Supplementary Information

Hydrothermal carbonization synthesis of amorphous carbon nanoparticles (15 – 150 nm) with a fine tuning of the size, bulk order, and the consequent impact on antioxidant and photothermal properties

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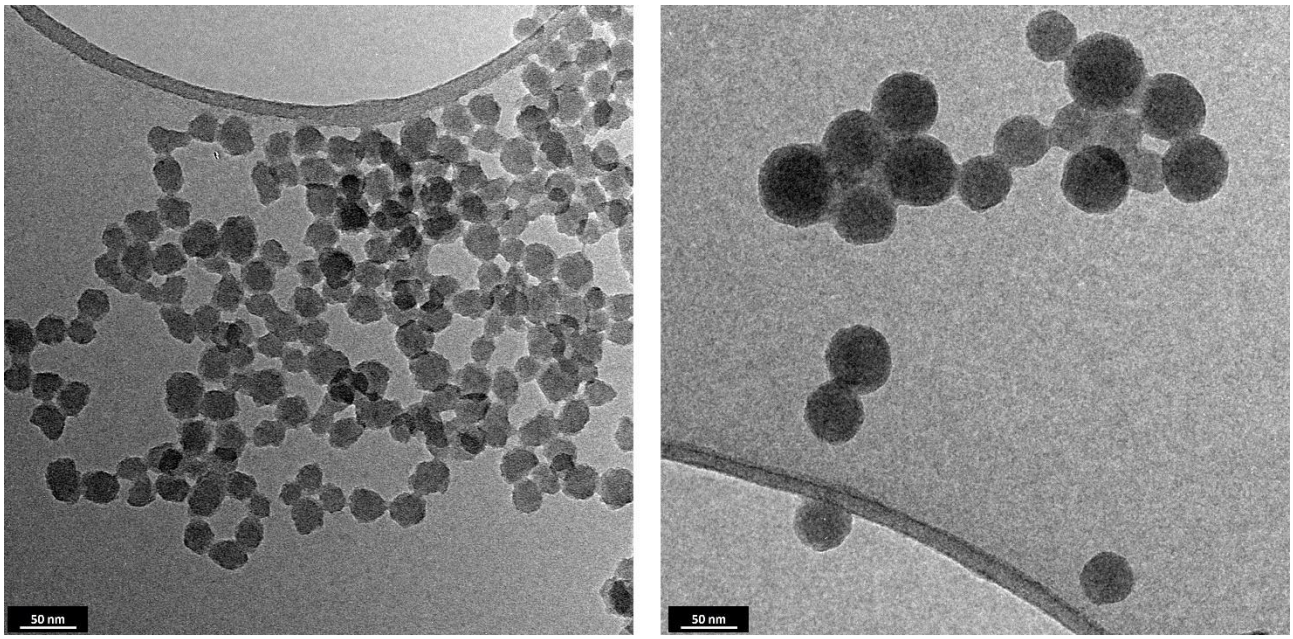
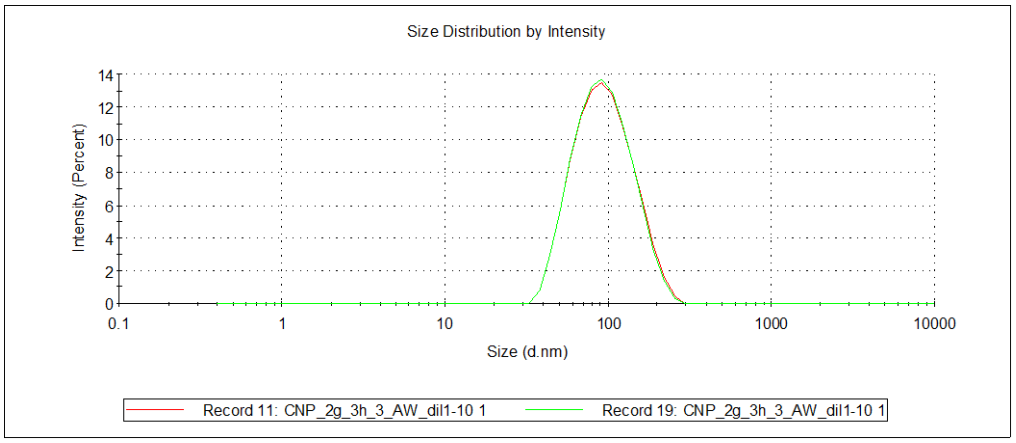


Figure SI-1. TEM images of CNP synthetised at 0.022 M glucose in 6 h (left) and 0.22 M – 3 h (right).

Size	Glucose 0.022 M				0.22 M					2.2 M
(nm)	3 h	6 h	9 h	15 h	1 h	3 h	4 h	5 h	6 h	3 h
Z-ave	16.5	30.5	40.0	141.1	*	79.7	96,5	189.5	627.1	834.0
PdI	0.101	0.057	0.114	0.161	*	0.072	0.026	0.191	0.136	0.172

Table SI-1. Z-average size and polydispersity indexes of CNP synthetised at different precursor concentration and synthesis times measured by DLS cumulant analysis.

A



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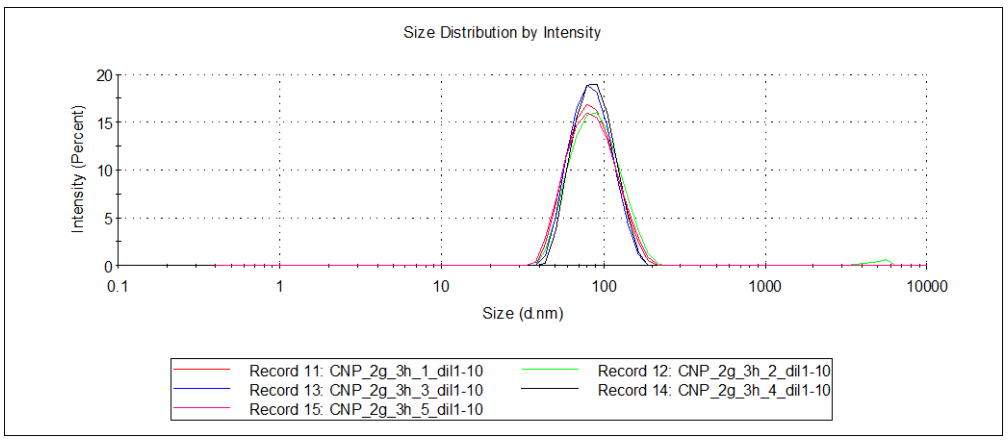

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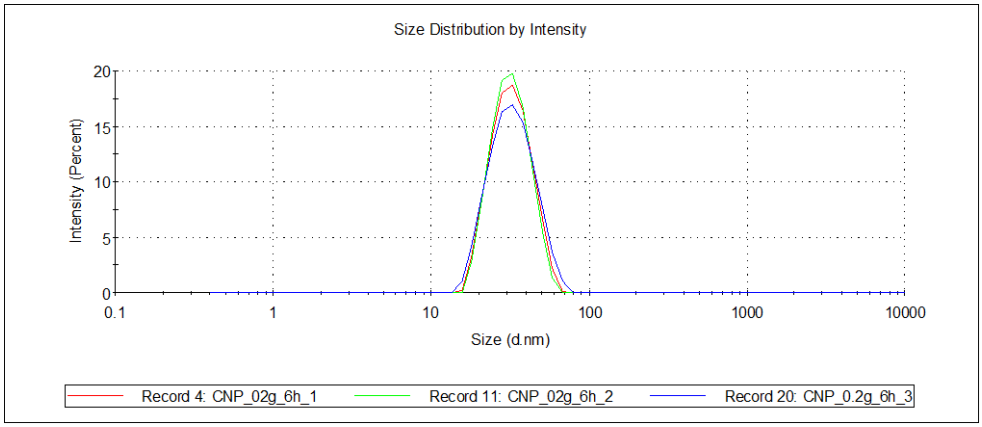
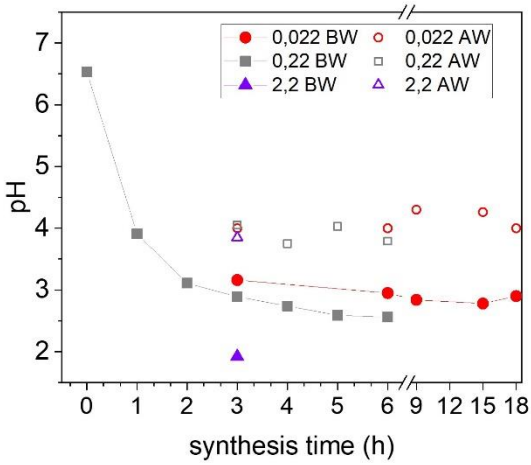


Figure SI-2. (A) CNP Stability: D_H distribution (DLS) of CNP 0.22 M – 3 h after purification at time 0 and after one year at room temperature. (B-C) CNP reproducibility: D_H distribution (DLS) of 5 different synthesis of CNP 0.22 M – 3 h (C) and of 3 different synthesis of CNP 0.022 M – 6 h.

A



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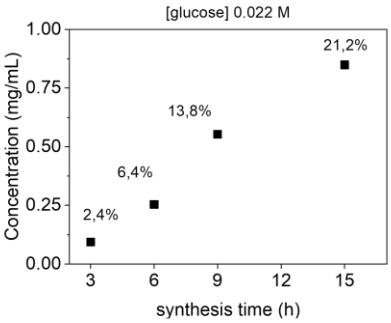

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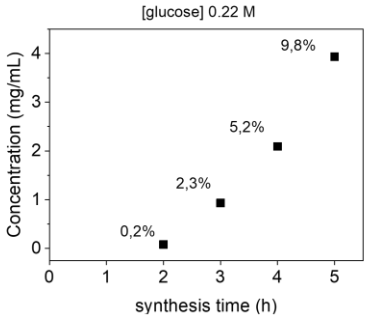

D

[glucose] 2.2 M

Synthesis time	Concentration (mg/mL)	Yield
3h	28,05	7%

Figure SI-3. (A) pH values of CNP dispersion before purification (filled symbols) and after purification (empty symbols). CNP prepared starting with 0.022 M (red circles), 0.22 M (gray square) and 2.2 M (violet triangles) of glucose solution. (B, C, D) yield of reaction of CNP prepared starting with 0.022 M, 0.22 M and 2.2 M of glucose solution, respectively.

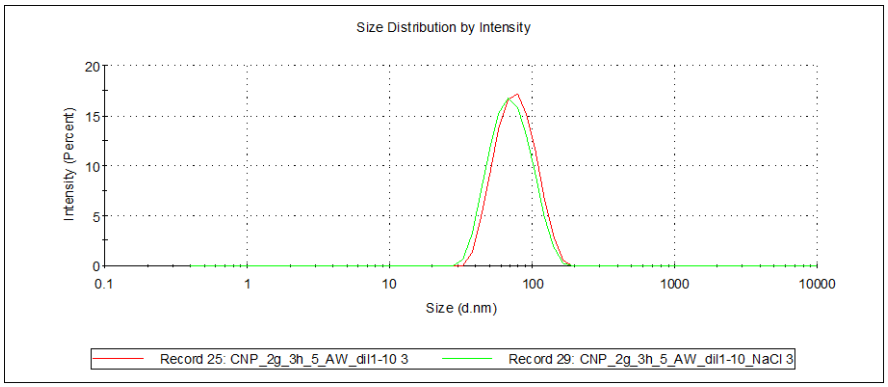

Figure SI-4. DLS measurements of CNP 0.22 M – 3h diluted in water (red) or in 137 mM NaCl after 2 h of incubation (green).

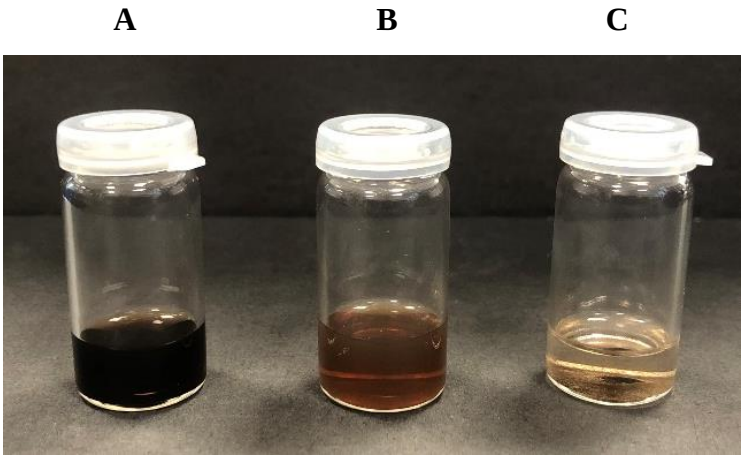

Figure SI-5. CNP synthetised stating form 0.022 M glucose and carbonized for 15 h dispersed in: (A) acetone, (B) dichloromethane, (C) n-hexane.

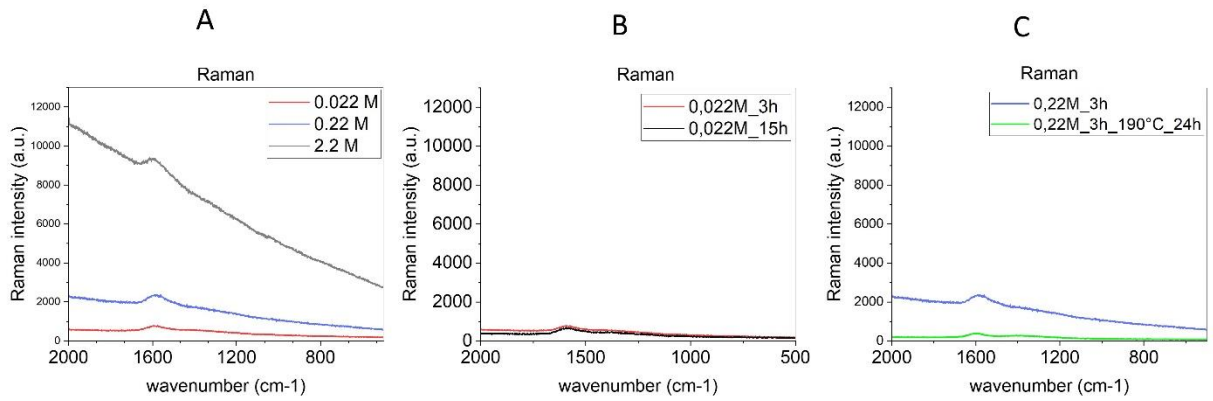

Figure SI-6. (A) Raman spectra of CNP synthetized starting from 0.022 M (red), 0.22 M (blue) and 2.2 M (grey) of glucose aqueous solution with a synthesis time of 3h at 190°C. (B) Raman spectra of CNP synthetized starting from 0.022 M glucose aqueous solution with a synthesis time of 3h (red) and 15 h (grey) at 190°C. (B) Raman spectra of CNP synthetized starting from 0.22 M glucose aqueous solution with a synthesis time of 3h (blue) 190°C and the same sample purified and re-heated at 190°C for 24h (green).

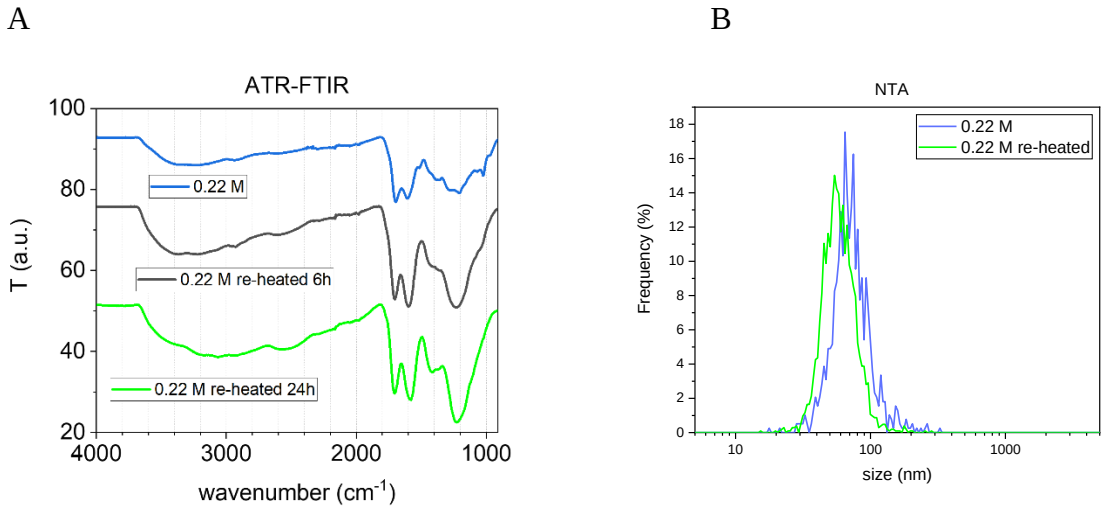

Figure SI-7. (A) ATR-FTIR of CNP before (blue) and after been re-heated at 190°C for 6 h (black) 24 h (green). All samples were purified by 30 KDa tangential dialysis. (B) NTA analysis of CNP before (blue) and after be re-heated at 190°C for 24 h (green).

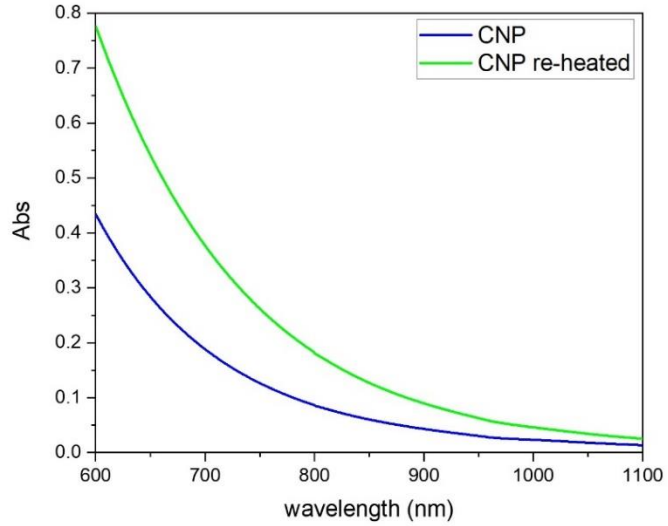

Figure SI-8. Vis-NIR spectra of CNP before (blue) and after been re-heated at 190°C for 24 h (green) measured at the same mass concentration.

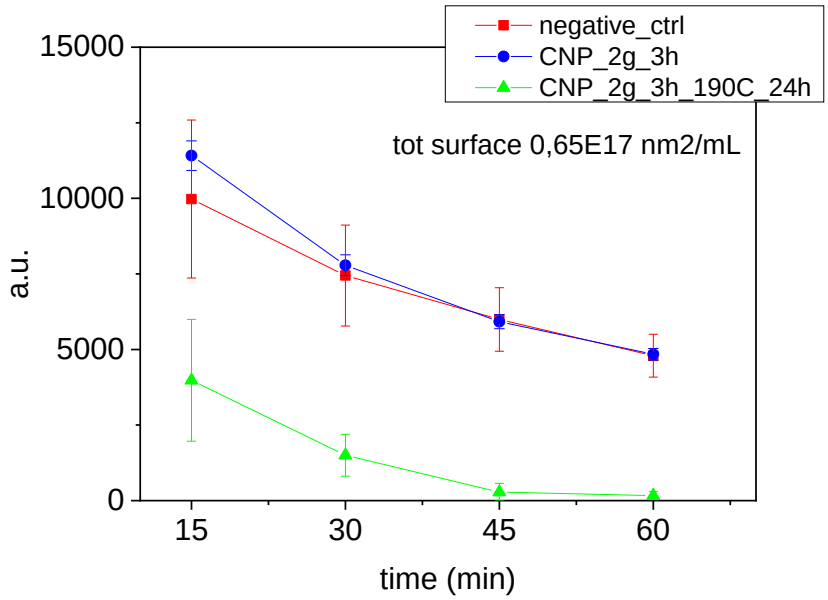

Figure SI-9. Scavenging activity of CNP toward hydroxyl radicals generated by Fenton reaction measure by EPR spin-trapping technique. DMPO was used as spin-trap molecule. The graph shows the average and standard deviation intensity of EPR signal at 3305 G after 15, 30, 45 and 60 minutes of incubation. Sample without CNP (red, Ctrl -), have been performed 7 independent experiments in this condition; EPR spectra recorded in presence of: CNP obtained from 0.22 M of glucose in 3 h (blue) and the same sample subsequently re-heated for 24 h at 190°C (green), have been performed 3 independent experiments in these conditions. The number of radicals produced is proportional to the intensity of the EPR signal.