Electronic Supplementary Material (ESI) for Lab on a Chip

Supplementary Materials

for

A portable and autonomous multichannel fluorescence detector for on-line and in situ explosive detection in aqueous phase

Yunhong Xin,*[a] Qi Wang,[a] Taihong Liu,[b] Lingling Wang,[a] Jia Li,[b] and Yu Fang*[b]

[a] School of Physics and Information Technology, Shaanxi Normal University, Xi'an 710062, P. R. China. E-mail: xinyh@snnu.edu.cn

[b] Key Laboratory of Applied Surface and Colloid Chemistry (Shaanxi Normal University), Ministry of Education, School of Chemistry and Chemical Engineering, Shaanxi Normal University, Xi'an 710062, P. R. China. E-mail: yfang@snnu.edu.cn

Table Captions

Table S1. Parameters of the LED adopted

Table S2. Parameters of the optical filter adopted

Table S3. Experimental data employed for the classification of NB

Table S4. Experimental data employed for the classification of PA

Table S5. Experimental data employed for the classification of TNT

Table S6. Experimental data employed for the classification of DNT

Figure Legends

Fig. S1 Photograph of the print circuit board (PCB) of the wireless communication module based on the chip CC2530

Fig. S2 Photograph of the PCB of wireless communication module based on the chip CC2531

Fig. S3 The complete interface of the control panel

Fig. S4 Experimental results from the interference test of 9,10-anthraquinone (100 μM) and 1,2,5,8-tetrahydroxy-9,10-anthracenedione (100 μM) to the fluorescence emissions of the five film sensors.

Table S1. Parameters of the LED adopted

Channel No.	LED Type*	Manufactory	Parameter (nm)
1	YCL-365a	Shenzhen Yuanchuang Electronic Co. Ltd, China	360-370
2	YCL-365a		360-370
3	YCL-365a		360-370
4	YCL-400-405		390-420
5	YCL-480-485		470-500

* Note: Although the maximum excitation wavelengths of the fluorescent sensing films appear at 346 nm, 353 nm, 370 nm, 397 nm, and 497 nm, respectively, to produce and debug convenience, only three types of the LED have been used. In fact, with the compensation of the gain of the signal amplifier, these changes show little effect to the performance of the device.

Table S2. Parameters of the optical filter adopted

Channel No.	Filter Input*	Filter Output*	Manufactory
1	365/10/OD5	400/20/OD4,	Hzxd Optical Technology Co. Ltd., China
2	365/10/OD5	410/20/OD4	
3	365/10/OD5	500/20/OD4	
4	400/10/OD5	520/20/OD4	
5	480/10/OD5	600/20/OD4	

* Note: The central wavelengths of the input bandpass optical filters are exactly consistent with those of the LEDs adopted, and the central wavelengths of the output bandpass optical filters are approximately consistent with the maximum emission wavelengths of the fluorescent sensing films, which are 376 nm, 408 nm, 500 nm, 505 nm, and 600 nm, respectively.

Table S3. Experimental data employed for the classification of NB*

CN \ FM	1	2	3	4	5
0 μM	2045	2047	2062	2068	2041
10 μM	1923	558	2041	2028	2044
20 μM	1833	292	1993	2003	1971
30 μM	1702	176	1965	1963	1907
40 μM	1614	97	1928	1949	1743
50 μM	1576	24	1910	1934	1700
60 μM	1556	0	1909	1899	1633

Table S4. Experimental data employed for the classification of PA*

CN \ FM	1	2	3	4	5
0 μM	1992	2015	1972	2005	2005
10 μM	1357	1983	1357	2004	1779
20 μM	1040	1964	799	1980	1554
30 μM	798	1783	471	1972	1169
40 μM	629	1717	213	1995	1015
50 μM	490	1633	96	1990	852
60 μM	393	1447	0	1942	679

Table S5. Experimental data employed for the classification of TNT*

CN \ FM	1	2	3	4	5
0 μM	1406	1385	1408	1406	1401
10 μM	1067	1367	1368	726	1216
20 μM	707	1312	1362	474	949
30 μM	494	909	1291	305	821
40 μM	351	725	1291	171	560
50 μM	255	591	1232	67	428
60 μM	172	340	1216	0	319

Table S6. Experimental data employed for the classification of DNT*

CN \ FM	1	2	3	4	5
0 μM	924	925	923	921	930
10 μM	831	911	829	758	834
20 μM	655	901	751	701	745
30 μM	493	757	719	679	626
40 μM	416	473	659	644	531
50 μM	327	289	473	571	477
60 μM	217	0	310	548	387

*where, FM stands for number of sensing film and CN stands for concentration.

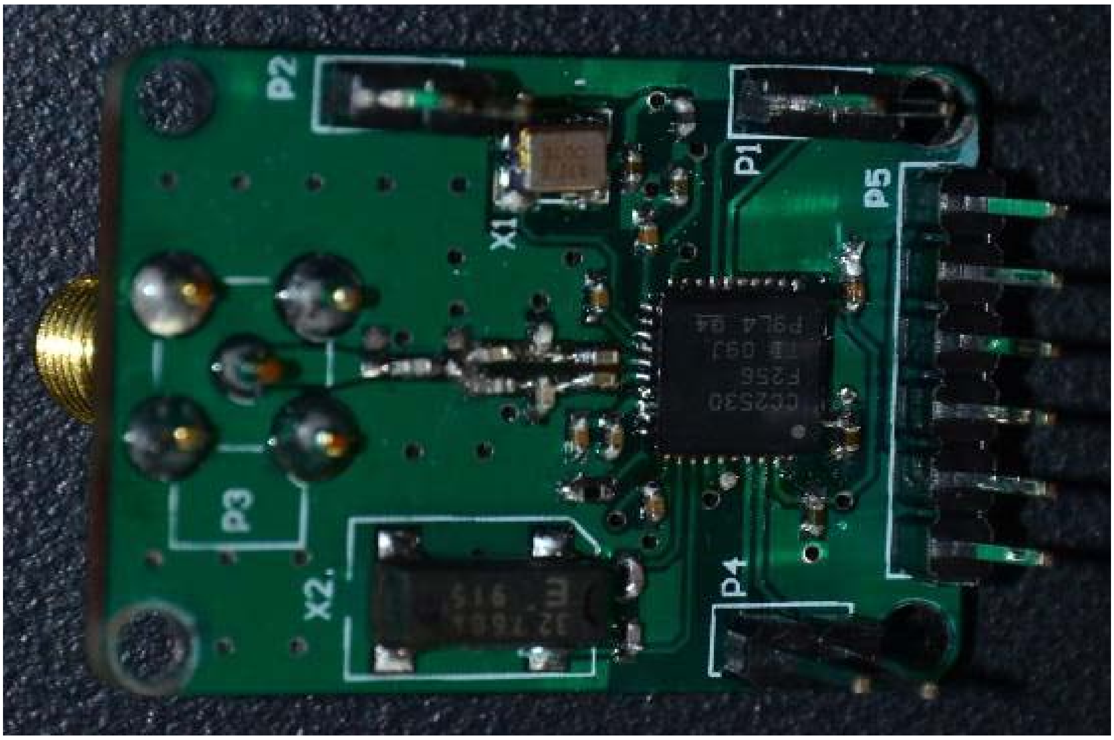

Fig. S1 Photograph of the print circuit board (PCB) of wireless communication module based on the chip CC2530. The CC2530 is a true System-on-Chip (SoC) solution for IEEE 802.15.4, Zigbee applications. It enables robust network nodes to be built with very low total bill-of-material costs. The CC2530 combines the excellent performance of a leading RF transceiver with an industry-standard enhanced 8051 MCU, in-system programmable flash memory, 8-KB RAM, and many other powerful features. The CC2530 comes in four different flash versions: CC2530F32/64/128/256, with 32/64/128/256 KB of flash memory, respectively. The CC2530 has various operating modes, making it highly suitable for systems where ultralow power consumption is required. Short transition times between operating modes further ensure low energy consumption.

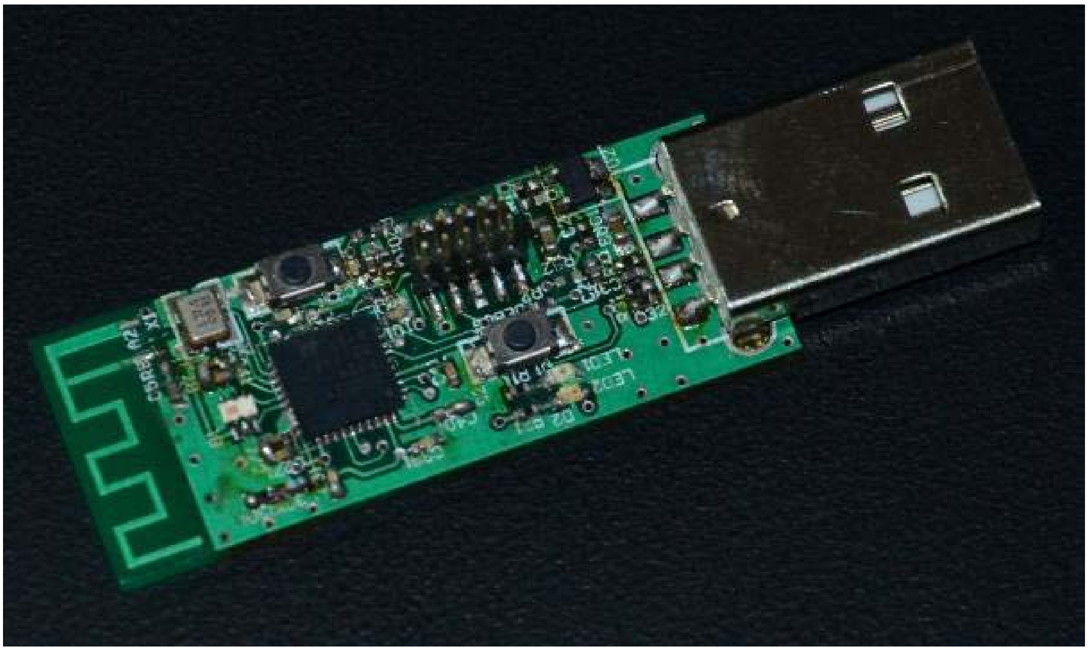

Fig. S2 Photograph of the PCB of wireless communication module based on the chip CC2531. The chip CC2531 is identical to CC2530, with the addition of a built in full speed USB 2.0 compliant interface.

Fig. S3 The complete interface of the control panel, where the five curves stand for the test results of five sensor channels. The seven steps in the curves correspond to the test results from samples of different concentrations: 0, 10, 20, 30, 40, 50, 60 μM.

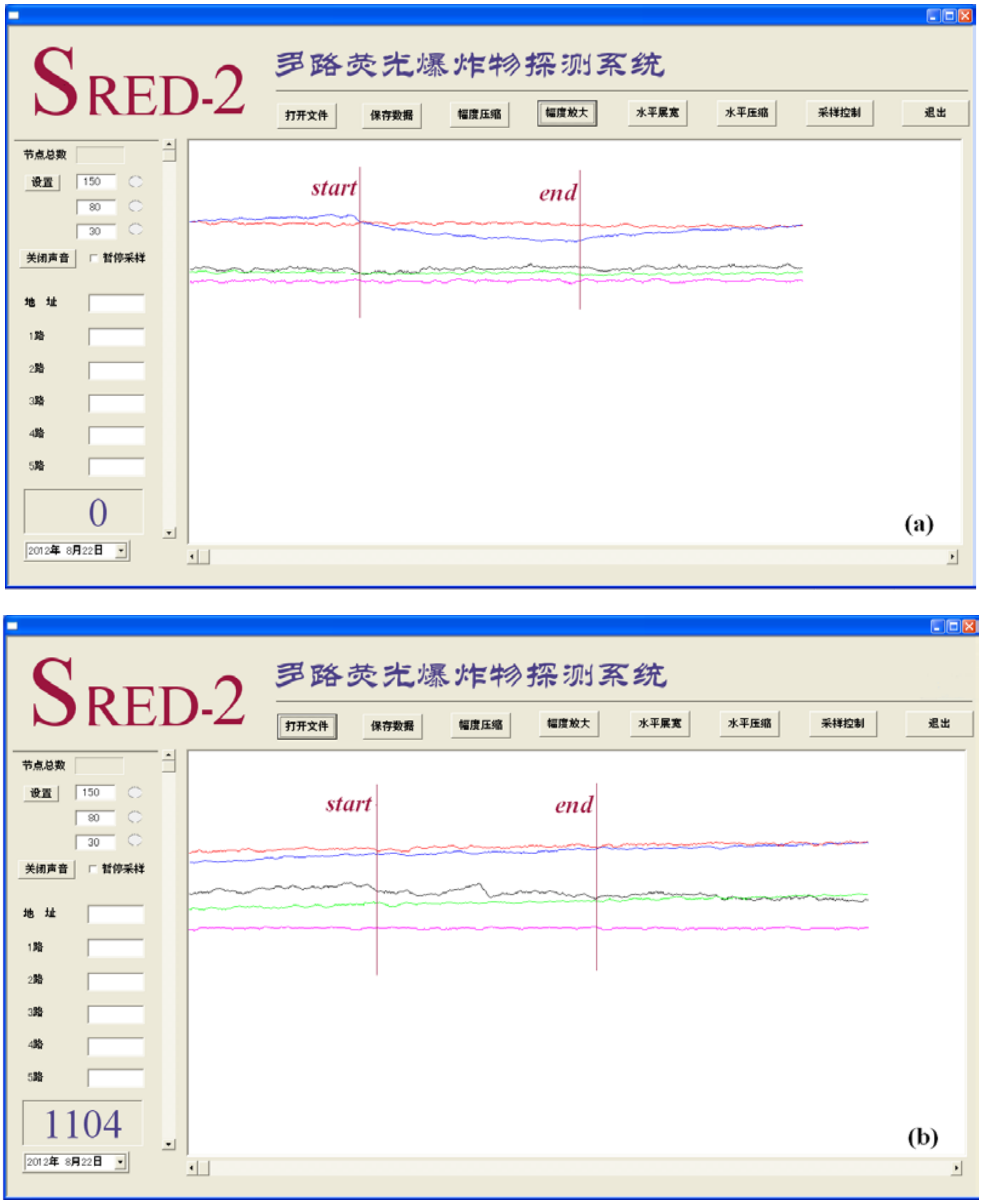

Fig. S4 Experimental results from the interference test of 9,10-anthraquinone (100 μM) and 1,2,5,8-tetrahydroxy-9,10-anthracenedione (100 μM) to the fluorescence emissions of the five film sensors.

Note: Start in the two widows means at that point the interference was introduced, and the end means at which pure water was used instead of the interference solution. Clearly, all the sensors excepting the one in blue (a) show little response to the interference. As for the blue, the response is very weak if compared to that of the sensor to the nitroaromatic explosives (*c.f.* Figure 6 in the main text).