

## A differential ICT based molecular probe for multi-ions and multifunction logic circuits

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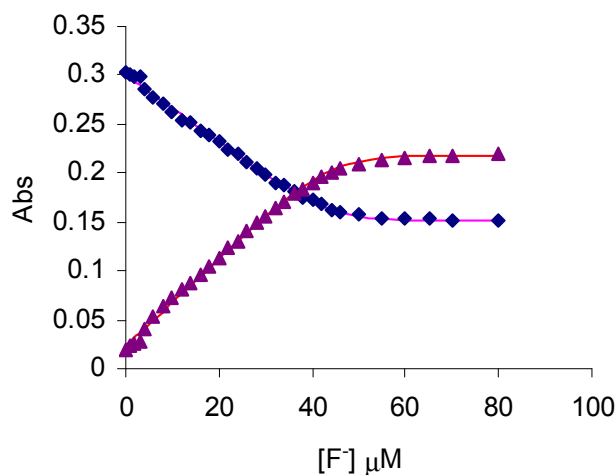
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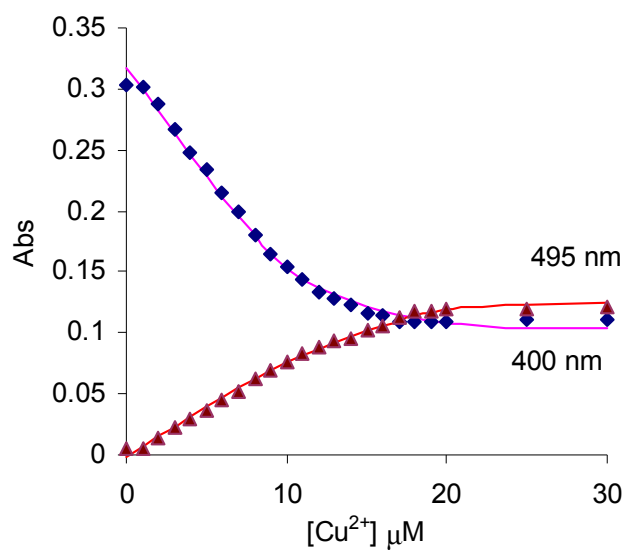
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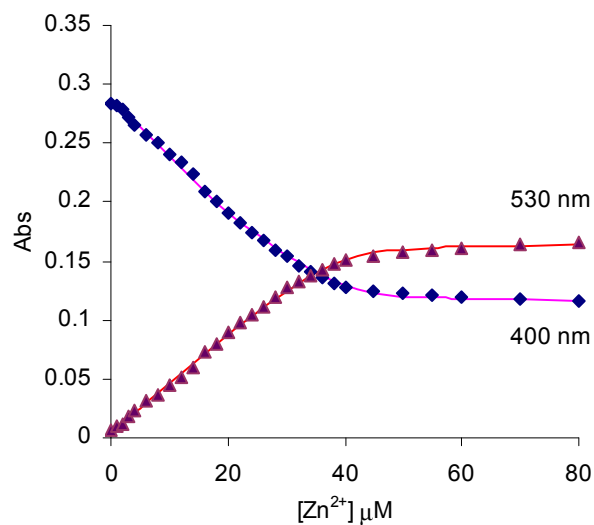


**Fig. S1:** The spectral fitting of the absorbance data on incremental addition of fluoride ions to the solution of probe **1** (20  $\mu$ M,  $CH_3CN$ )



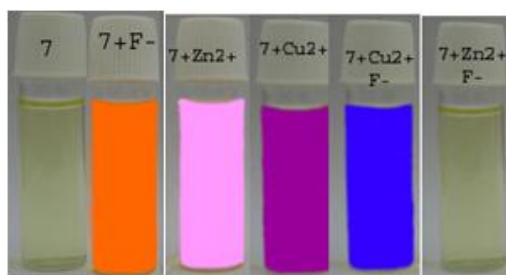
**Fig. S2:** The spectral fitting of the absorbance data on incremental addition of Cu<sup>2+</sup> ions to the solution of probe **1** (20 μM, CH<sub>3</sub>CN)

The spectral fitting of these absorbance data shows the formation of M:L complex  $\log \beta_{\text{LCu}} = 6.78 \pm 0.12$ .

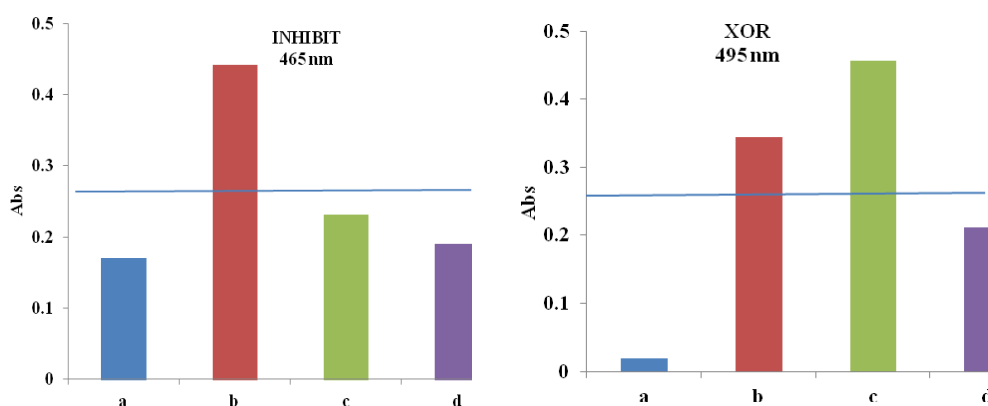


**Fig. S3:** The spectral fitting of the absorbance data on incremental addition of Zn<sup>2+</sup> ions to the solution of probe **1** (20 μM, CH<sub>3</sub>CN)

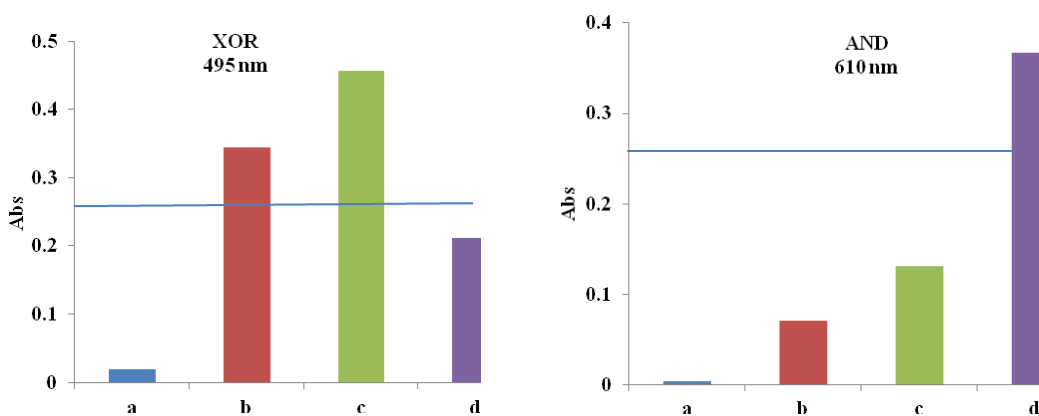
The spectral fitting of these absorbance data shows the formation of ML complex  $\log \beta_{\text{LZn}} = 5.6 \pm 0.02$



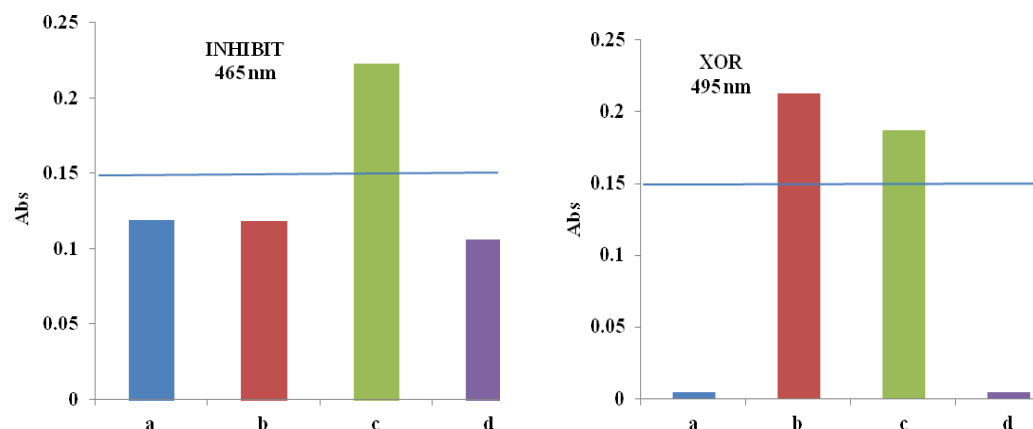
**Fig. S4:** The visible color changes observed on addition of  $F^-$ ,  $Zn^{2+}$ ,  $Cu^{2+}$  or both  $F^-$  and  $Cu^{2+}$  or  $F^-$  and  $Zn^{2+}$  ions to the solution of **1** ( $20 \mu M$ ,  $CH_3CN$ ).



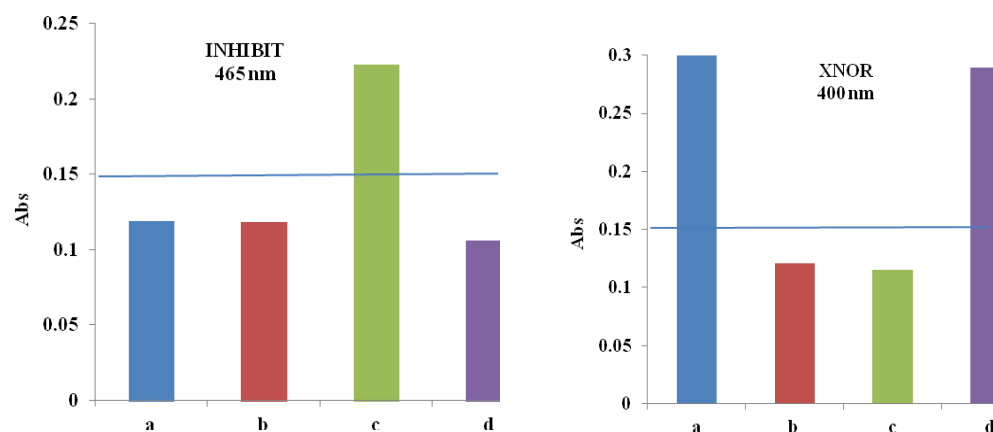
**Fig. S5:** Bar diagram of half-subtractor showing the absorption intensities with different inputs; (a) only **1**; (b) **1** + TBA F ( $80 \mu M$ ); (c) **1** +  $Cu^{2+}$  ( $20 \mu M$ ); (d) **1** +  $Cu^{2+}$  ( $20 \mu M$ ) + TBA F ( $80 \mu M$ ).



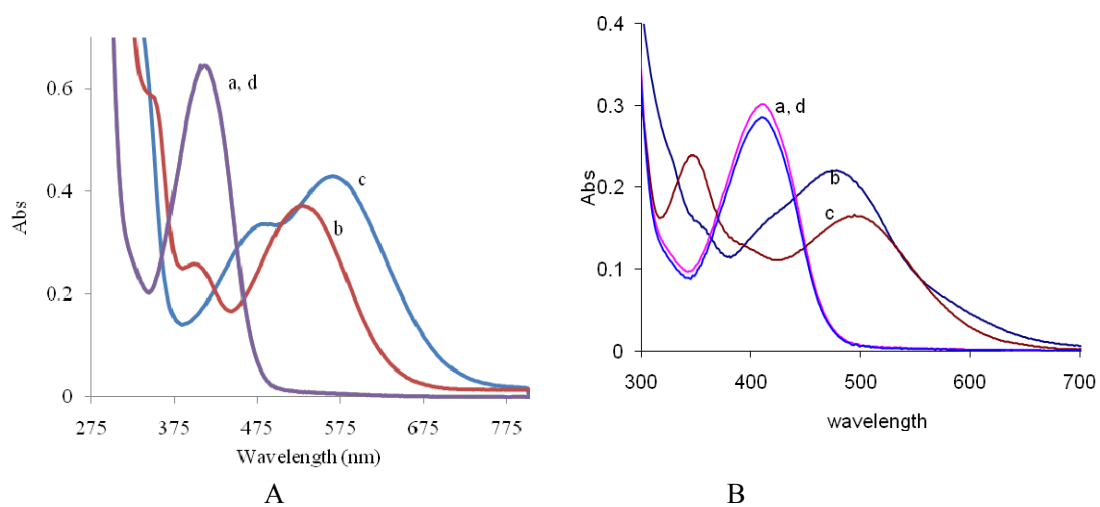
**Fig. S6:** Bar diagram of half-adder with the absorption intensities with different inputs; probe **1** ( $20 \mu M$ ) (a) only **1**; (b) **1** + TBA F ( $80 \mu M$ ); (c) **1** +  $Cu^{2+}$  ( $20 \mu M$ ); (d) **1** +  $Cu^{2+}$  ( $20 \mu M$ ) + TBA F ( $80 \mu M$ ); XOR at  $495 \text{ nm}$  AND at  $610 \text{ nm}$ .



**Fig. S7:** Bar diagram of half-adder with the absorption intensities with different inputs to **1** (20  $\mu\text{M}$ ,  $\text{CH}_3\text{CN}$ ). (a) only **1**; (b) **1** + TBA F (80  $\mu\text{M}$ ); (c) **1** +  $\text{Zn}^{2+}$  (20  $\mu\text{M}$ ); (d) **1** +  $\text{Zn}^{2+}$  (20  $\mu\text{M}$ ) + TBA F (80  $\mu\text{M}$ ). XOR at 495 nm, INHIBIT at 465 nm.



**Fig. S8:** Bar diagram of comparator logic function with the absorption intensities with different inputs to **1** (20  $\mu\text{M}$ ,  $\text{CH}_3\text{CN}$ ). (a) only **1**; (b) **1** + TBA F (80  $\mu\text{M}$ ); (c) **1** +  $\text{Zn}^{2+}$  (20  $\mu\text{M}$ ); (d) **1** +  $\text{Zn}^{2+}$  (20  $\mu\text{M}$ ) + TBA F (80  $\mu\text{M}$ ). XNOR at 400 nm, INHIBIT at 465 nm.



**Fig. S9:** (A) UV-vis spectra of probe **1** (20  $\mu\text{M}$ ,  $\text{CH}_3\text{CN}$ ) (a) only **1**; (b) **1** +  $\text{Cu}^{2+}$  (20  $\mu\text{M}$ ); (c) **1** +  $\text{Cu}^{2+}$  (20  $\mu\text{M}$ ) + TBA F (80  $\mu\text{M}$ ); (d) **1** +  $\text{Cu}^{2+}$  (20  $\mu\text{M}$ ) + TBA F (80  $\mu\text{M}$ ) + EDTA (80  $\mu\text{M}$ ). (B) UV-vis spectra of probe **1** (20  $\mu\text{M}$ ,  $\text{CH}_3\text{CN}$ ) (a) only **1**; (b) **1** + TBA F (80  $\mu\text{M}$ ); (c) **1** +  $\text{Zn}^{2+}$  (20  $\mu\text{M}$ ); (d) **1** +  $\text{Zn}^{2+}$  (20  $\mu\text{M}$ ) + TBA F (80  $\mu\text{M}$ ).

The addition of EDTA removes  $\text{Cu}^{2+}$  due to complex formation and free  $\text{F}^-$  ions due to formation of HF or NaF.