Electronic Supplementary Material (ESI) for Nanoscale
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Supplementary Information

Vortex fluidic entrapment of functional microalgal cells in a magnetic polymer matrix

Ela Eroglu[a,b], Nicholas J. D'Alonzo,[a] Steven M. Smith[b], and Colin L. Raston[a, c]*

[a] *Centre for Strategic Nano-Fabrication, School of Chemistry and Biochemistry, The University of Western Australia, Crawley, WA 6009, Australia, Fax: (+61) 8 6488 8683; Tel: (+61) 8 6488 3045; E-mail: colin.raston@uwa.edu.au*

[b] *ARC Centre of Excellence in Plant Energy Biology, The University of Western Australia M313, 35 Stirling Highway, Crawley, WA 6009, Australia.*

[c] *School of Chemical and Physical Sciences, Flinders University, Bedford Park, SA 5042, Australia*

S1. Atomic Force Microscopy

Tapping-mode AFM imaging was undertaken to investigate the location of the magnetite nanoparticles with respect to their PVP coating. Height (Figure S1a, S2a), phase (Fig. S1b, S2b), and amplitude (Fig. S1c, S2c) AFM results have been reported as two-phase (Fig.S1) and 3D topographic images (Figure S2). Amplitude and phase AFM images revealed that the majority of the magnetic nanoparticles are embedded within the PVP coating, as the imaging tip of the AFM could not directly make contact with the nanoparticles. The amplitude AFM image gives information about the edges of the features. Figure S1c and S2c mostly displayed a nearly uniform/smooth surface of PVP polymer, without any significant amplitude peaks. If the magnetite particles were on the surface, major amplitude peaks are expected. The location of the magnetic nanoparticles came from AFM phase contrast images (Figure S1b, S2b), with sharp peaks having a sharp color contrast (white color) indicative of the hard surface of the magnetic nanoparticles compared to the soft PVP material coating them. Height profile (Fig S1a) gave the size of the particles at around 2 nm (Fig. S1a), in contrast to 10 nm particles (Figure S1b) from TEM and XRD (Figure 2). Blocking of the actual height of the nanoparticles by the PVP coating can also be interpreted as an evidence for the particles being embedded within the PVP polymer matrix.

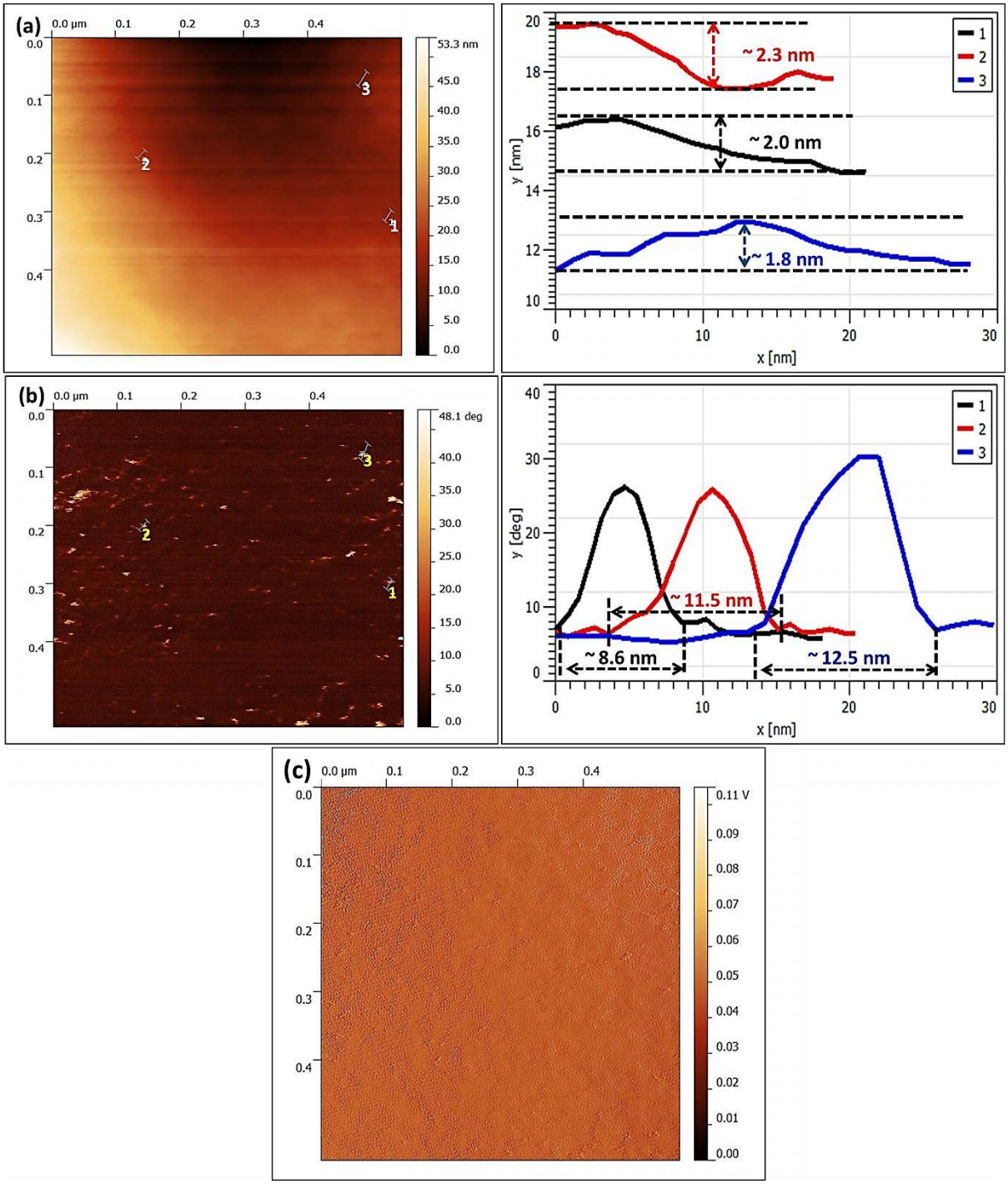

Figure S1. Two-dimensional (a) height, (b) phase, and (c) amplitude AFM images of 0.55 x 0.55 µm surface area of the PVP/magnetite nanoparticle composite. Height and phase profiles of selected area in Figure S1a and S1b are given on the right hand side of each associated figure.

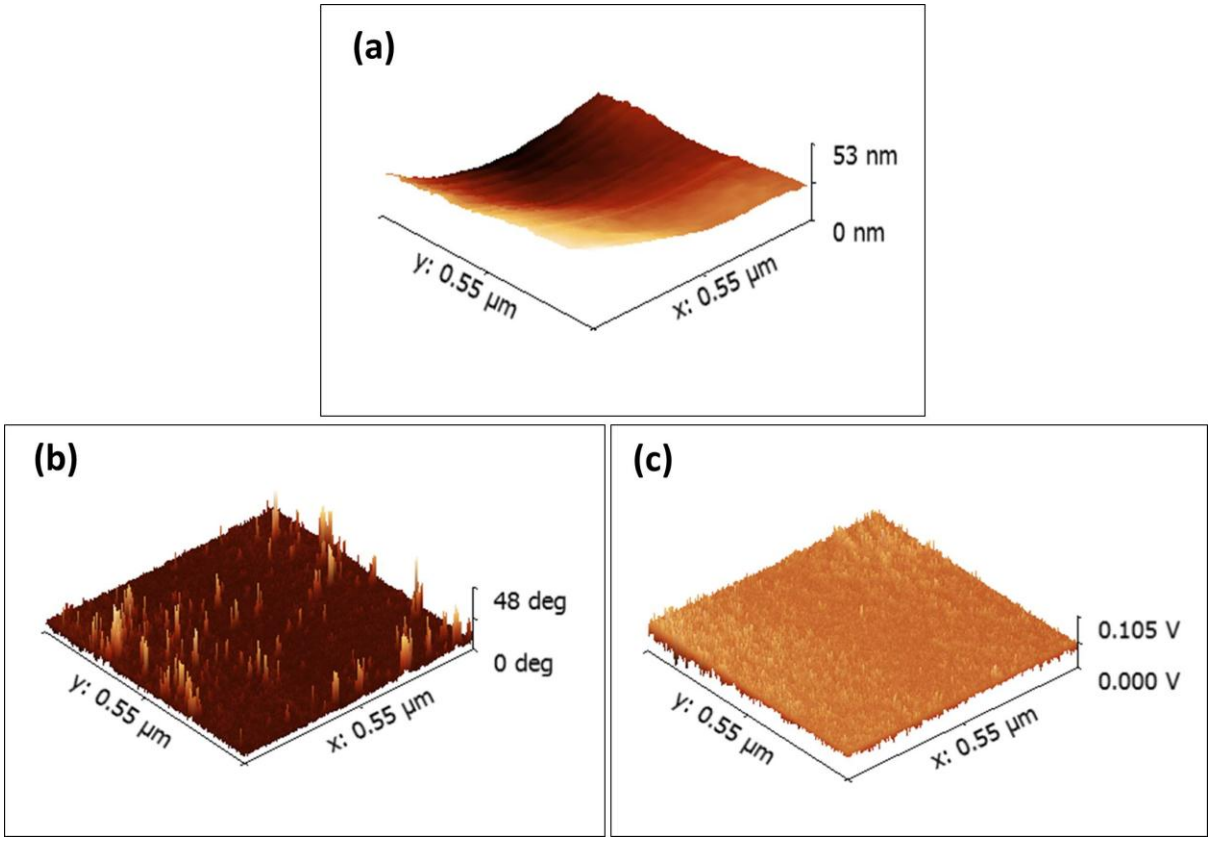

Figure S2. Three-dimensional (a) height, (b) phase, and (c) amplitude AFM images of 0.55 x 0.55 µm surface area of the PVP/magnetite nanoparticle composite.

S2. Total chlorophyll content of recollected microalgal cells from their PVP matrix via mild sonication

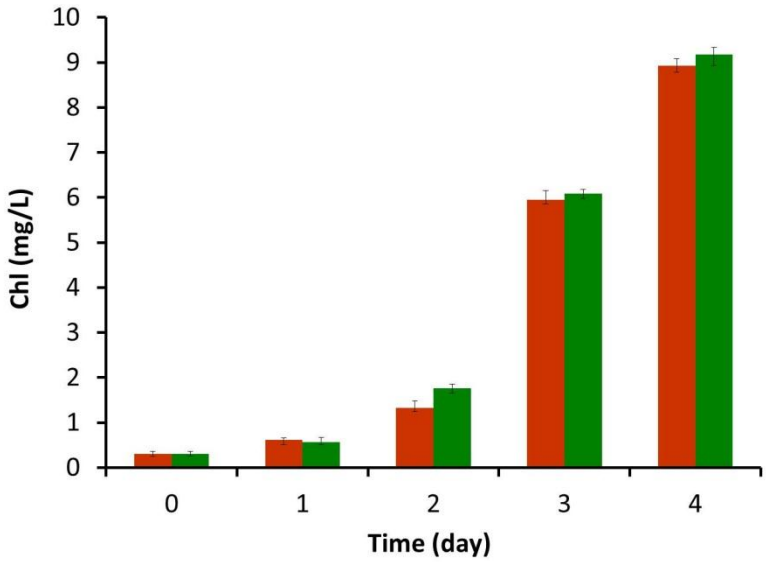

Figure S3. Total chlorophyll (Chl *a* & *b*) content as a function of time with unprocessed microalgal cells as a control (green column), and recollected microalgal cells from their PVP matrix using mild sonication for 30 seconds (red column).