

Supporting Information

Carboxylated Cellulose Nanocrystals Decorated with Varying Molecular Weights of Poly(diallyldimethylammonium chloride) as Sustainable Antibacterial Agents

Eliskander Rabia ¹, Beza Tuga ¹, José de Ondarza ², Saleen M. Ramos ¹, Edmond Lam ^{3,4}, Sabahudin Hrapovic ³, Yali Liu ³ and Rajesh Sunasee ^{1,*}

¹ Department of Chemistry and Biochemistry, State University of New York at Plattsburgh, Plattsburgh, NY 12901, USA; erabi003@plattsburgh.edu (E.R.); btuga001@plattsburgh.edu (B.T.); sramo009@plattsburgh.edu (S.M.R.)

² Department of Biological Sciences, State University of New York at Plattsburgh, Plattsburgh, NY 12901, USA; deondaj@plattsburgh.edu

³ Aquatic and Crop Resource Development Research Centre, National Research Council Canada, Montreal, QC H4P 2R2, Canada; edmond.lam@cnrc-nrc.gc.ca (E.L.); sabahudin.hrapovic@cnrc-nrc.gc.ca (S.H.); yali.liu@cnrc-nrc.gc.ca (Y.L.)

⁴ Department of Chemistry, McGill University, 801 Sherbrooke St. West, Montreal, QC H3A 0B8, Canada

* Correspondence: rajesh.sunasee@plattsburgh.edu; Tel.: +1-518-564-2703

Table S1. Apparent particle size (DLS), polydispersity index and zeta potential of cCNCs and cCNCs-PDDA samples.

Sample	Apparent Particle Size (nm)	Polydispersity Index (PDI)	Zeta Potential (mV)
cCNCs	97.4 ± 0.4	0.21	-35.1 ± 1.2
cCNCs-PDDA-8500	125.6 ± 2.2	0.18	+31.2 ± 0.8
cCNCs-PDDA-240,000	175.2 ± 0.9	0.27	+48.0 ± 1.4
cCNCs-PDDA-400,000–500,000	207.9 ± 0.6	0.26	+61.8 ± 0.1

Table S2. Dimensions (average length and width) of cCNCs-PDDA samples from TEM images.

Sample	Length (nm)	Width (nm)	# of Particles
cCNCs-PDDA-8500	133.1 ± 37.5	5.26 ± 1.03	218
cCNCs-PDDA-240,000	145.3 ± 39.1	5.09 ± 1.23	240
cCNCs-PDDA-400,000–500,000	133.7 ± 37.1	5.72 ± 1.79	240

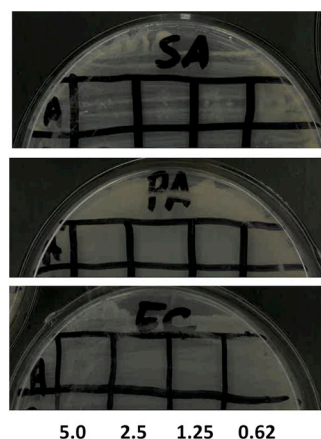


Figure S1. Bacterial lawn growth inhibition assay of pristine cCNCs (Sample A) at dilutions of 5.0, 2.5, 1.25 and 0.62 mg/mL on TSA plates inoculated with SA, EC and PA.

S2. Antibacterial test

MIC method: 24 h broth cultures of SA, EC and PA in Tryptic Soy Broth (TSB; Hardy Diagnostics, Santa Maria, CA) were grown at 30 °C and diluted to an absorbance of 0.1 (600 nm) in TSB, except that a 0.2 ABS₆₀₀ culture was used for the initial cCNCs dilution step (2.5 mg/mL). 100 µL aliquot of each culture was pipetted into wells of sterile 96 well assay plates. 100 µL of each cCNCs stock solution (5 mg/mL) was added to the first well containing bacterial culture (0.2 ABS₆₀₀) and mixed by repeated pipetting (final concentration = 2.5 mg/mL cCNCs and 0.1 A₆₀₀ of cells); 100 µL of this mixture was then transferred to the next well (0.1 A₆₀₀ culture) and mixed, and this process repeated to obtain concentrations of 2.50, 1.25, 0.63, 0.31, 0.16 and 0.08 mg/mL of the cCNC materials. Wells were incubated for 24 h at 35° C and evaluated for growth (turbidity) and survival (streaking 5 µL of each well onto agar plates).

Results: Serial dilution of different cCNCs solutions attained concentrations of 2.5–0.08 mg/mL in culture containing ~10⁷ cells/mL. Dilutions of 2.5 and 1.25 mg/mL exhibited turbidity due to cCNCs. Following incubation at 30 °C for 24 h, cloudiness of each well due to bacterial growth was assessed. Absence of cloudiness indicated growth inhibition.

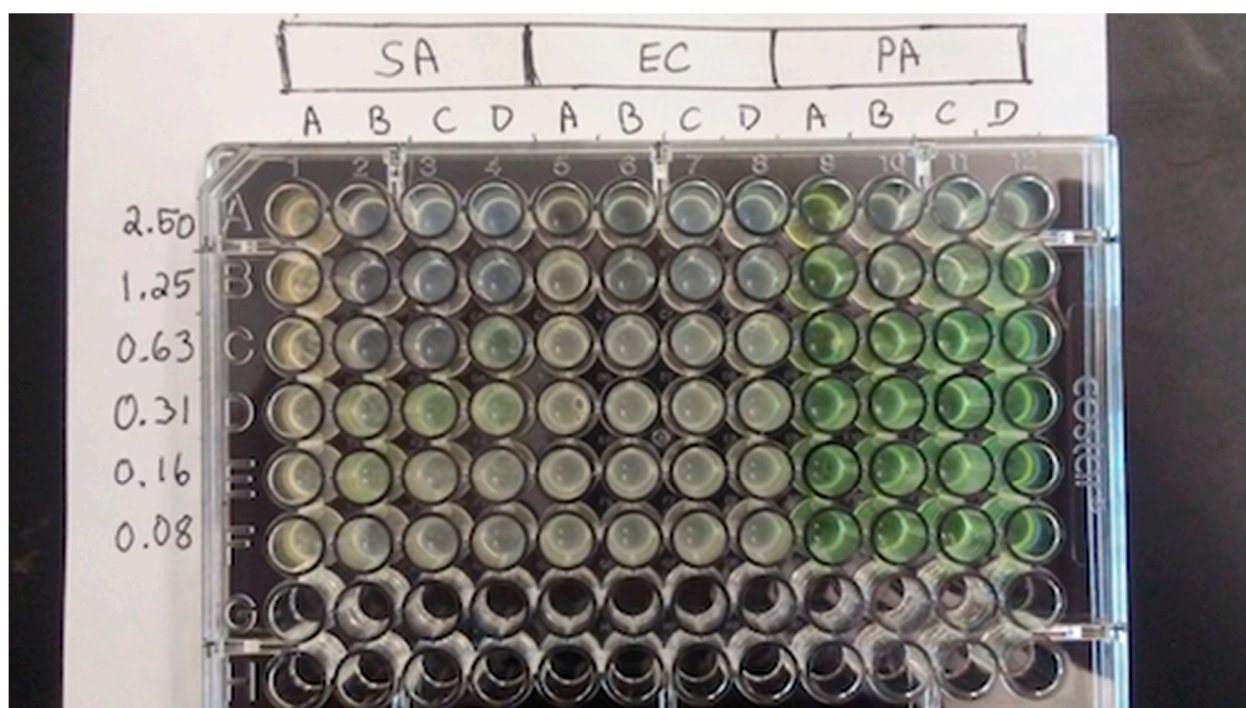


Figure S2. Broth dilution assay with (A) cCNCs, (B) cCNCs-PDDA-8500, (C) cCNCs-PDDA-240,000, and (D) cCNCs-PDDA-400,000–500,000 against the bacterial species (SA, EC, PA) at varying concentrations.

Table S3. MIC values of free PDDA as positive control from bacterial lawn inhibition assays.

Bacteria	PDDA-8500	PDDA-400–500k
<i>E. coli</i>	0.625 mg/mL	0.078 mg/mL
<i>S. aureus</i>	1.25 mg/mL	0.156 mg/mL
<i>P. aeruginosa</i>	none	2.5 mg/mL

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