Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting information

Solvent-dependent carbon dots and their applications in detection of water in organic solvents

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Experimental

Preparation of *o*-CD/polymer films

For *o*-CDs/PS or *o*-CDs/PVP film preparation: 1 g PS or PVP was mixed with 5 mL *o*-CDs solution (3.0 mg in dichloromethane) and treated by ultrasound using an ordinary ultrasonic cleaner with a power of 50W to a complete dissolution. The obtained mixture was transferred into a home-made instrument and dried overnight under ambient circumstances.

For *o*-CDs/PVA film preparation: 1 g PVA was added into 10 mL *o*-CDs solution (3.0 mg in water) and heated to 95°C to be completely dissolved. The obtained solution was dropped casting on a home-made instrument and allowed drying for overnight under ambient circumstances.

Quantum yields (QYs) measurements

The QYs of *o*-CDs in all the selected solvents were determined by a relative method using rhodamine 6G (QY = 95% in ethanol) as a reference sample. The QYs were calculated according to the below equation:

$$\phi_x = \phi_r \times \frac{A_r}{I_r} \times \frac{I_x}{A_x} \times \frac{\eta_x^{\,2}}{\eta_r^{\,2}}$$

Where ϕ is the QY, I is the integrated emission intensity, A is the optical density, and η is the refractive index of the solvent. The subscripts of "r" and "x" refer to the reference and the sample, respectively. The absorbance values of all samples were kept under 0.1 at the excitation wavelength (420 nm) to minimize re-absorption effects.

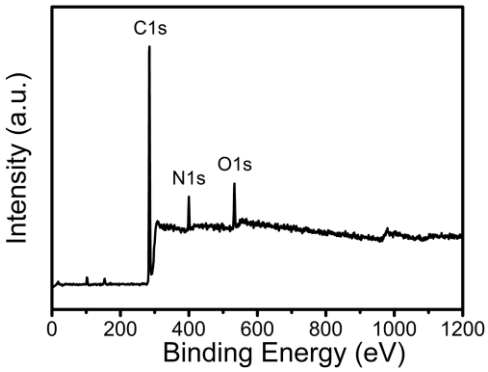

Fig. S1 The XPS spectrum of the *o*-CDs.

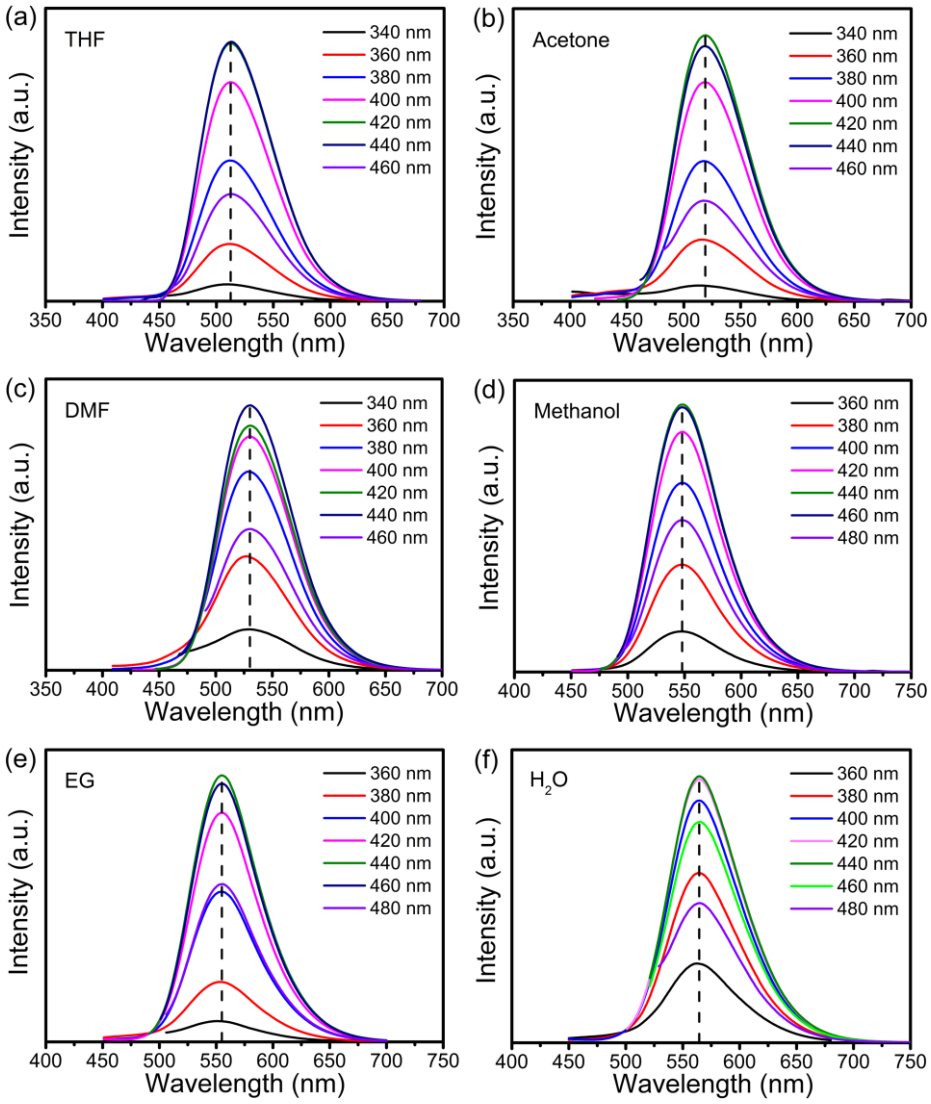

Fig. S2 The PL emission spectra of *o*-CDs in six solvents under different wavelengths.

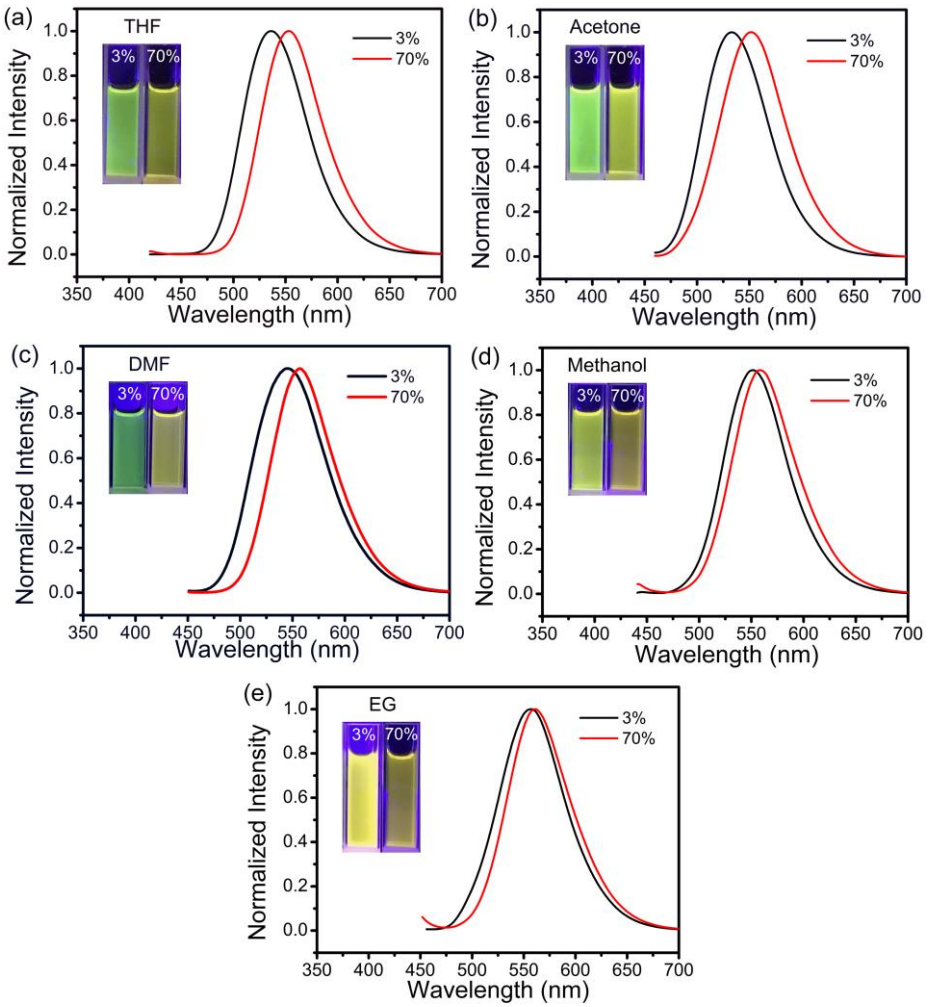

Fig. S3 The PL spectra of o-CDs in different solvents with a certain amount of water and corresponding photographs excited at 400 nm.

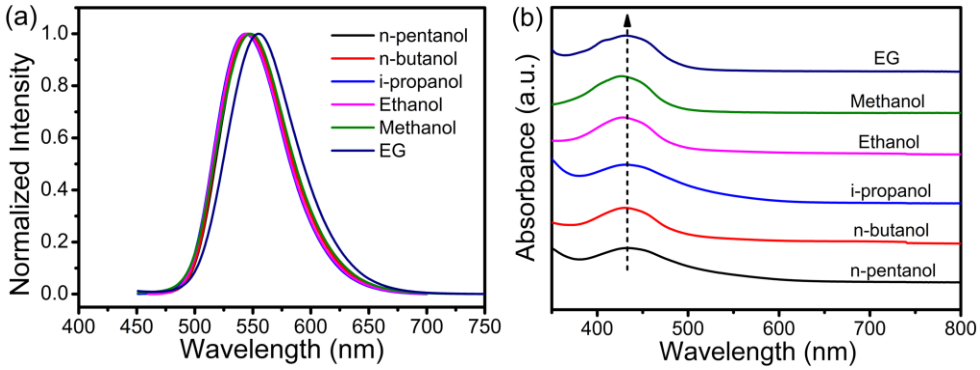

Fig. S4 (a) The normalized PL emission and (b) UV-vis absorption spectra of *o*-CDs in six alcohol solvents.

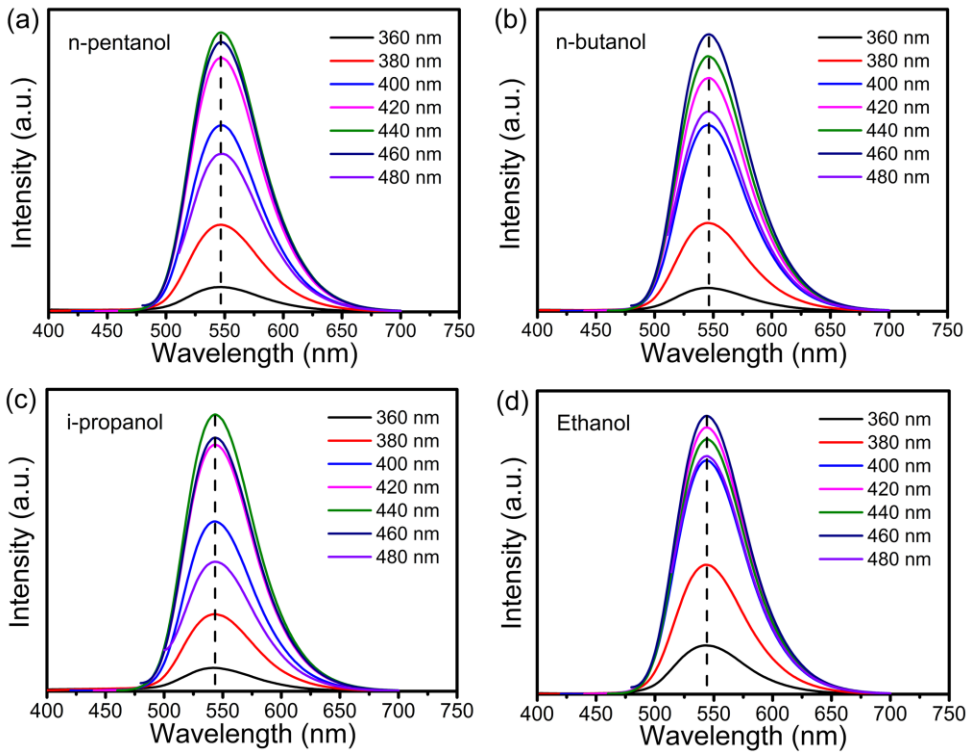

Fig. S5 The fluorescence spectra of *o*-CDs in different alcohol solvents under various excitation wavelengths.

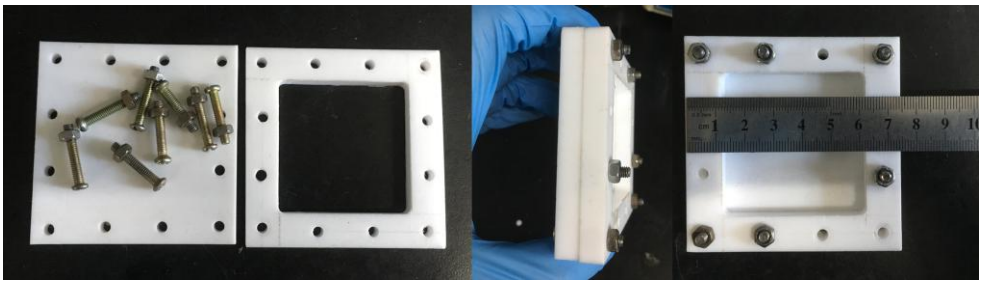

Fig. S6 Photos of the instrument for preparing CDs/polymer films.

Table S1 The PL properties of *o*-CDs in different solvents

Solvent	THF	Acetone	DMF	Methanol	EG	H_2O
Emission peak (nm)	512	519	530	547	554	565
FWHM (nm)	73	76	78	69	68	72
QY (%)	25.9	38.3	14.8	21.5	18.5	7.7

Table S2 The PL properties of *o*-CDs in different alcohol solvents

Solvent	n-pentanol	n-butanol	i-propanol	Ethanol	Methanol	EG
Emission peak (nm)	545	545	543	544	547	554
FWHM (nm)	67	67	68	68	69	68
QY (%)	15.0	24.1	12.5	27.0	21.5	18.5

Table S3 The PL properties of different *o*-CDs/polymer films

Polymer	PS	PVP	PVA
Emission peak (nm)	503	533	550
FWHM (nm)	99	72	73

Table S4 Comparison of o-CDs with solvent-dependent fluorescence

Material	Synthesis method	Peak change (nm)	Color change	QY (%)	Application	Ref.
Formamide	Microwave	385–420	Blue	no	no	4
pCN-TPA[a] and PEG_{2k}	Solvothermal	443–476 in organic solvents, 606 in H_2O	Blue, Pink	10.1–36.5	VOCs[b] detection	5
EDTA-2Na[c]	Pyrolytic	400–435	Blue	no	no	23
Graphene oxide	Solvothermal	475–515	Blue–green	no	no	24
CPC[d]	Hydrothermal	no	Blue–yellow	no	no	25
p-PD	Hot injection	511–615	Dark green–red	9.2–34.7	CDs/polymer films and CDs-LEDs	26
m-PD	Solvothermal	400–500	Blue–cyan	no	no	38
Hydroquinone and Ethylenediamine	Refluxing	450–520	Blue–green	26.6–78.6	no	40
o-PD	Hydrothermal	512–565	Cyan–orange	7.7–38.3	CDs/polymer films and Water detection	This work

[a] pCN-TPA = (Z)-4-(2-cyano-2-(4′-(diphenylamino)-[1,1′-biphenyl]-4-yl)-vinyl)benzonitrile.

[b] VOCs = Volatile organic compounds. [c] EDTA-2Na = ethylene-diamine-tetraacetic acid salts.

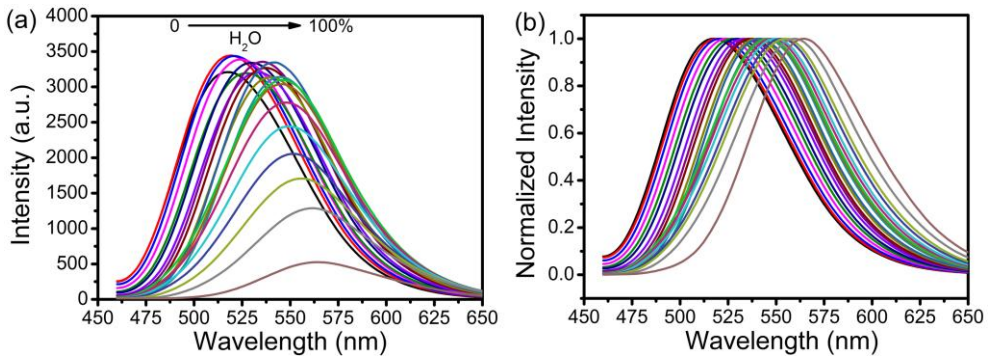

Fig. S7 (a) Original PL emission spectra and **(b)** corresponding normalized PL emission spectra of *o*-CDs dispersed in acetone with increasing water content.

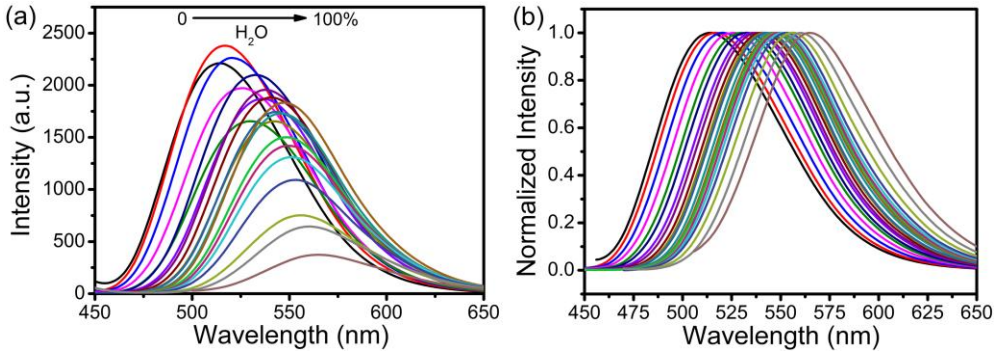

Fig. S8 (a) Original PL emission spectra and **(b)** corresponding normalized PL emission spectra of *o*-CDs dispersed in THF with increasing water content.

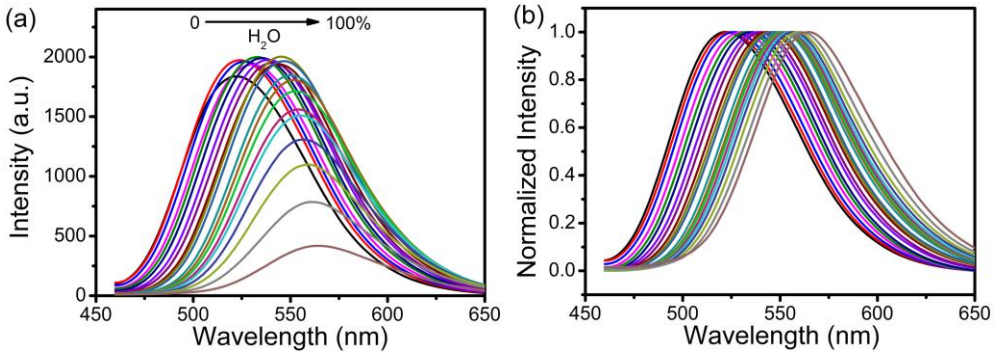

Fig. S9 (a) Original PL emission spectra and **(b)** corresponding normalized PL emission spectra of *o*-CDs dispersed in acetonitrile with increasing water content.

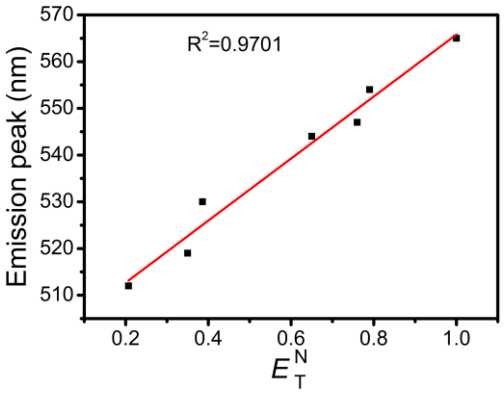

Fig. S10 Emission peak of spectra from six different solvents (Fig. 4a) and ethanol as a function of *E*T N solvent polarity parameter.

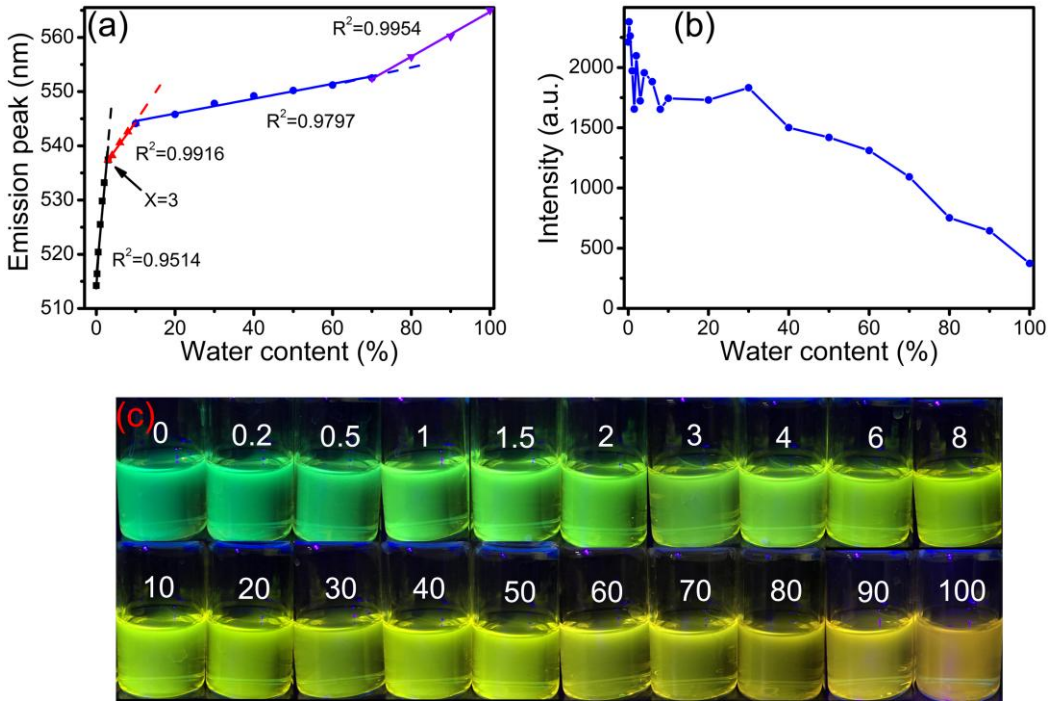

Fig. S11 Plot of **(a)** emission peak and **(b)** emission intensity versus water content in THF. **(c)** Visual PL photos of *o*-CDs dispersed in THF with various water contents excited at 400 nm.

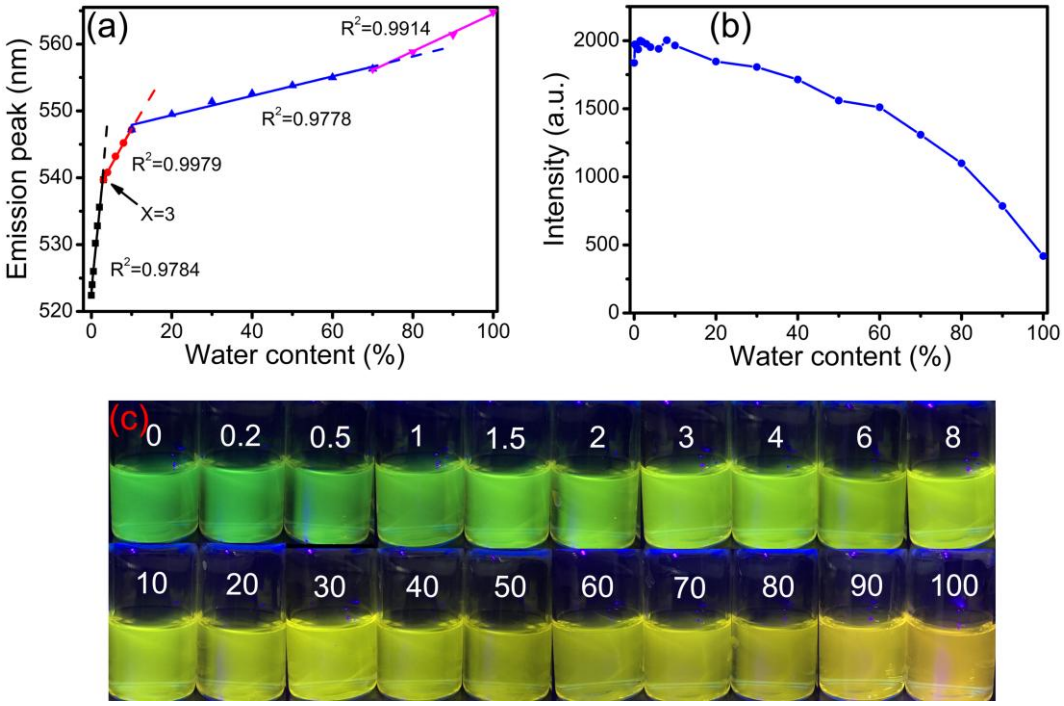

Fig. S12 Plot of **(a)** emission peak and **(b)** emission intensity versus water content in acetonitrile. **(c)** Visual PL photos of *o*-CDs dispersed in acetonitrile with various water contents excited at 400 nm.