Supporting Information

for

Fluorometric detection of pH and quercetin based on nitrogen and phosphorus co-doped highly luminescent graphene-analogous flakes

Buhong Gao,[a] Yu Sun,[b] Yingchun Miao,[a] Li Xu*[b] and Zhongxia Wang*[c]

[a]Advanced Analysis&Testing Center, Nanjing Forestry University Nanjing 210037, China.

[b]College of Science, Nanjing Forestry University, Nanjing, 210037, China.

[c]School of Chemistry and Chemical Engineering, Yancheng Institute of Technology, Yancheng 224051, P. R. China.

Corresponding author

*E-mail: gaobuhong@126.com; wangzx198411@163.com

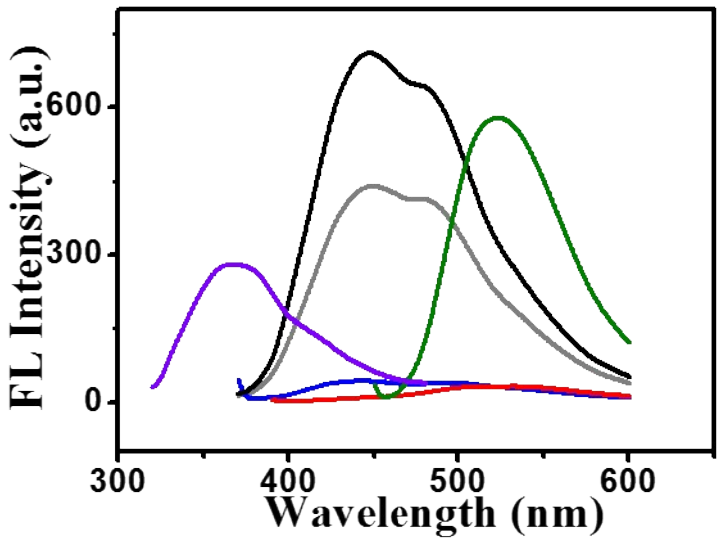

Fig. S1 The CNMs from different comonomers: β-CD (pink line), β-CD and VPA (blue line), β-CD, VPA and oPD (black line), β-CD, VPA and mPD (green line), β-CD, VPA and pPD (purple line) and β-CD, VPA and H_3PO_4 (gray line).

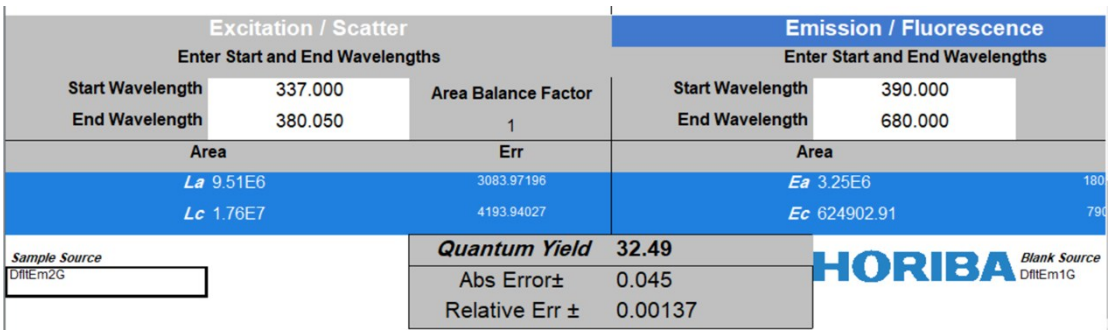

Fig. S2 The quantum yield of the prepared NPCGFs.

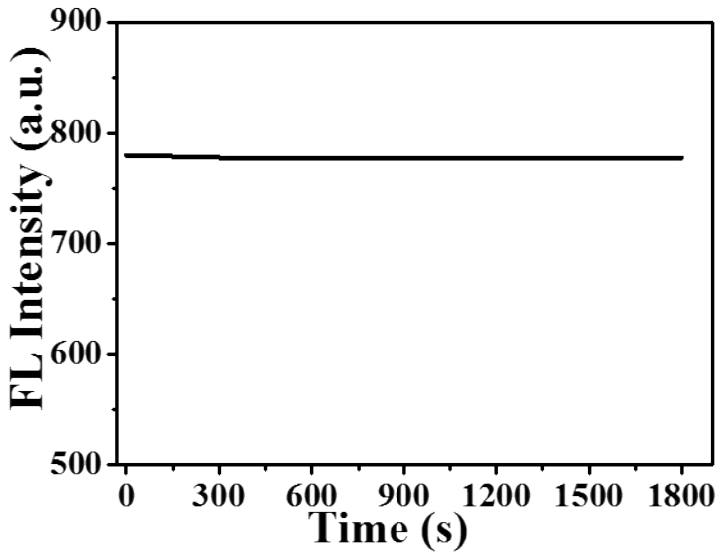

Fig. S3 Effect of time under illumination on the FL intensity of NPCGFs.

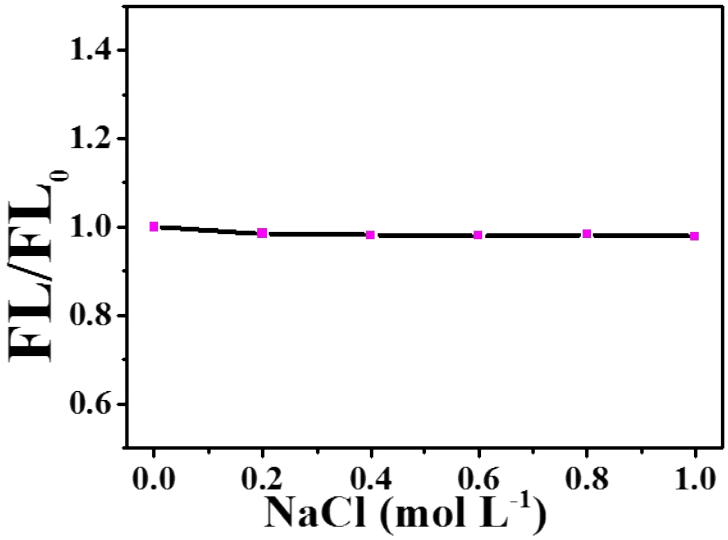

Fig. S4 Effect of ionic strength on the FL intensity of NPCGFs.

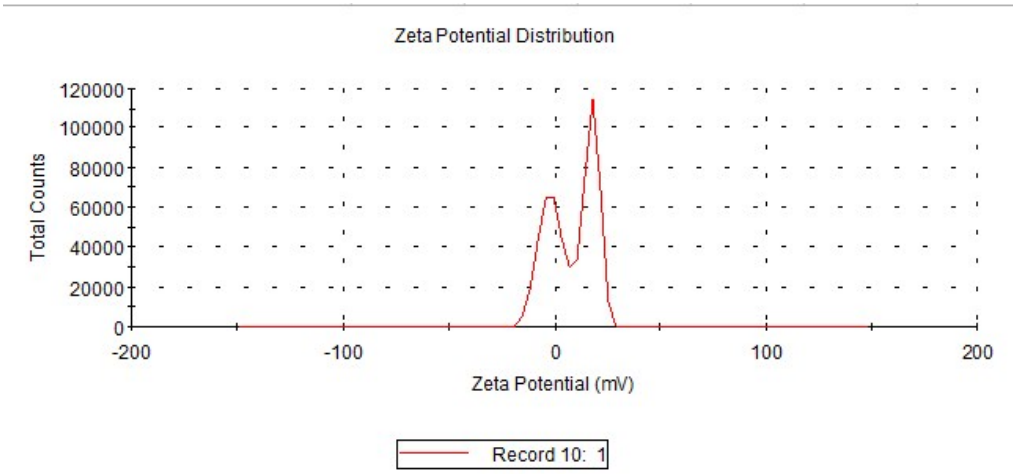

Fig. S5 Zeta potential of NPCGFs in 0.05 M PBS buffer (pH = 7) solution.

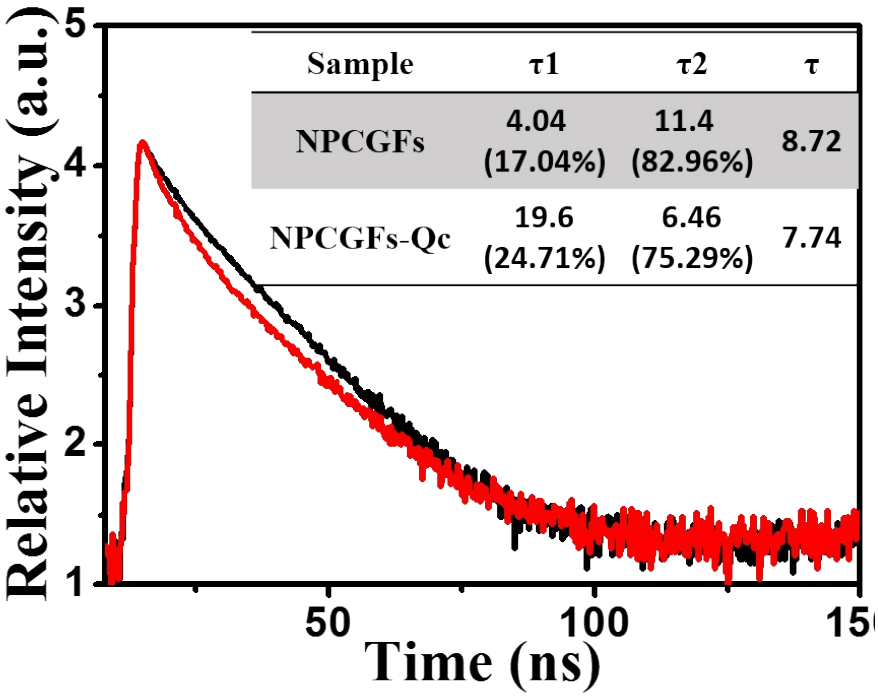

Fig. S6 FL decay of free NPCGFs (black line, 40μg mL^{-1}) and NPCGFs (red line, 40μg mL^{-1}) in the presence of Qc (20μg mL^{-1}).

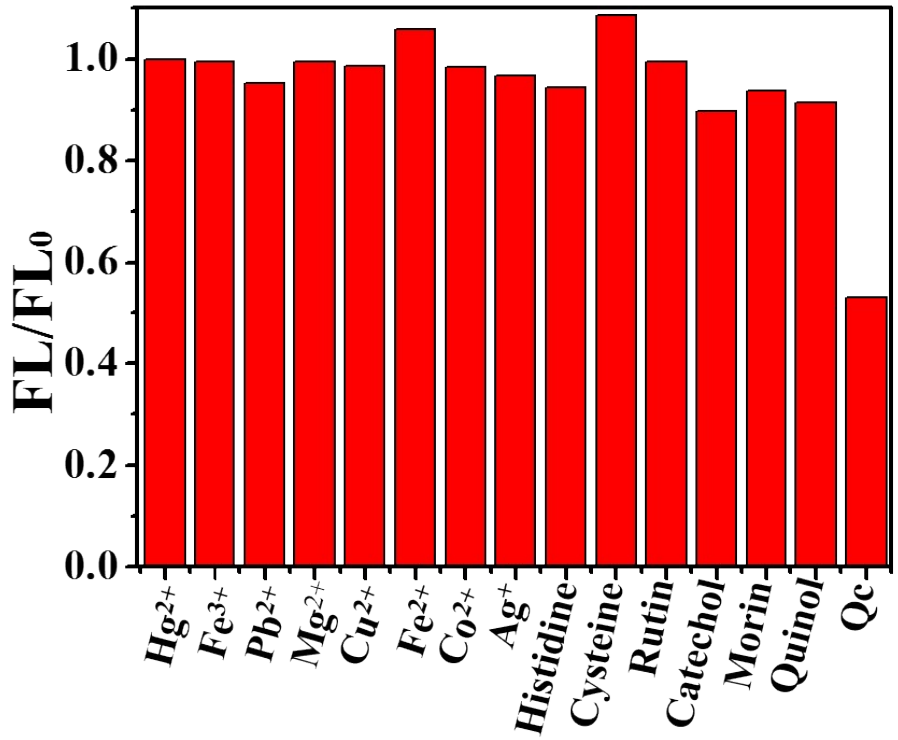

Fig. S7 Relative FL intensity (FL/FL_0) of the NPCGFs probe with the addition of interfering compounds.

Table S1 Comparison of materials, method, selectivity, excitation wavelength, and

emission wavelength for different N, P co-doped CNMs.

Material used	Method	Selectivity	λex	λem	Ref.
Glucose and monopotassium phosphate	Hydrothermal treatment		350nm	435nm	1
Sodium citrate and diammonium phosphate	Hydrothermal method	Hg (II)	340nm	440nm	2
Uric acid, citric acid and phosphoric acid	Hydrothermal approach	Captopril	330nm	425nm	3
β-CD, oPD and VPA	Hydrothermal method	Quercetin	360nm	445nm	This work

Table S2 Effect of the mass ratio between β-CD and oPD on the FL intensity of the obtained NPCGFs.

$m_{\beta\text{-CD}}$: m_{oPD}	5:1	2:1	1:1	2:1	3:1
FL Intensity	269	342	723	719	712

Table S3 Effect of the temperature on the emission wavelength and FL intensity of the obtained NPCGFs.

Temperature	λex (nm)	λem (nm)	FL Intensity (a.u.)
4℃	360	443	614
20℃	360	445	589
40℃	360	445	576
60℃	360	445	554
80℃	360	445	542

Table S4 Comparison of different probes for Qc detection.

Methods	Linear range (μM)	LOD (μM)	Recovery (%)	Ref.
Electrochemical detction	0.005-7	0.0024	101.3-103.3	4
HPLC detection	0.33-82.7			5
Raman spectroscope	3.2-23.1	0.97	97.1-102.6	6
Fluorescent detection	2.87-31.5	0.98	93.3-105.1	7
This method	1.15-99.3	0.66	99.5-101.3	Our method

Table S5 Analytical results for the determination of Qc in Xuan Wu river samples using the proposed NPCGFs probe.

Samples	Target	Added (μM)	Measured (μM)	Recovery (%)	RSD (n=3, %)
1	Qc	10	10.09	100.08	4.59
2	Qc	10	10.18	100.21	4.74
3	Qc	10	9.95	99.60	5.09

References

1 Z. C. Yang, M. Wang, A. M. Yong, S. Y. Wong, X. H. Zhang, H. Tan, A. Y. Chang, X. Li and J. Wang, *Chem. Commun.,* 2011, 47, 11615-11617.

2 Q. Xu, B. F. Li, Y. C. Ye, W. Cai, W. J. Li, C. Y. Yang, Y. S. Chen, M. Xu, N. Li, X. S. Zheng, J. Street, Y. Luo and L. L. Cai, *Nano. Res.,* 2018, 11, 3691-3701.

3 Z. X. Wang, Y. F. Gao, X. H. Yu, F. Y. Kong, W. X. Lv and W. Wang, *Microchim. Acta,* 2018, 185, 422-431.

4 X. W. Kan, T. T. Zhang, M. Zhong and X. J. Lu, *Biosens. Bioelectron.,* 2016, 77, 638-643.

5 K. S. Abdelkawy, M. E. Balyshev and F. Elbarbry, *Biome. Chromatogr.,* 2017, 31, e3819-e3827.

6 Z. G. Chen, S. H. Qian, J. H. Chen and X. Chen, *J. Nanopart. Res.,* 2012, 14, 1264-1269.

7 B. H. Gao, Y. Sun, Y. C. Miao, H. H. Min, L. Xu and C. B. Huang, *Aust. J. Chem.*, 2018, 71, 882-829.