

Supporting Information

Sustainable synthesis of cyclodextrin-based polymers exploiting natural deep eutectic solvents

Claudio Cecone, Gjylije Hoti, Ilona Krabicová, Silvia Lucia Appleton, Fabrizio Caldera, Pierangiola Bracco, Marco Zanetti and Francesco Trotta

Polymer Structure

Citric acid was exploited to link together β CD units forming polymer structures while choline chloride to functionalize the product with positive charged pendants in a one-step reaction.

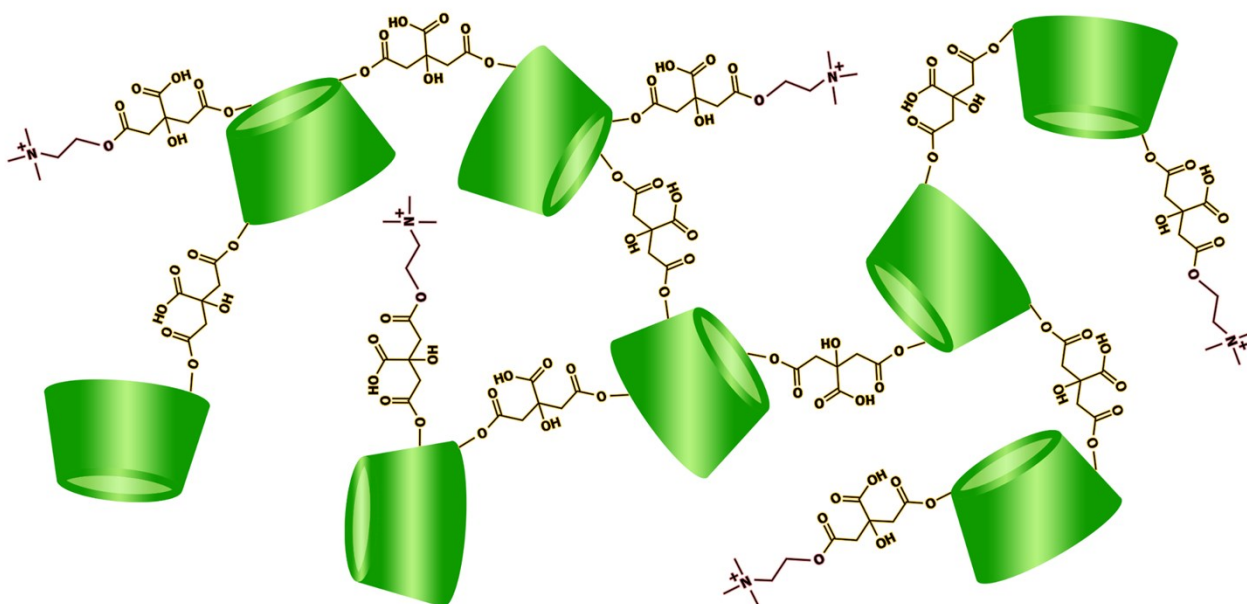


Figure S1 Schematic representation of the resulting water-soluble polymer.

Extended histogram map

Results observed in function of CHO:CIT ratio while keeping fixed the temperature, compared with the results in function of temperature while keeping fixed CHO:CIT ratio.

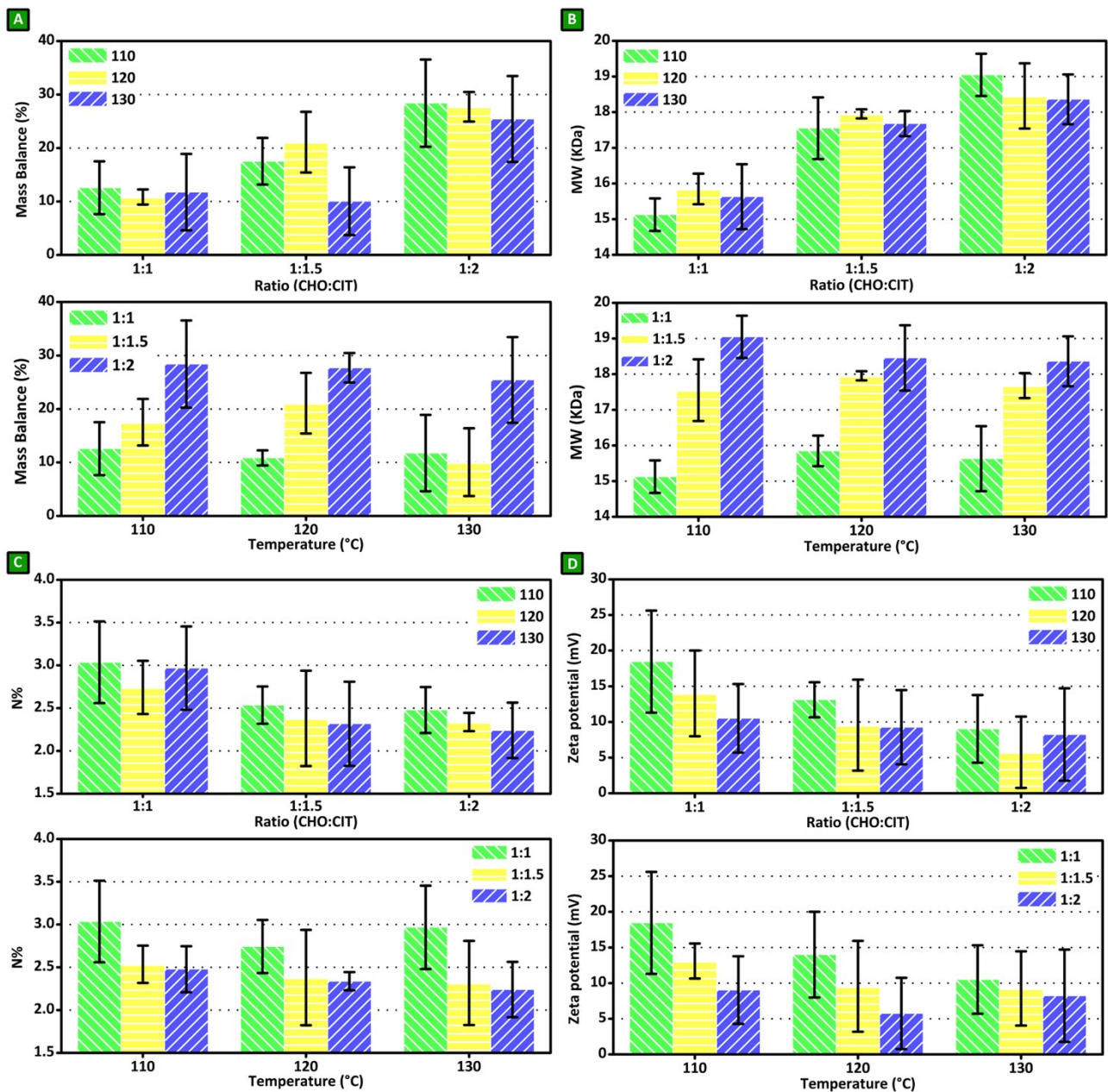


Figure S2 (A) MB, (B) MW, (C) N%, and (D) ζ -potential in function of both CHO:CIT ratio and temperature.

Mass Balance (%)

T (°C)	CHO:CIT ratio		
	1:1	1:1.5	1:2
110	12.6 ± 5.0	17.5 ± 4.4	28.4 ± 8.2
120	10.9 ± 1.4	21.1 ± 5.7	27.7 ± 2.8
130	11.8 ± 7.1	10.1 ± 6.3	25.4 ± 8.0

Table S1 MB results from each synthetic condition.

Molecular Weight (kDa)

T (°C)	CHO:CIT ratio		
	1:1	1:1.5	1:2
110	15.1 ± 0.5	17.6 ± 0.9	19.0 ± 0.6
120	15.8 ± 0.4	18.0 ± 0.1	18.5 ± 0.9
130	15.6 ± 0.9	17.7 ± 0.4	18.4 ± 0.7

Table S2 MW results from each synthetic condition.

Elemental Analysis (wt. %)

T (°C)	CHO:CIT ratio		
	1:1	1:1.5	1:2
110	3.0 ± 0.5	2.5 ± 0.2	2.5 ± 0.3
120	2.7 ± 0.3	2.4 ± 0.6	2.3 ± 0.1
130	3.0 ± 0.5	2.3 ± 0.5	2.2 ± 0.3

Table S3 N% results from each synthetic condition.

ζ-potential (mV)

T (°C)	CHO:CIT ratio		
	1:1	1:1.5	1:2
110	18.5 ± 7.2	13.1 ± 2.5	9.0 ± 4.7
120	14.0 ± 6.0	9.6 ± 6.4	5.7 ± 5.0
130	10.5 ± 4.8	9.3 ± 5.2	8.2 ± 6.5

Table S4 ζ-potential results from each synthetic condition.

SEM supplementary images

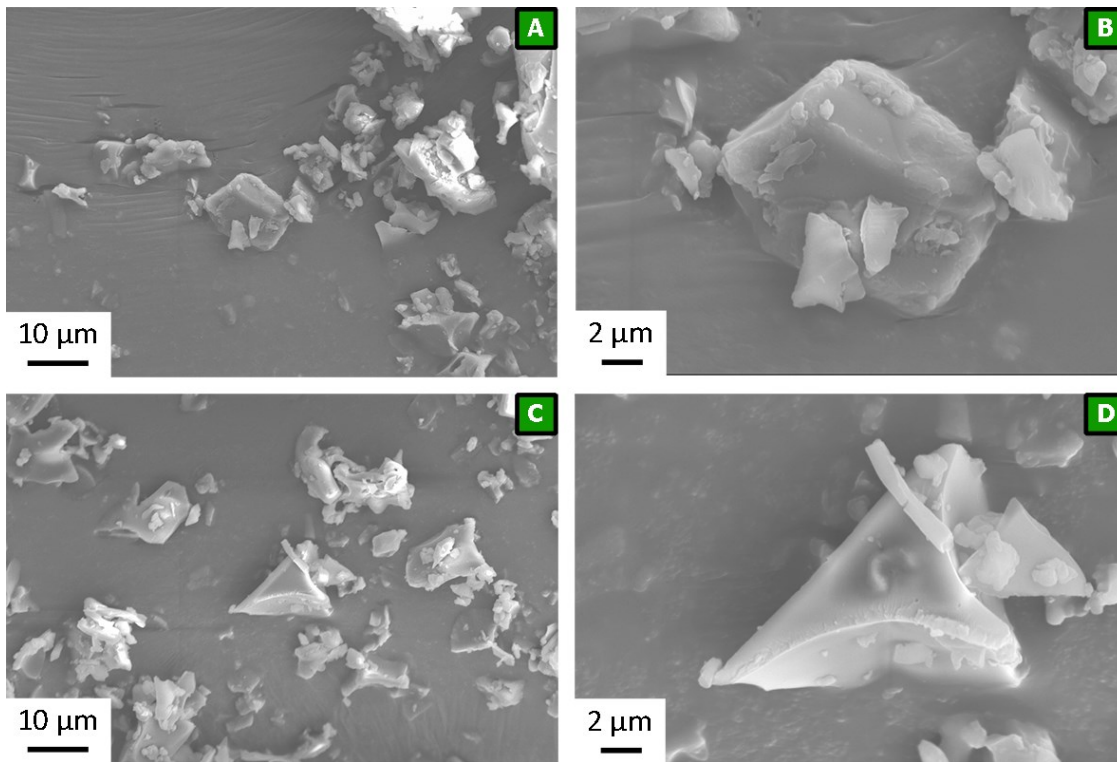


Figure S3 SEM of different polymer granules after thermal treatment.

Nanoparticles Deposition

Particles deposition was obtained by using a Buchi Nano Spray Dryer B-90 HP (Flawil, Switzerland). Keeping the piezoelectric spray mesh vibration rate fixed at 122 KHz, 0.1 wt % polymer distilled water solution was used for the process. As reported in Figure S4 the thermal treatment did not alter the morphology obtained after the processing step.

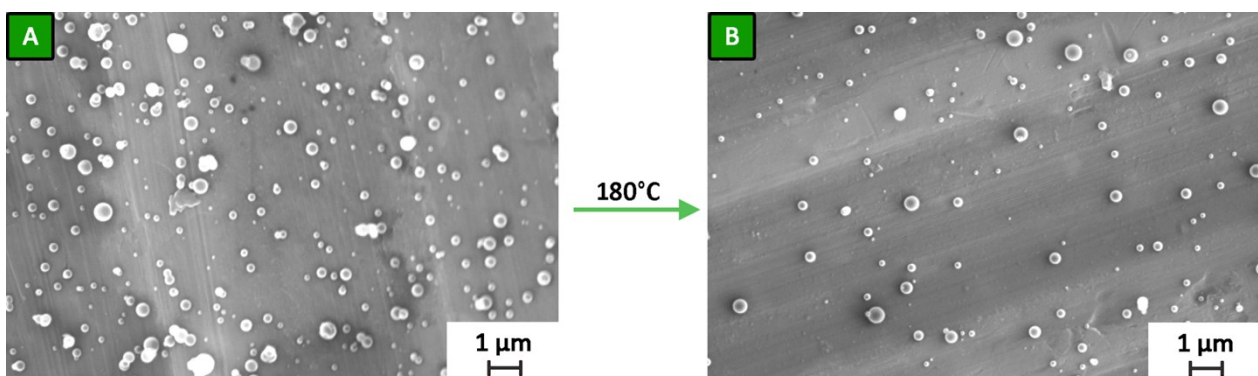


Figure S4 Nanoparticles obtained via nano spray drying (A) before and (B) after thermal treatment.

FTIR-ATR extended map

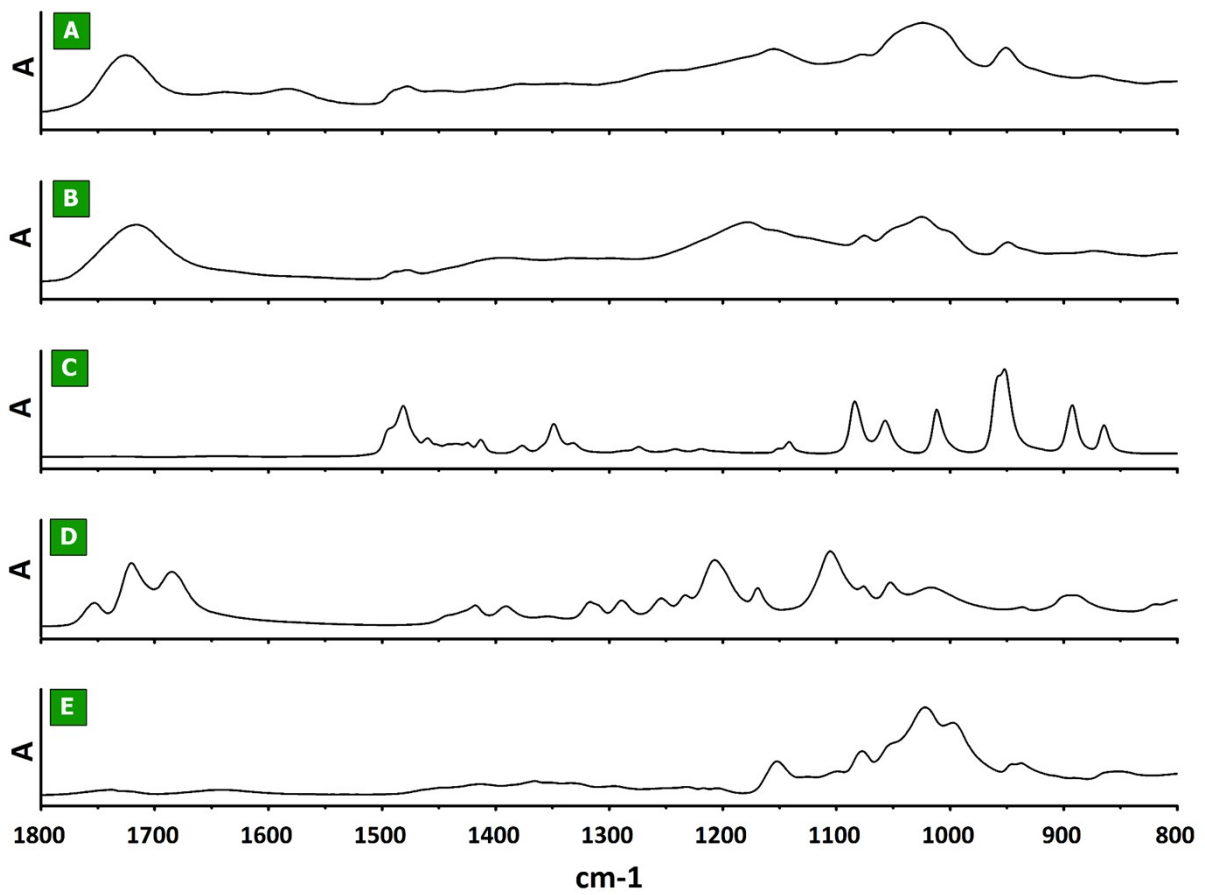


Figure S5 FTIR-ATR spectra of (A) water-insoluble polymer (post thermal curing), (B) water-soluble polymer, (C) choline chloride, (D) citric acid, and (E) β -cyclodextrin.