Supporting Information

Molybdophosphoric heteropoly acid and fluorescent microsphere-based dual-mode system for reliable and ultrasensitive alkaline phosphatase detection

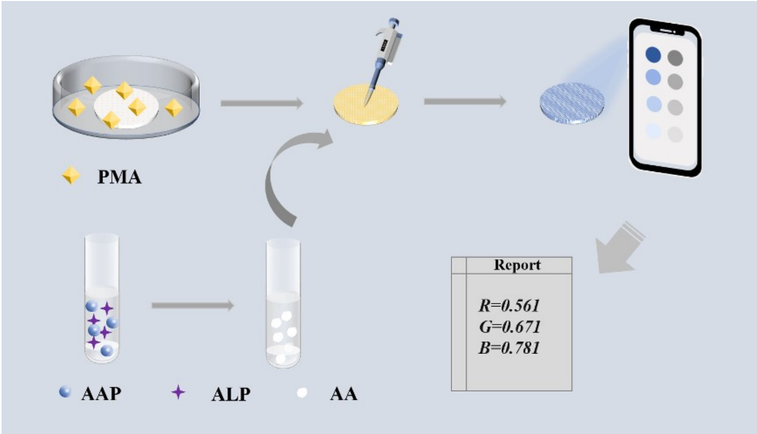
Qiannan Li[a], Yufei Wang[a], Qianqian Zhu [a, *], Haifang Liu[b], Jianbo Liu [b, *], Hong-Min Meng [a, *], and Zhaohui Li[a]

[a] College of Chemistry, Henan Joint International Research Laboratory of Green Construction of Functional Molecules and Their Bioanalytical Applications, Zhengzhou Key Laboratory of Functional Nanomaterial and Medical Theranostic, Zhengzhou University, Zhengzhou 450001, China

[b] Henan Key Laboratory of Precision Diagnosis of Respiratory Infectious Diseases, Zhengzhou Key Laboratory of Precision Diagnosis of Respiratory Infectious Diseases,

The Second Affiliated Hospital of Zhengzhou University, Zhengzhou, Henan 450014, China

Scheme:



Scheme S1. The schematic diagram illustrating of the test kit for ALP sensing.

Figures:

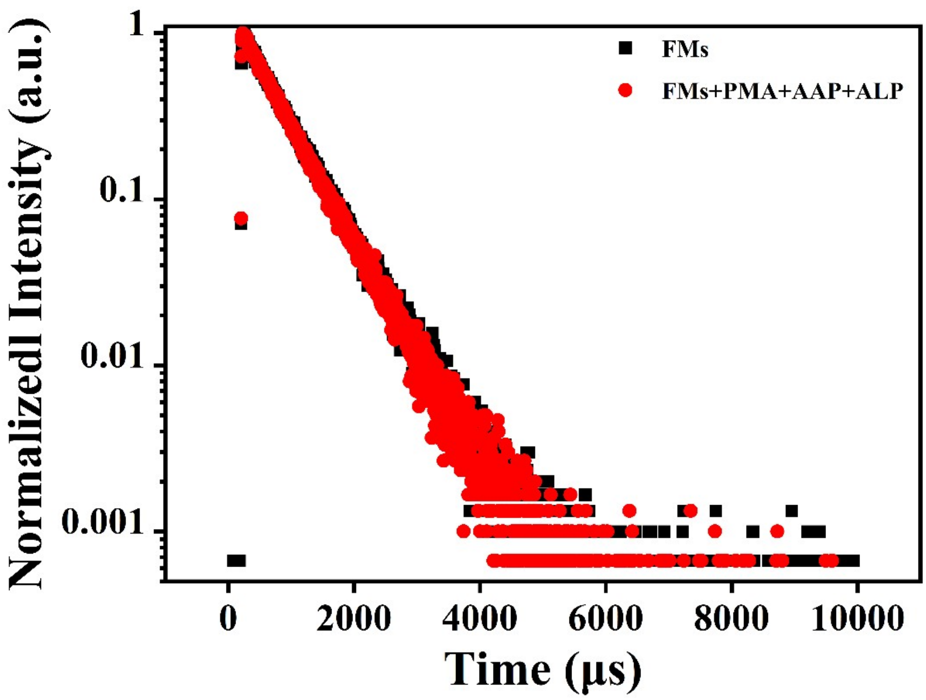


Fig. S1. The tithe-resoled spectroscopy spectra of FMs in the absence and presence of ALP.

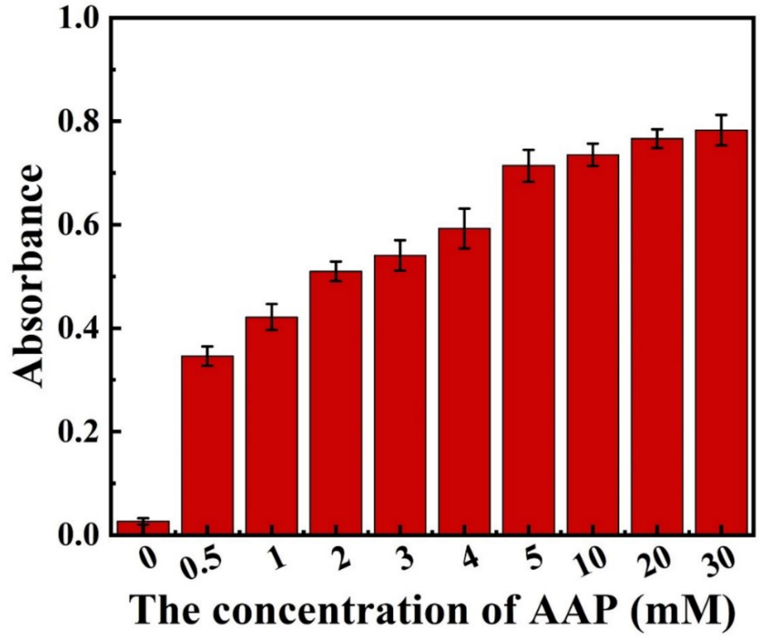


Fig. S2. The effect of the concentration of AAP on the UV–vis absorption intensity of the dual-mode sensing system.

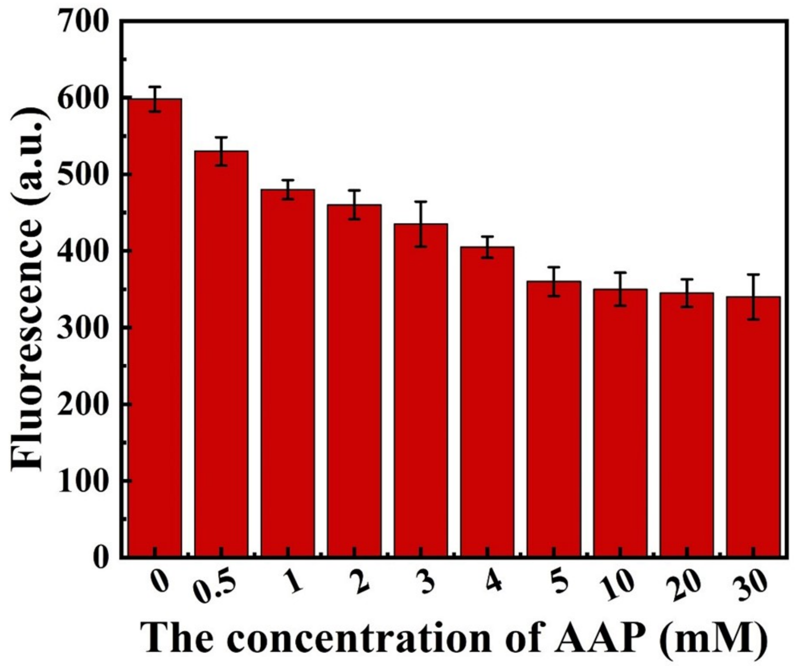


Fig. S3. The effect of the concentration of AAP on the fluorescence intensity of the dual-mode sensing system.

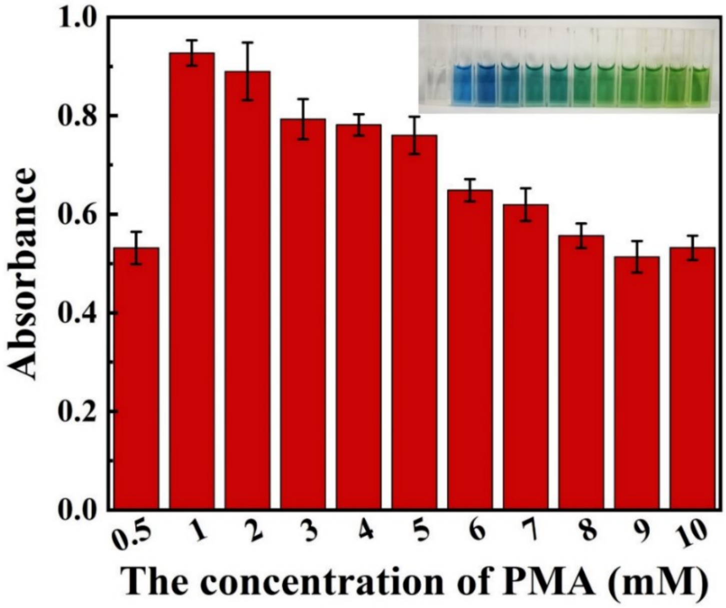


Fig.S4. The effect of the concentration of PMA on the UV–vis absorption intensity.

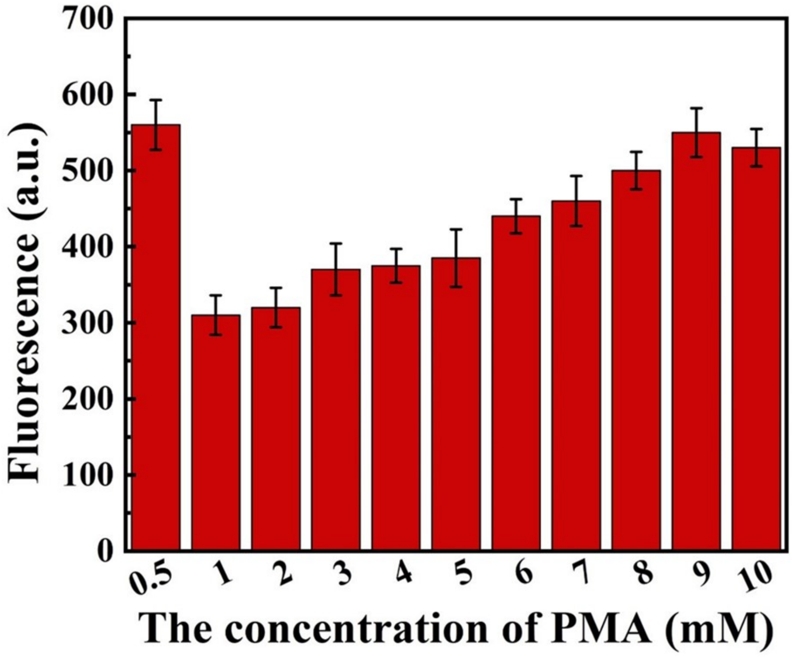


Fig. S5. The effect of the concentration of PMA on the fluorescence intensity.

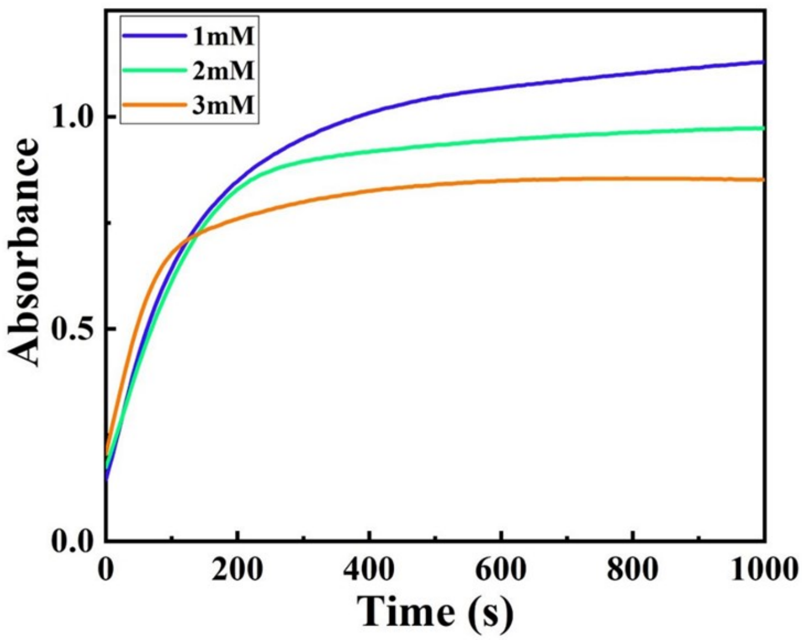


Fig. S6. The effect of PMA concentration on reaction time.

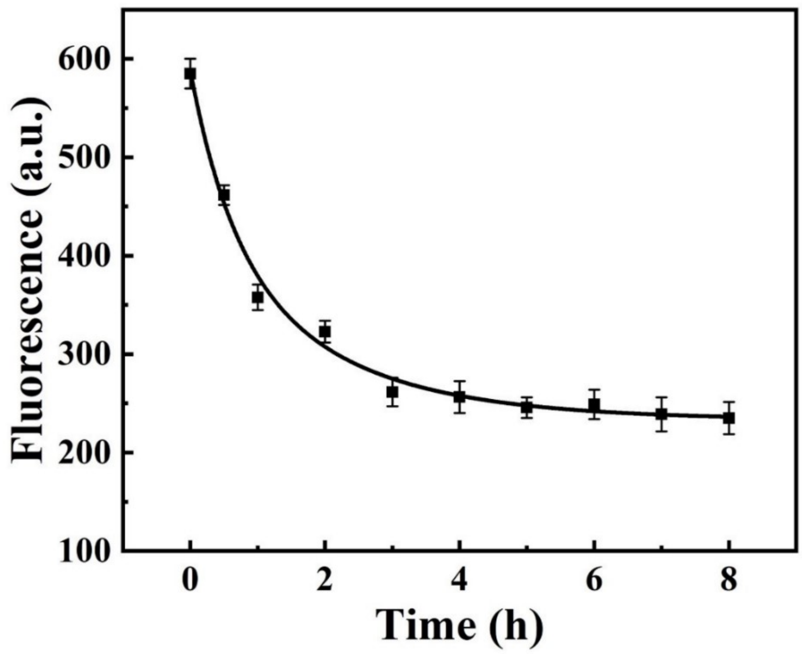
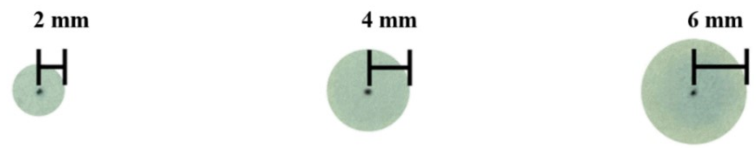


Fig. S7. The effect of the incubation time on fluorescence quenching efficiency.



2mm	1	2	3	4	5	6	7	8	9	10	RSD(%)
R/225	0.71	0.698	0.690	0.737	0.714	0.710	0.694	0.718	0.698	0.702	2.0
G/225	0.796	0.796	0.788	0.835	0.804	0.784	0.784	0.808	0.788	0.792	
B/225	0.725	0.710	0.702	0.749	0.730	0.710	0.740	0.729	0.710	0.714	
255*B/(R*B)	1.283	1.278	1.291	1.217	1.272	1.276	1.312	1.257	1.291	1.284	
4mm											
R/225	0.690	0.671	0.718	0.659	0.706	0.659	0.686	0.686	0.659	0.675	3.7
G/225	0.780	0.769	0.796	0.757	0.796	0.749	0.776	0.780	0.749	0.765	
B/225	0.675	0.678	0.702	0.671	0.698	0.671	0.698	0.686	0.671	0.686	
255*B/(R*B)	1.254	1.314	1.228	1.345	1.242	1.359	1.311	1.282	1.359	1.328	
6mm											
R/225	0.647	0.643	0.639	0.710	0.663	0.702	0.624	0.596	0.671	0.627	7.5
G/225	0.753	0.749	0.737	0.800	0.749	0.776	0.729	0.698	0.757	0.714	
B/225	0.678	0.675	0.651	0.694	0.663	0.663	0.663	0.647	0.667	0.635	
255*B/(R*B)	1.392	1.402	1.382	1.222	1.335	1.217	1.457	1.555	1.313	1.418	

Fig. S8. Optimization of the color range for the portable paper-based kit.

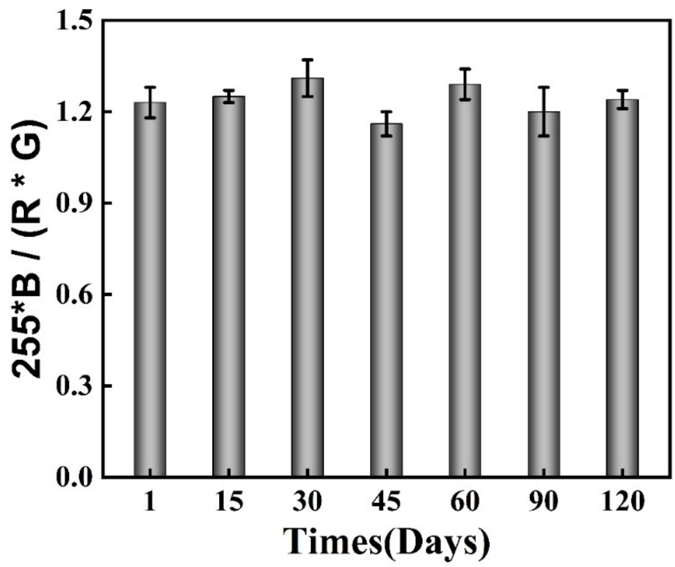


Fig. S9. The stability of the developed test strip.

Table:

Table S1. Comparison of different strategies for ALP assay.

Method	Probe	Linear range (U/L)	LOD (U/L)	Ref
Fluorescence	Coumarin @Tb-GMP ICPNPs	25~200	10	1
Fluorescence	PDA-NDs	1~50	0.94	2
Colorimetry	Cu（BPDS）$_2^{2-}$	0~200	1.75	3
Colorimetry	G_{20}-Cu (II)	20~200	0.84	4
Fluorescence	FMs-PMA	0.2~30	0.11	
Colorimetry	FMs-PMA	0.2~35	0.27	This work
Paper based - colorimetric	FMs-PMA	2~50	0.4	

Reference:

1. J. Deng, P. Yu, Y. Wang, and L. Mao, Anal. Chem., 2015, 87, 3080-3086.
2. Q. Xue, X. Cao, C. Zhang and Y. Xian, Microchim. Acta, 2018, 185, 231.
3. Q. Hu, M. He, Y. Mei, W. Feng, S. Jing, J. Kong and X. Zhang, Talanta, 2016, 163, 146-152.
4. J. Yang, L. Zheng, Y. Wang, W. Li, J. Zhang, J.Gu and Yan Fu, Biosens. Bioelectron., 2015,77, 549-556.