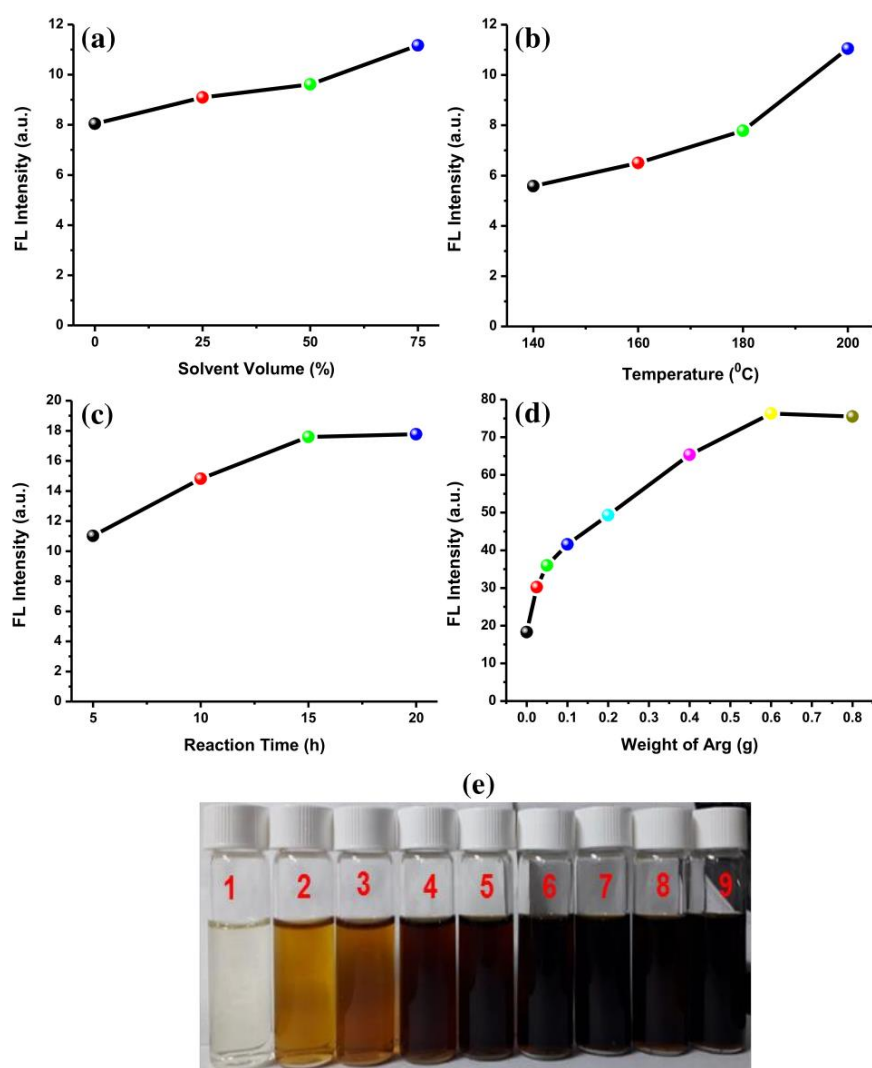


## Electronic Supporting Information

# Nitrogen-Doped Carbon Dots from *Averrhoa carambola* Fruit Extract as a Fluorescent Probe for Methyl Orange

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**Figure S1.** Fluorescence intensity of AC-NCDs prepared at different (a) solvent volume percentages, (b) hydrothermal temperatures, (c) reaction time durations, (d) weights of Arg in 10 mL AC fruit extract solutions, and (e) the appearances of synthetic products (1: 0.1 g L-arginine only in 10 mL H<sub>2</sub>O, 2: AC fruit extract solution only, 3-9: AC fruit extract solution with L-arginine (0.025, 0.05, 0.1, 0.2, 0.4, 0.6, 0.8 g, respectively)). Synthetic conditions were kept at 200°C of temperature and 15 h of reaction time duration.

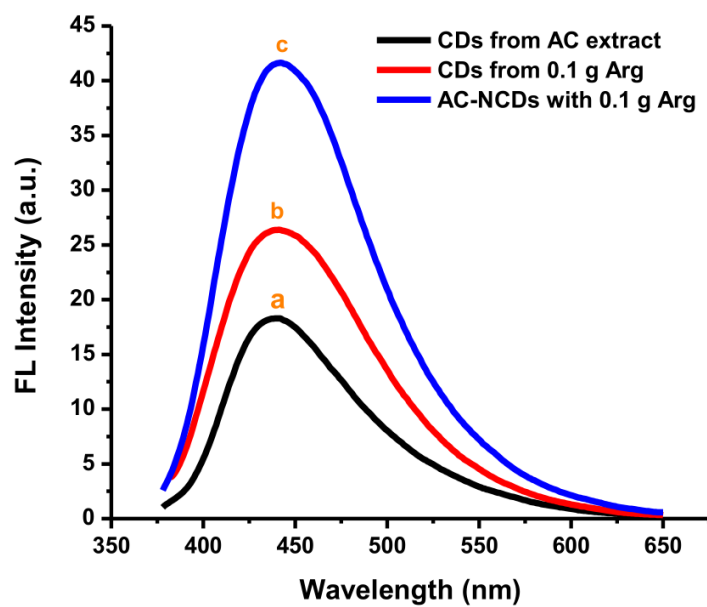


Figure S2. Fluorescence intensity of (a) CDs from AC fruit extract solution, (b) CDs from 0.1 g Arg in 10 mL ultrapure water, and (c) AC-NCDs prepared from AC fruit extract solution with 0.1 g Arg. The excitation wavelength was 360 nm and the synthetic conditions were kept at 200°C for 15 h.

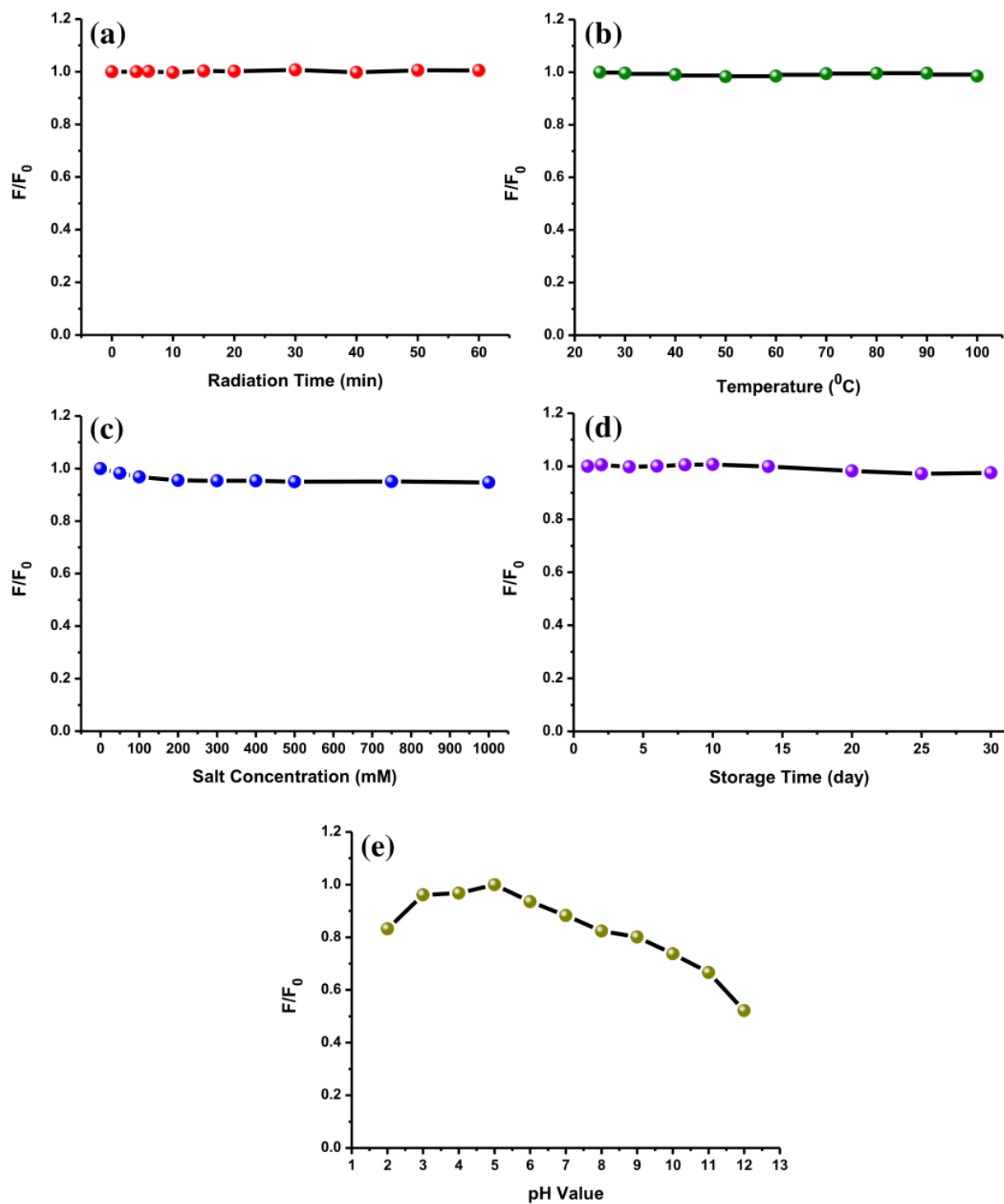


Figure S3. The fluorescence spectra comparison of AC-NCDs' solution with various (a) light irradiation times, (b) heating temperatures, (c) salt concentrations, (d) storage times, and (e) pH values.

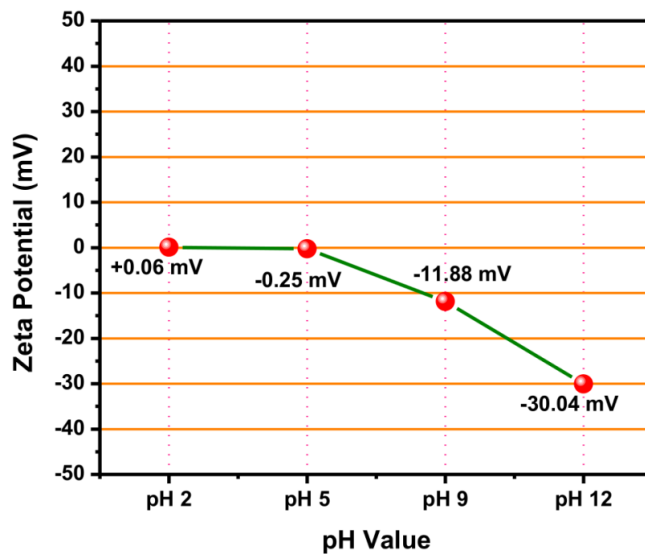


Figure S4. Zeta potential graphs of AC-NCDs' solutions at different pH values (2, 5, 9, and 12).

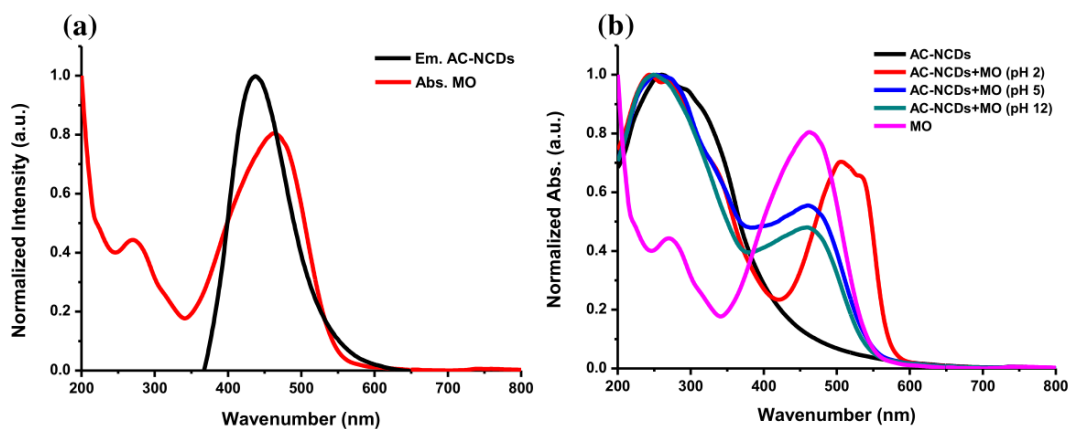


Figure S5. (a) The normalized fluorescence emission spectrum of AC-NCDs and UV-vis absorption spectrum of MO dye, and (b) UV-vis spectra comparison of AC-NCDs, MO, and AC-NCDs/MO system (pH 2, 5, and 12). The MO concentration was 50  $\mu\text{M}$ .

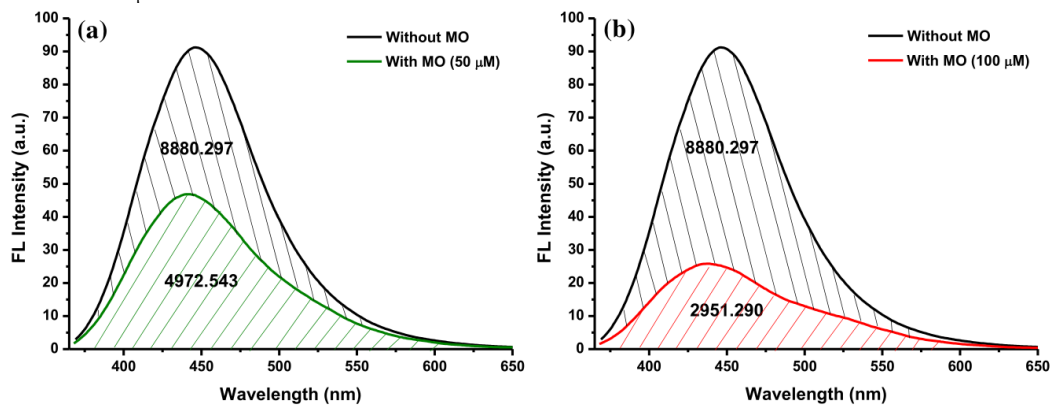


Figure S6. FRET measurement according to the equation  $E=1-(FD/FD')$ . The excitation wavelength was 360 nm; the integrated fluorescence intensity was calculated from 360 nm to 650 nm with (a) 50  $\mu\text{M}$  MO and (b) 100  $\mu\text{M}$  MO.

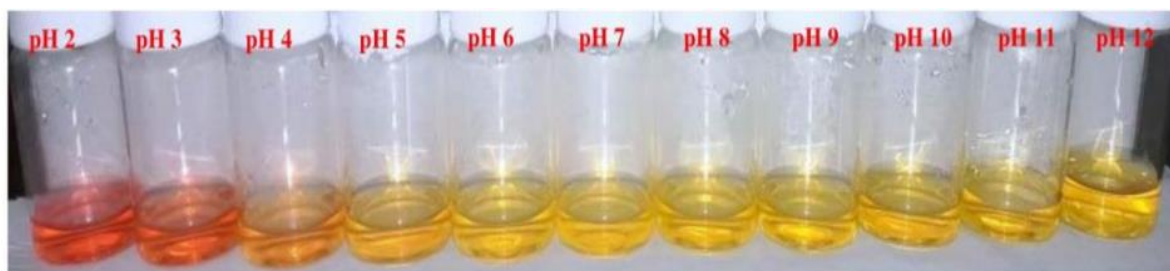


Figure S7. The appearance of AC-NCDs/MO system with different pH values (MO concentration was 50  $\mu\text{M}$ ).

Table S1. The comparison of starting materials, synthetic methods, excitation wavelengths ( $\lambda_{\text{ex}}$ ), emission wavelengths ( $\lambda_{\text{em}}$ ), and quantum yield (QY) from some N-doped CDs

No.	Starting Material	Method	$\lambda_{\text{ex}}$ (nm)	$\lambda_{\text{em}}$ (nm)	QY (%)	Ref.
1	Glucose + <i>m</i> -phenylenediamine	Microwave	370	500	11.2	48
2	Citric acid + 1,10-Phenanthroline	Solid State	360	440	10	49
3	<i>Chionanthus retusus</i> fruit + Ammonia	Hydrothermal	340	425	9	50
4	Lemon fruit + L-arginine	Hydrothermal	340	490	7.7	51
5	<i>Prunus avium</i> fruit + Ammonia	Hydrothermal	310	411	13	52
6	AC fruit + L-arginine	Hydrothermal	360	440	12.35	This work

Table S2. The comparison of this method with other methods for the probing of MO

No	Detection method/based on	Linear range ( $\mu\text{M}$ )	LOD ( $\mu\text{M}$ )	Ref.
1	Micellar Liquid Chromatography	0.15-15	0.15	18
2	Electrochemical/Smectite-HDTMA/GCE	0.1-1.6	0.04	19
3	SERS/ $\beta$ -CD@Ag NP monolayer	0.5-10	0.50	20
4	Extraction/Chitosan-zinc oxide NPs	10-1000	0.70	21
5	Fluorescent probe/AC-NCDs	1-25	0.30	This work

Table S3. The probing of MO in tap water samples ( $n = 3$ ).

No.	Added ( $\mu\text{M}$ )	Found ( $\mu\text{M}$ )	R (%)	RSD (%)
1	0	ND <sup>a</sup>	-	-
2	5	4.98 $\pm$ 0.01	99.59	0.25
3	10	9.97 $\pm$ 0.03	99.68	0.34
4	20	19.96 $\pm$ 0.02	99.79	0.09
5	50	49.63 $\pm$ 0.08	99.27	0.21
6	75	74.78 $\pm$ 0.11	99.71	0.18

<sup>a</sup>ND: not detected