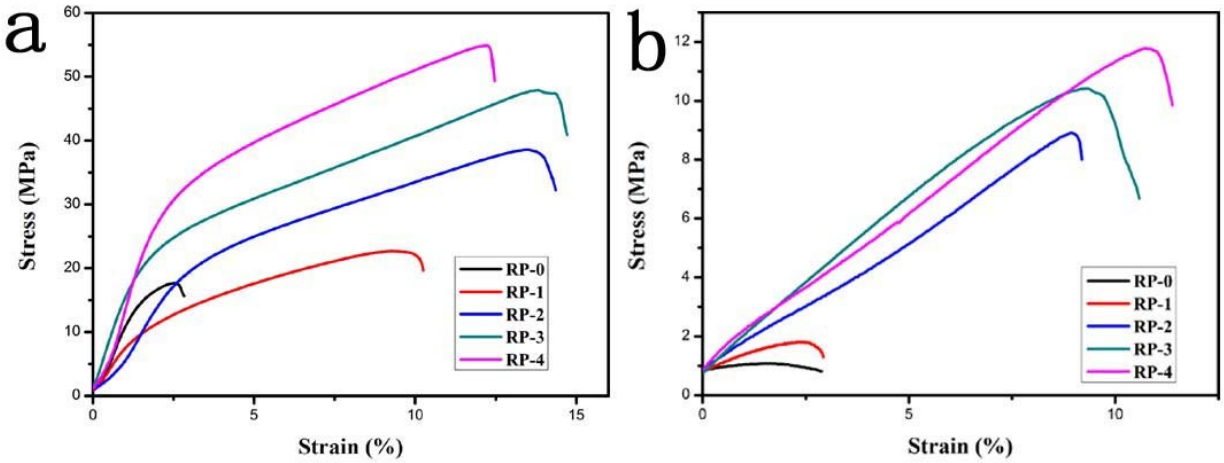


Figure S2. a) Stress–strain curves of origin paper and cross-linked paper without ECH at 50 RH. b) Stress–strain curves of origin paper and cross-linked paper without ECH under wet conditions.

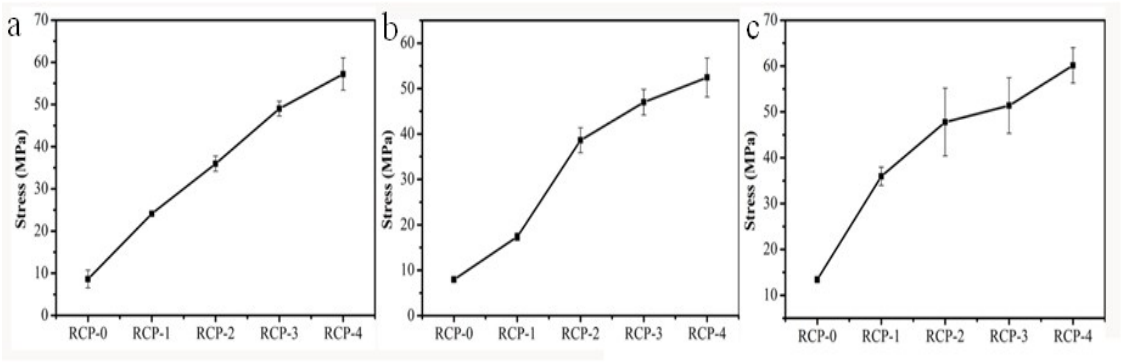


Figure S3. a) Stress-strain curves of regenerated cellulose cross-linked paper treated with 8 M H_2SO_4, 10 M NaOH and saturated NaCl for 10 min, respectively.

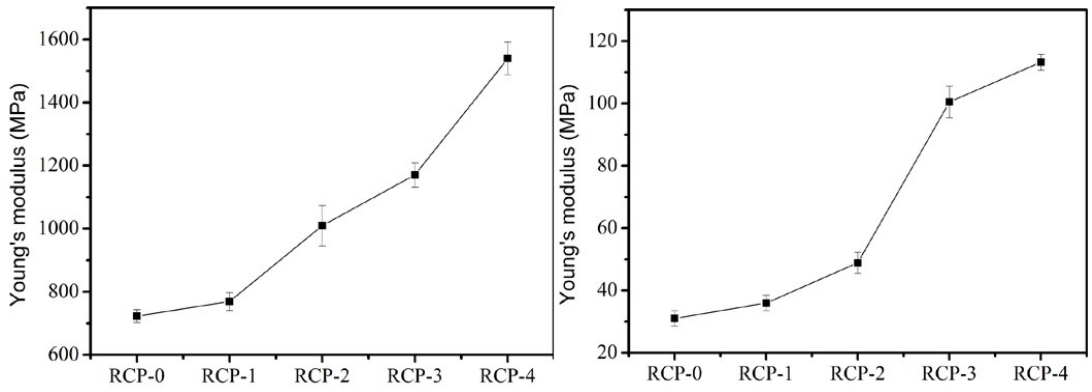
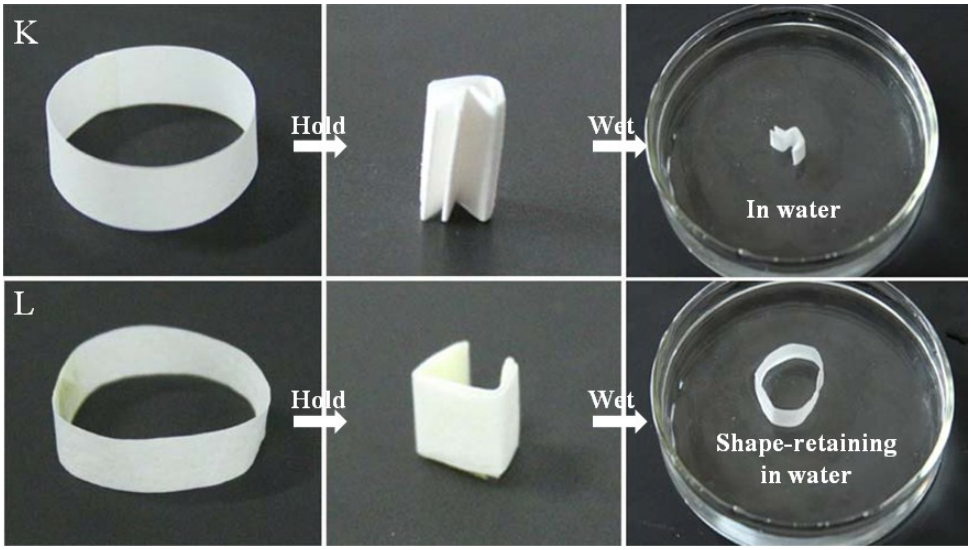


Figure S4. a) Young's modulus of the dry samples. b) Young's modulus of the wet samples.



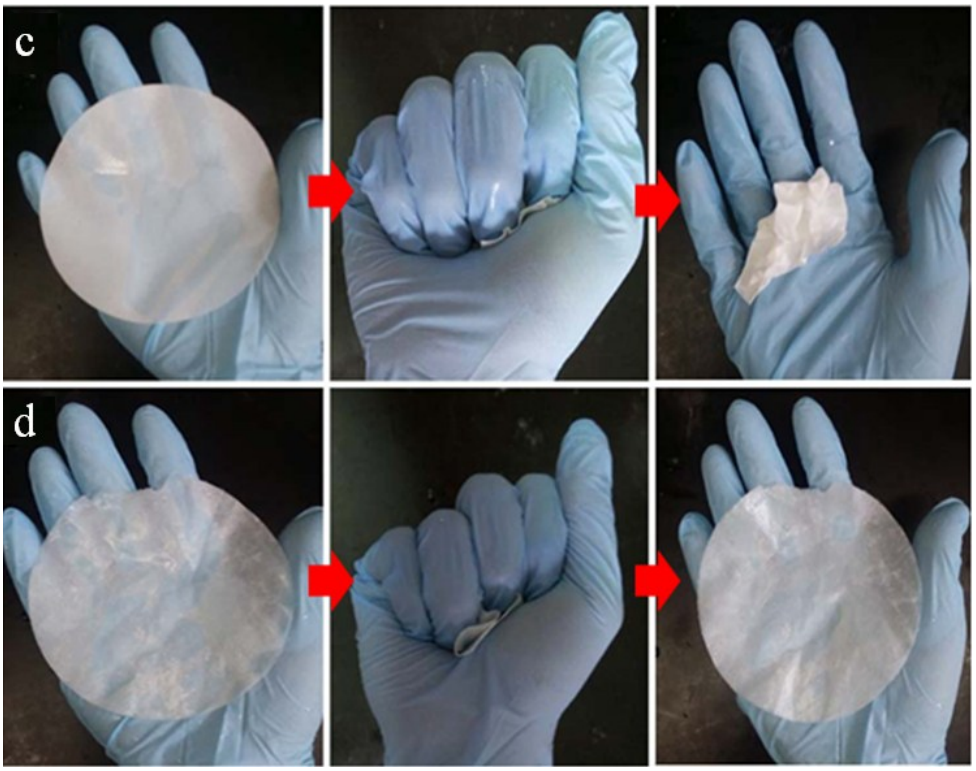


Figure S5 a) Shape deformation of folded RCP-0 when immerged in water. b) Shape-retaining of folded RCP-4 when immerged in water. c) Shape deformation of wet paper(RCP-0). d) Shape-retaining of wet RCP-4.