Supplementary Information (SI) for RSC Advances.
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Supporting Information

Investigating the Fluorescence in C-Dots immobilized on Alginate Hydrogels- A study on Diffusion Kinetics and Adsorption Mechanisms

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Supporting Figures

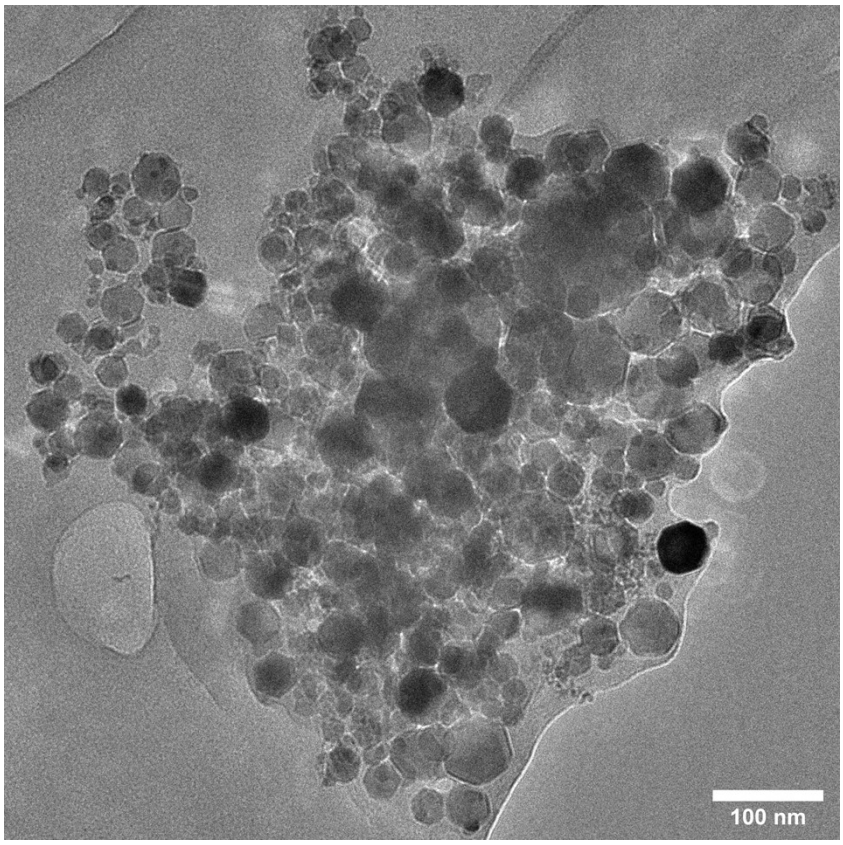

Figure S1. Transmission electron microscopy (TEM) image of synthesized C-dots with a 100 nm scale bar, where the size and size distribution of the synthesized C-dots were illustrated and analyzed.

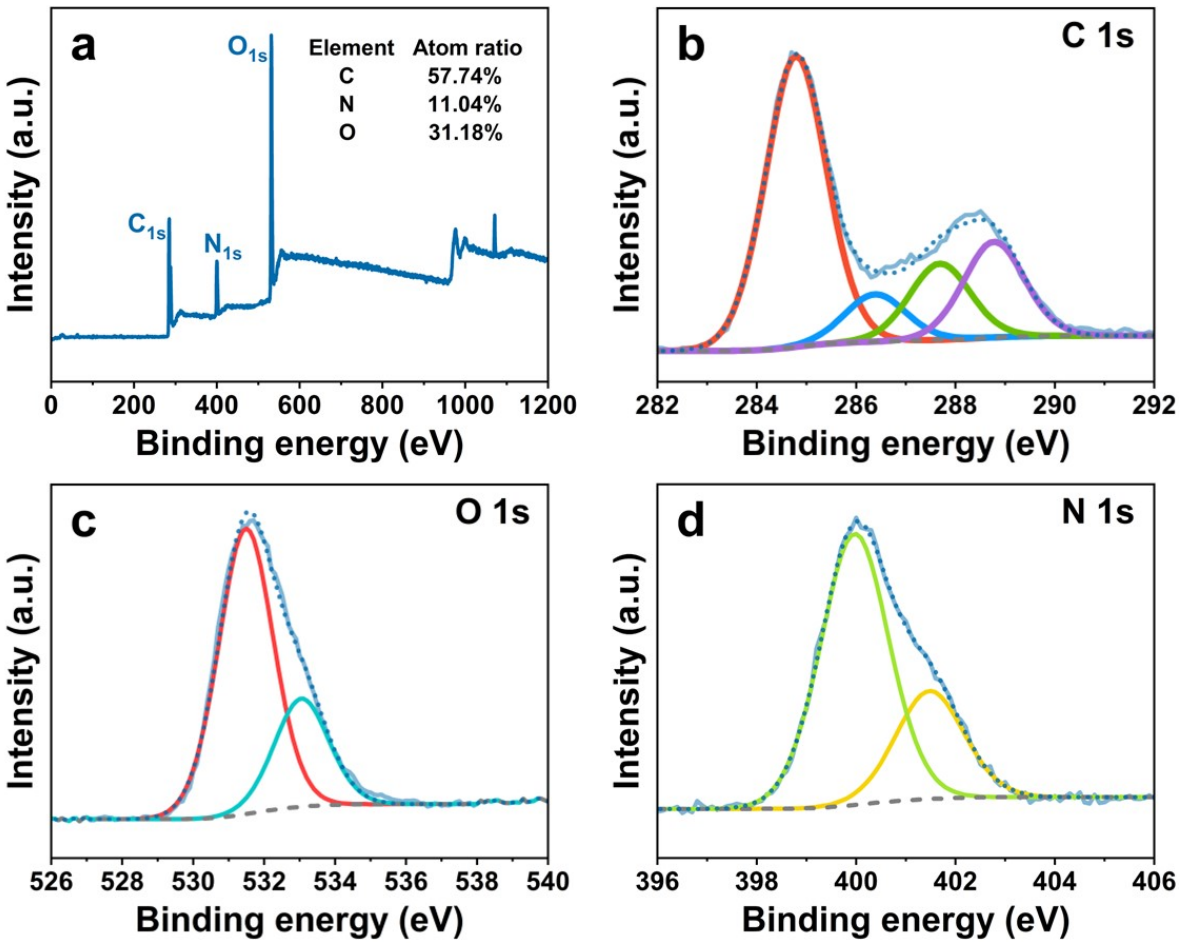

Figure S2. (a) XPS survey spectra, **(b)** C 1s spectra, **(c)** O 1s spectra, and **(d)** N 1s spectra of synthesized N-doped C-dots.

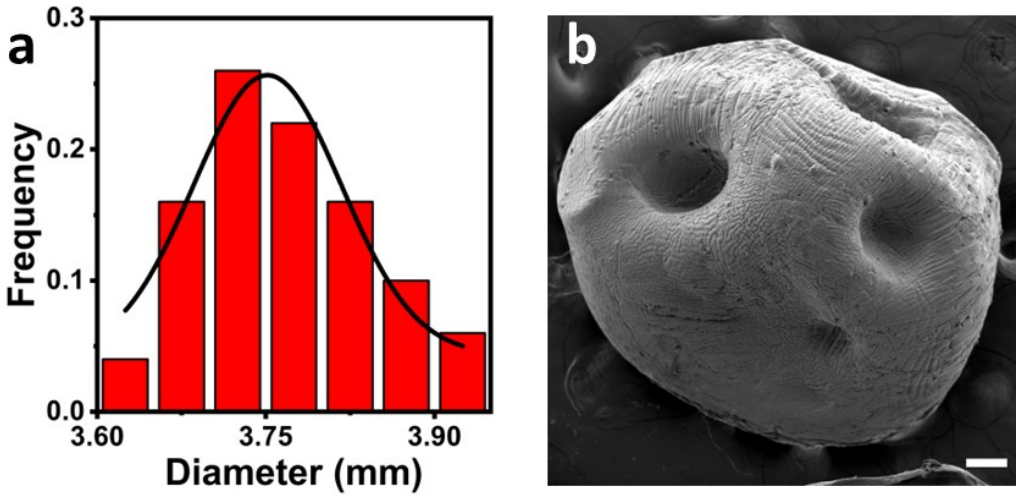

Figure S3. (a) Size distribution analysis of ALG-as-made hydrogel beads based on their optical microscopy images, and **(b)** SEM image of the surface of a freeze-dried ALG-as-made bead, scale bar = 100 μm.

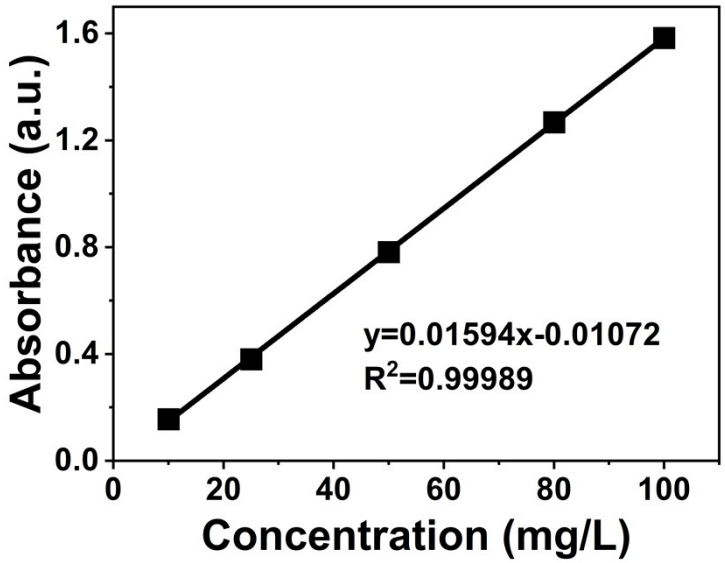

Figure S4. Concentration calibration plot from UV-Vis absorption of C-dots solution with concentrations of 100, 80, 50, 20, and 10 mg/L, respectively. All samples were measured at neutral pH.

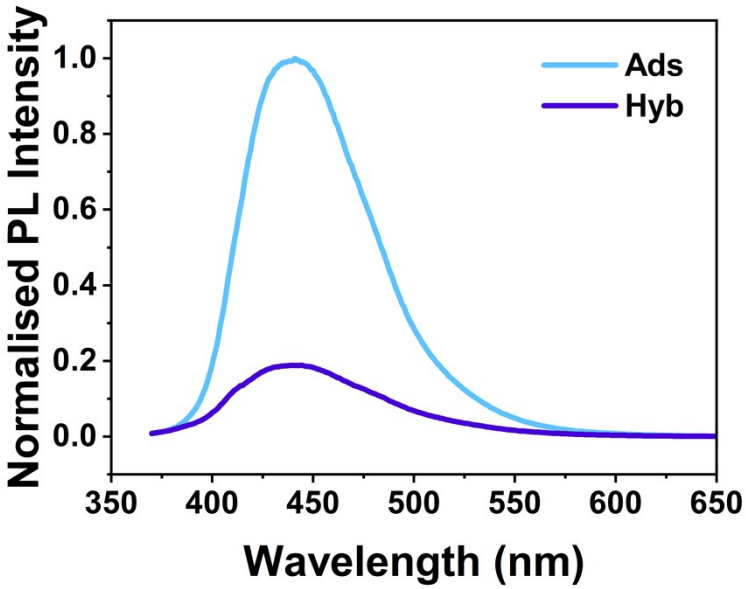

Figure S5. Normalised PL intensity of C-dots in the solution outside the beads after immersing ALG-C-dots-Ads and ALG-C-dots-Hyb for the same duration, with identical C-dot content in both systems.

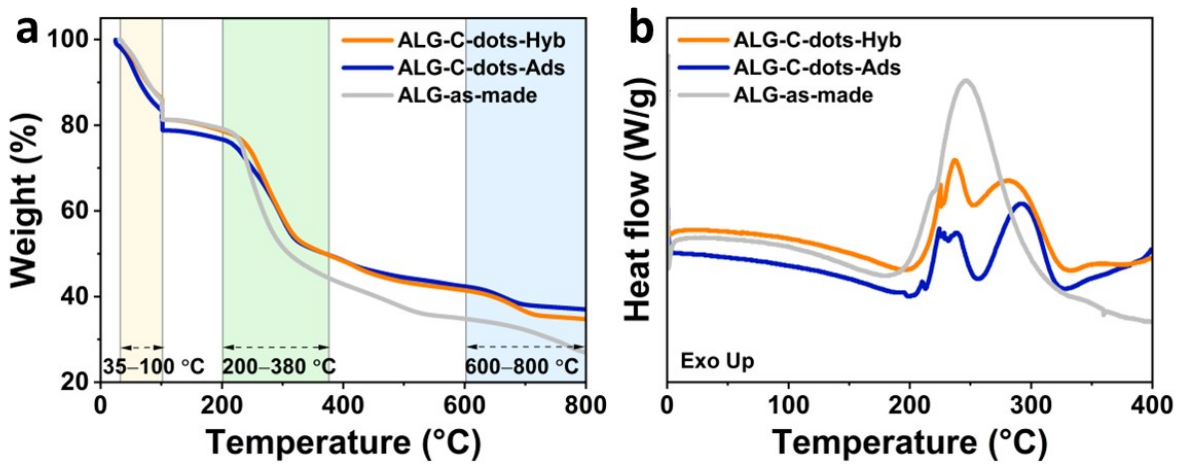

Figure S6. (a) TGA and **(b)** DSC analysis curves of ALG-as-made, ALG-C-dots-Hyb, and ALG-C-dots-Ads beads, respectively.

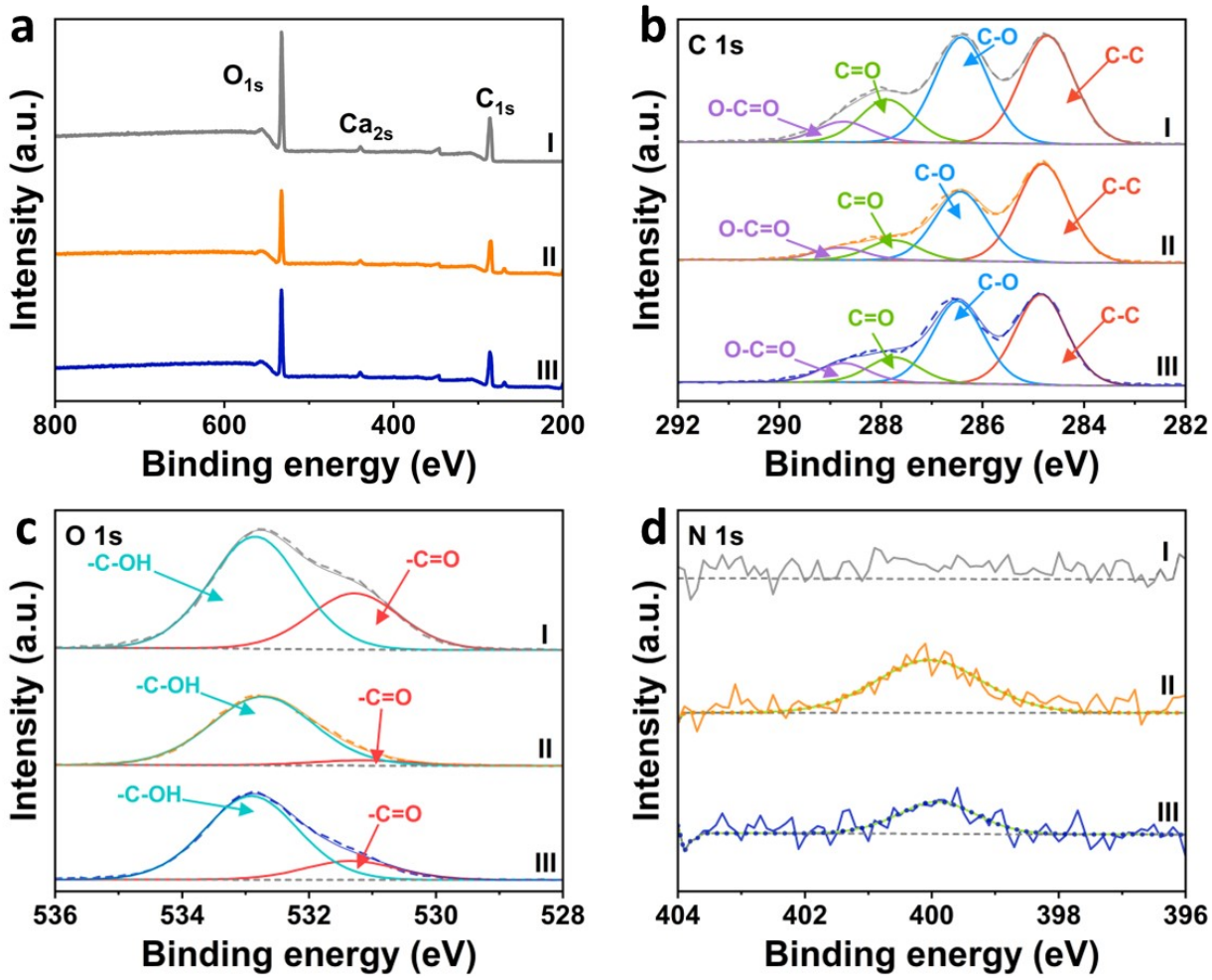

Figure S7. (a) XPS survey spectra, **(b)** C 1s spectra, **(c)** O 1s spectra, and **(d)** N 1s spectra of freeze dried ALG-as-made, ALG-C-dots-Hyb, and ALG-C-dots-Ads bead samples, respectively.

Supporting Tables

Table S1. Kinetic parameters for C-dots adsorption with 4 batches of initial concentrations on ALG-as-made beads.†

Concentration (mg/L)	$q_{e,exp}$ (mg/g)	**Pseudo-first-order model**			**Pseudo-second-order model**		
		$q_{e,cal}$ (mg/g)	K_1 (/min)	R^2	$q_{e,cal}$ (mg/g)	K_2 (g/mg min)	R^2
100	0.8543	0.8778	0.0166	0.930	0.9388	0.0230	0.859
80	0.6918	0.7003	0.0159	0.900	0.7513	0.0269	0.839
50	0.4236	0.4266	0.0249	0.900	0.4598	0.0773	0.824
20	0.2186	0.2178	0.0224	0.931	0.2305	0.1292	0.873

† $q_{e,exp}$ (mg/g) is the experimental value of adsorption capacity, $q_{e,cal}$ (mg/g) is the theoretical value of adsorption capacity.

Table S2. XPS peak binding energy shifts for ALG-as-made, ALG-C-dots-Hyb, and ALG-C-dots-Ads bead samples, respectively.

C 1S	C-C (eV)	C-O (eV)	C=O (eV)	O-C=O (eV)
ALG-as-made (I)	284.74	286.40	287.85	288.74
ALG-C-dots-Hyb (II)	284.84	286.49	287.75	288.78
ALG-C-dots-Ads (III)	284.82	286.44	287.78	288.81

O 1S	C=O (eV)	C-OH (eV)
ALG-as-made (I)	531.28	532.87
ALG-C-dots-Hyb (II)	531.35	532.92
ALG-C-dots-Ads (III)	531.01	532.73