Electronic Supplementary Material (ESI) for RSC Advances.

Online remote monitoring of explosives by optical fibres

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Electronic Supplementary Information

The preparation of silica sol-gel and the dip coating procedures

The details of the preparation procedures of silica sol-gel can be found in the published reports. [1] Simply, high concentrated hydrochloride acid (HCl) (37 wt. %) was used as catalyst to promotes the reaction of ethanol (EtOH), Tetraethyl orthosilicate (TEOS) and Milli-Q water. The concentration of the silica sol-gel can be adjusted by changing the ratio of EtOH/TEOS, but the volume ratio of EtOH/H_2O/HCl should be kept the same as 156/26/0.637 when preparing different concentration of Sol-gel. Based on the above ratio, EtOH was mixed with TEOS in a bottle and stirred for 5 min, mark as bottle 1; Milli-Q water and HCl was mixed in another bottle marked as bottle 2; The mixture in bottle in was gradually added into bottle 2 and keep stirring for 30 min, the final solution was then heated to 75 degrees for 4 hours.

The fibre tip as a substrate was immersed into the coating solution, which is a mixture of silica sol-gel and P3a molecules in our case, and a wet layer was then formed by withdrawing the fibre. Finally, the solvent evaporation resulted in the gelation of P3a/sol-gel mixture layer on the fibre tip.

Sensor performance analysis

The fluorescence intensities and the PA concentration is usually only linear in the low concentration range. This is because the P3a fluorescence intensity depends on the equilibrium for the formation of the PA-P3a complexes. The fluorescence mechanism of P3a is complex when the PA concentration is too high. Hence, the overall trend of the fluorescence intensities as a function of ion concentration usually fitted by a non-linear function. In this paper, the linear portion of the curve was fitted with a linear equation. The definitions of the sensitivity and the detection range used in this paper are based on the generally accepted norms, *i.e.* the sensitivity is the slope of the linear fit from the linear regression analysis of the linear portion of the curve. The data include in the linear regression are the maximum range of PA concentration that gives a high correction coefficient ($R^2 > 0.98$).[2] All the data shown in this paper are the real experimental results rather than the results after calibration

Figures

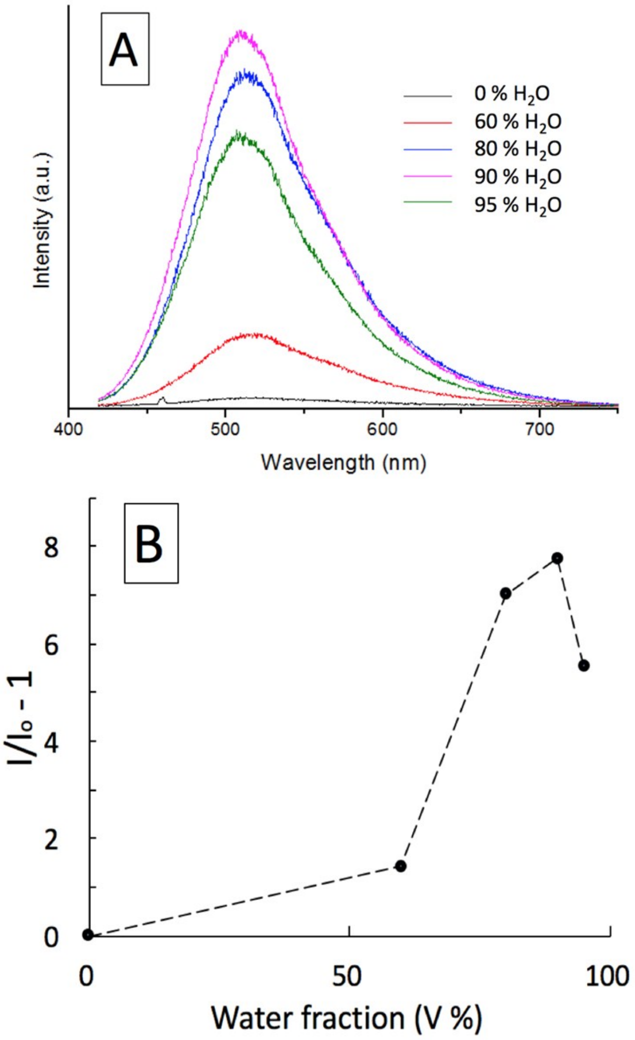
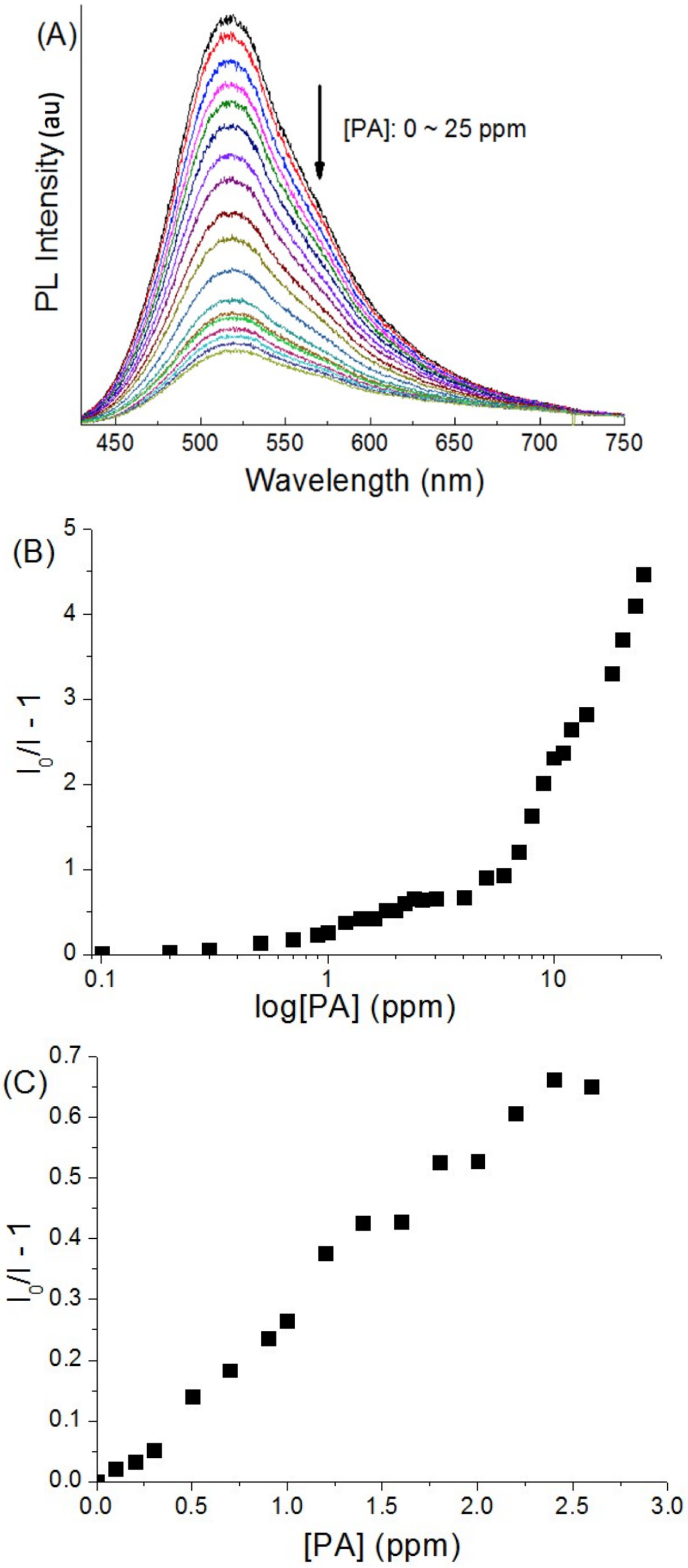


Figure S1. (a) The quenching process of p3a in the THF/water mixture (1:9 v/v) with the addition of PA from 0 to 70 ppm. (b) Plot of I/I_o - 1 versus PA concentration, where I = peak intensity and I_o = peak intensity at 0 % H_2O.


(A)
PL Intensity (au)
[PA]: 0 ~ 25 ppm
450
500
550
600
650
700
750
Wavelength (nm)
(B)
$I_0/I - 1$
0
1
2
3
4
5
0.1
1
10
log[PA] (ppm)
(C)
$I_0/I - 1$
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.0
0.5
1.0
1.5
2.0
2.5
3.0
[PA] (ppm)

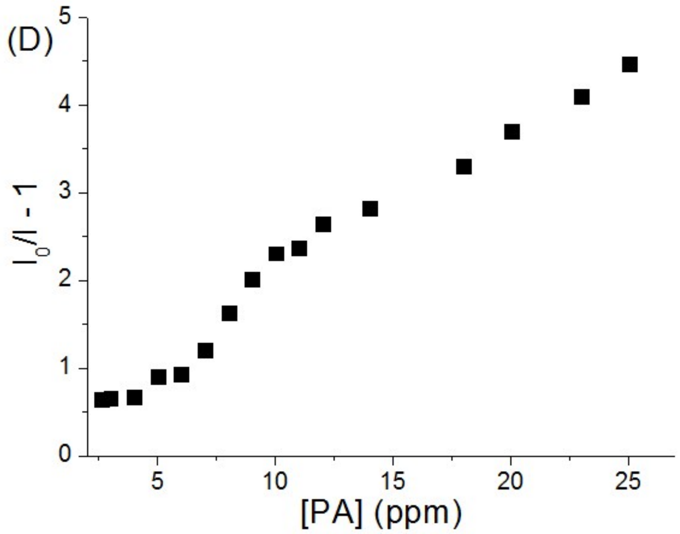
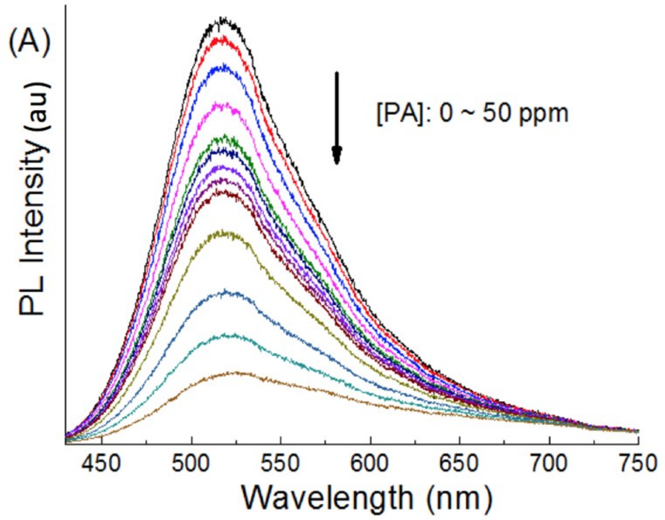
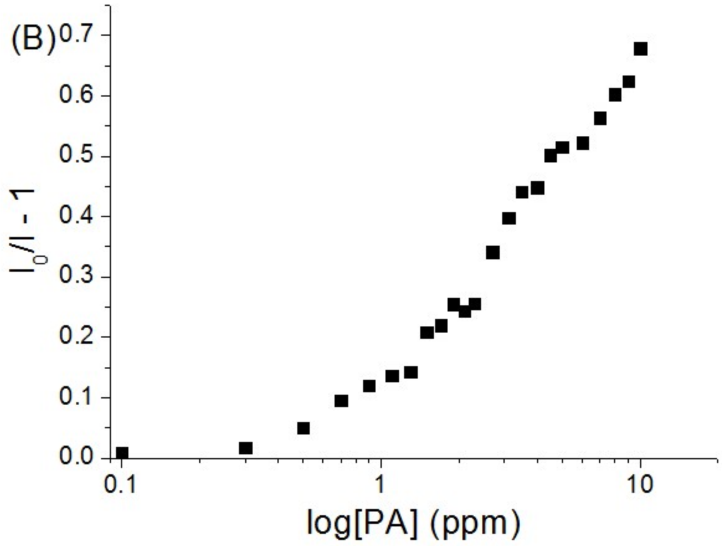


Figure S2. (a) PL spectra of P3a in the THF/water mixture (1:9 v/v) containing different amounts of picric acid (PA). Polymer concentration: 0.5 mg L^{-1}; excitation wavelength: 407 nm. (b) Plot of I_o/I - 1 versus PA concentration, where I = peak intensity and I_o = peak intensity at [PA] = 0 µg mL^{-1}. The PA concentration ranges from 0 to 2.6 ppm (c) and 2.6 to 25 ppm (d).





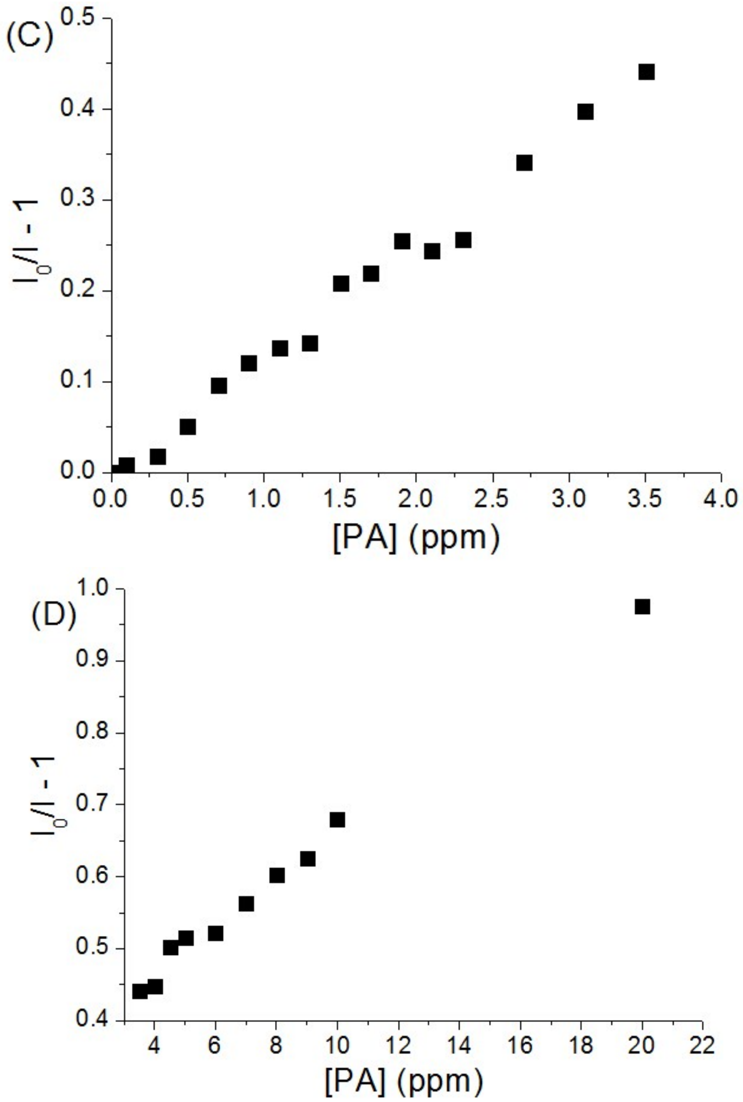


Figure S3. (a) PL spectra of P3a in the THF/water mixture (1:9 v/v) containing different amounts of picric acid (PA). Polymer concentration: 1.0 mg L^{-1}; excitation wavelength: 407 nm. (b) Plot of $I_o/I - 1$ versus PA concentration, where I = peak intensity and I_o = peak intensity at [PA] = 0 µg mL^{-1}. The PA concentration ranges from 0 to 3.5 ppm (c) and 3.5 to 20 ppm (d).

References

1(a) E. von Haartman, H. Jiang, A. A. Khomich, J. Zhang, S. A. Burikov, T. A. Dolenko, J. Ruokolainen, H. Gu, O. A. Shenderova and I. I. Vlasov, *Journal of Materials Chemistry B*, 2013, **1**, 2358; (b) Z. Ma, H. Ji, Y. Teng, G. Dong, J. Zhou, D. Tan and J. Qiu, *Journal of colloid and interface science*, 2011, **358**, 547.

2 D. A. Skoog and D. M. West, *Principles of instrumental analysis*, Saunders College Philadelphia, 1980.