Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Information

A novel diarylethene-based fluorescent "turn-on" sensor for the selective detection of Mg^{2+}

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other metal ions in acetonitrile.

Figure S15. Combinational logic circuits equivalent to the truth table given in Table 1: In1 (UV light), In2 (visible light), In3 (Mg^{2+}), In4 (EDTA).

Table S1. Truth table for all the possible strings of four binary-input data and the corresponding output digit.

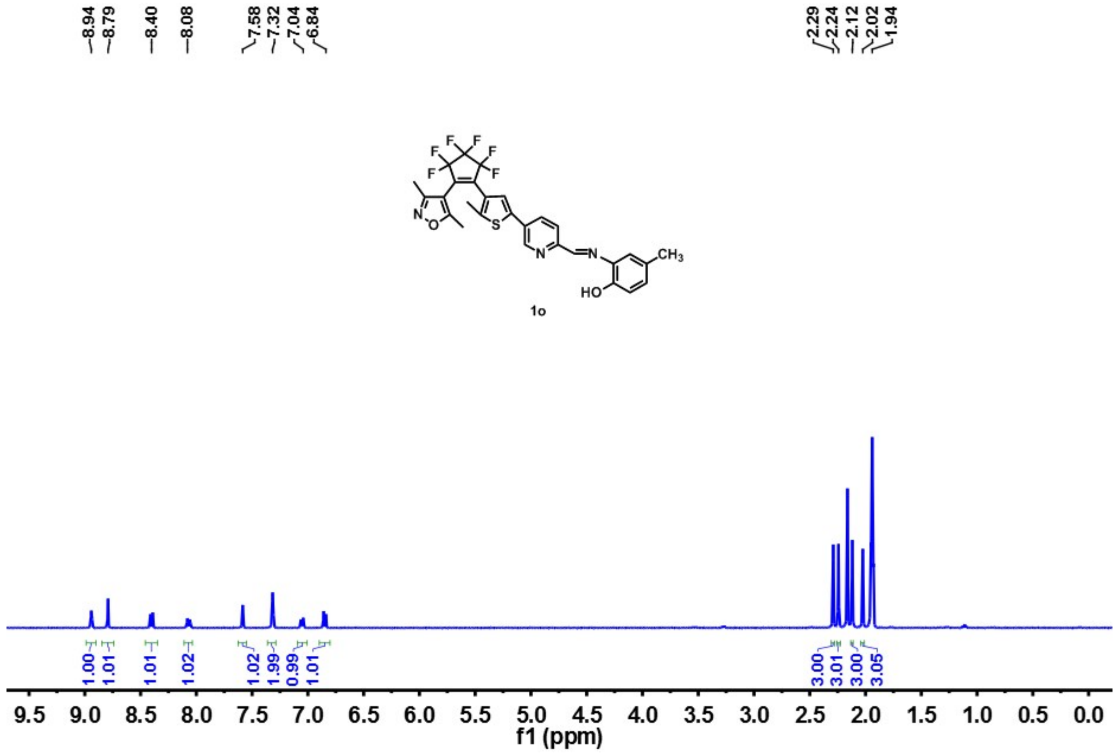

Figure S1. ^{1}H NMR spectrum of **1o**.

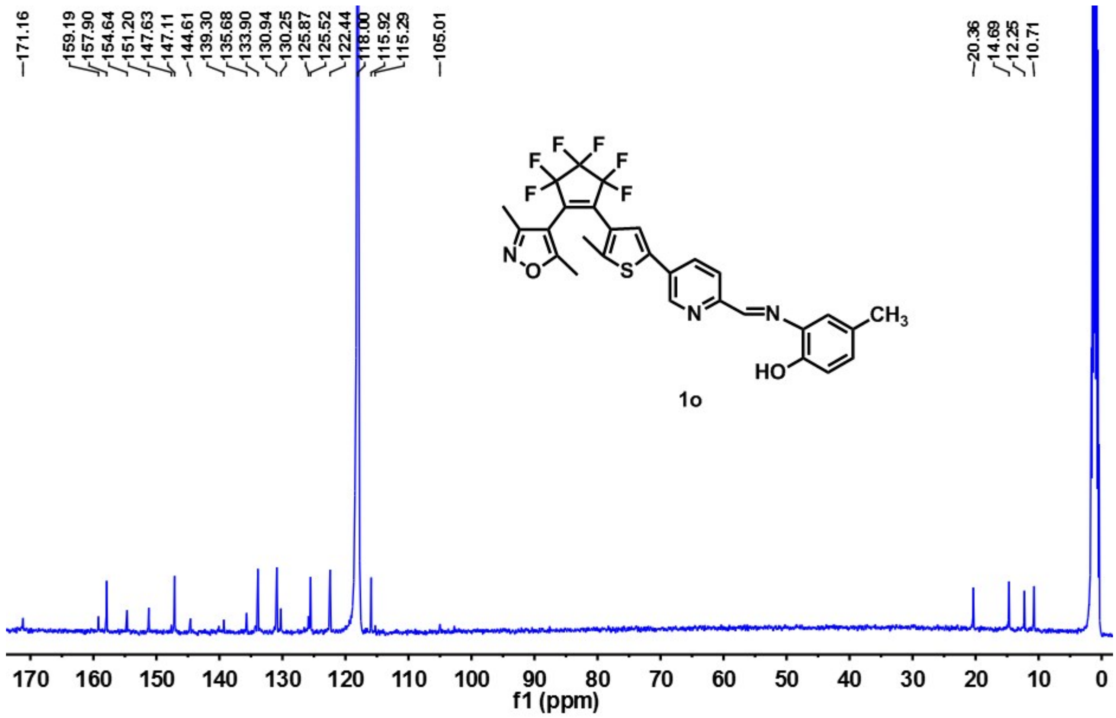

Figure S2. ^{13}C NMR spectrum of **1o**.

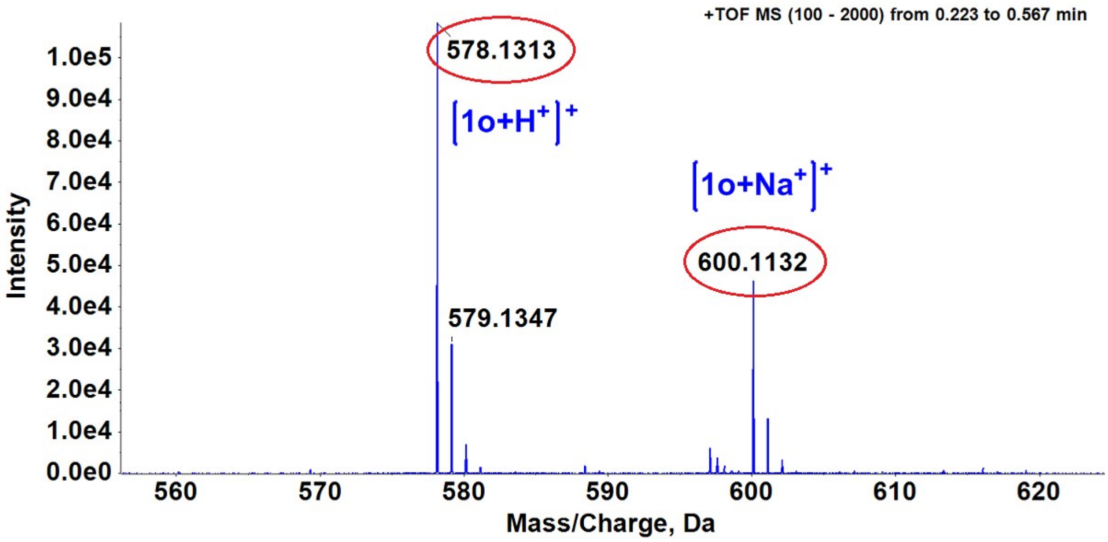

Figure S3. HRMS spectrum of **1o**.

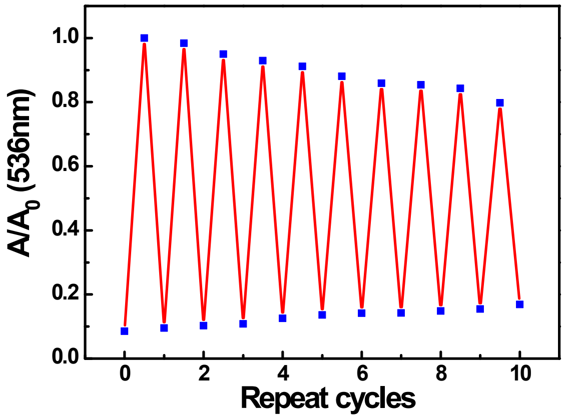

Figure S4. Fatigue resistance of **1o** at room temperature.

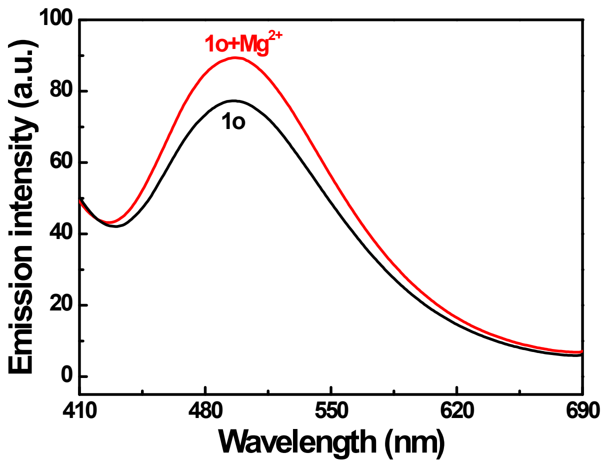

Figure S5. Fluorescence spectra (λ_{ex} = 350 nm) of **1o** (2.0×10^{-5} mol L^{-1}) and **1o**+Mg^{2+} in aqueous solution.

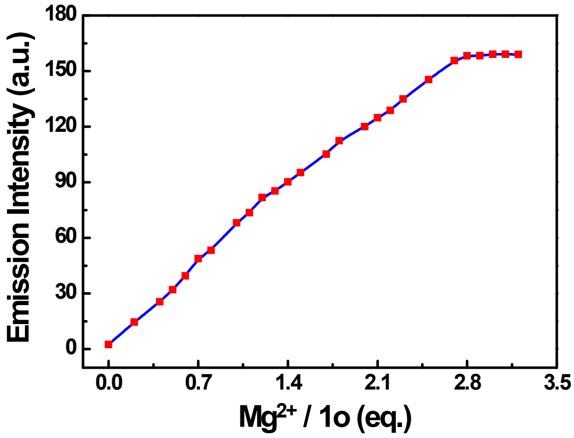

Figure S6. The emission intensity at 552 nm gradually increased until the amount of Mg^{2+} reached 3.0 equiv. of **1o**.

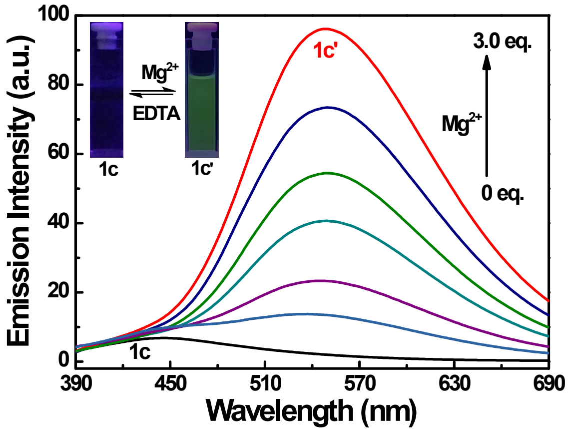

Figure S7. Fluorescence spectra changes of **1c** (2.0×10^{-5} mol L^{-1} in acetonitrile) induced by Mg^{2+} (0-3.0 equiv.) (λ_{ex} = 350 nm).

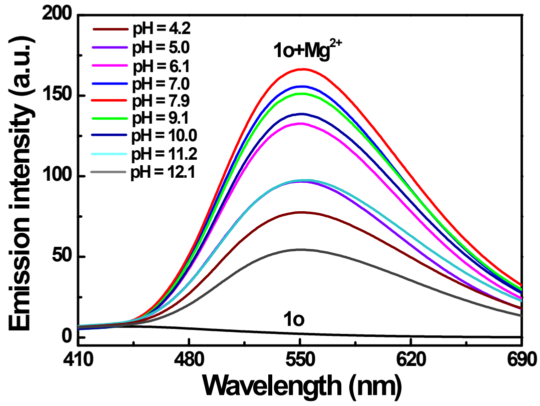

Figure S8. Fluorescence spectral changes of **1o-**Mg^{2+} over different pH values.

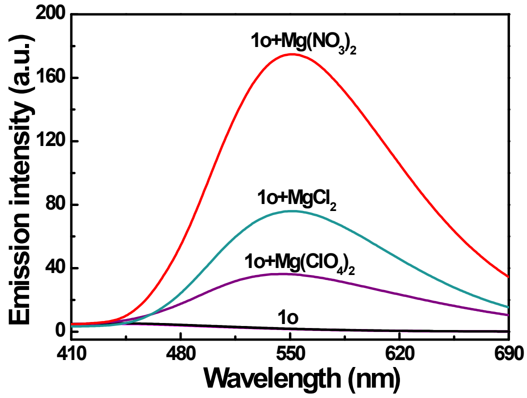

Figure S9. Fluorescence spectral changes of **1o** (2.0×10^{-5} mol L^{-1} in acetonitrile) with the addition of $Mg(NO_3)_2$, $MgCl_2$, and $Mg(ClO_4)_2$.

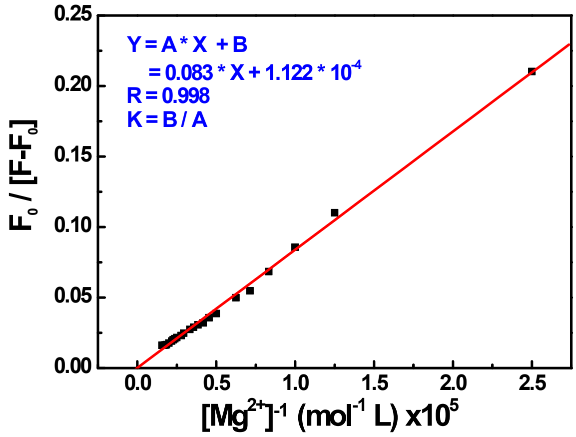

Figure S10. The binding constant of **1o** with Mg^{2+} was calculated to be 1.339×10^{2} $L \cdot mol^{-1}$.

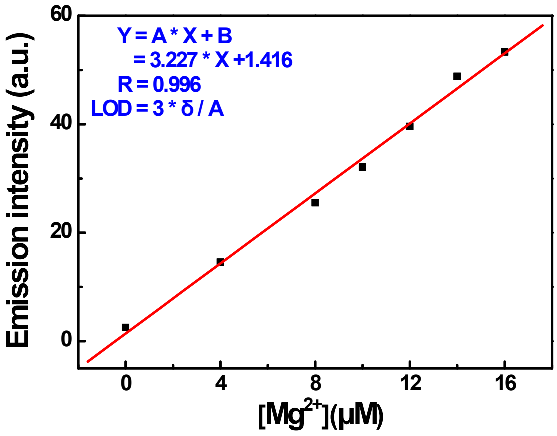

Figure S11. The limit of detection (LOD) for Mg^{2+} is 3.58×10^{-7} mol L^{-1}.

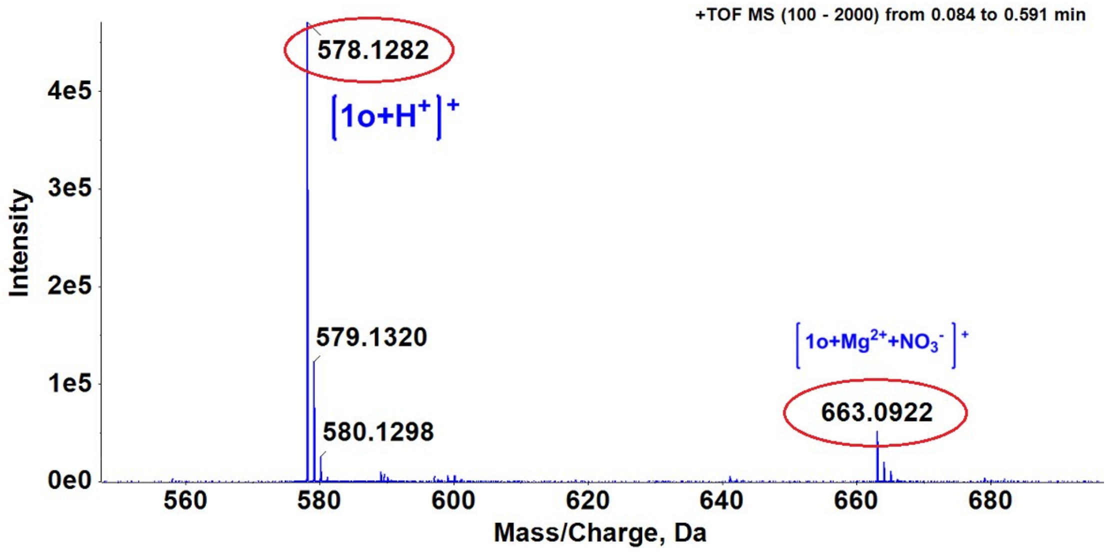

Figure S12. HRMS spectrum of **1o'**.

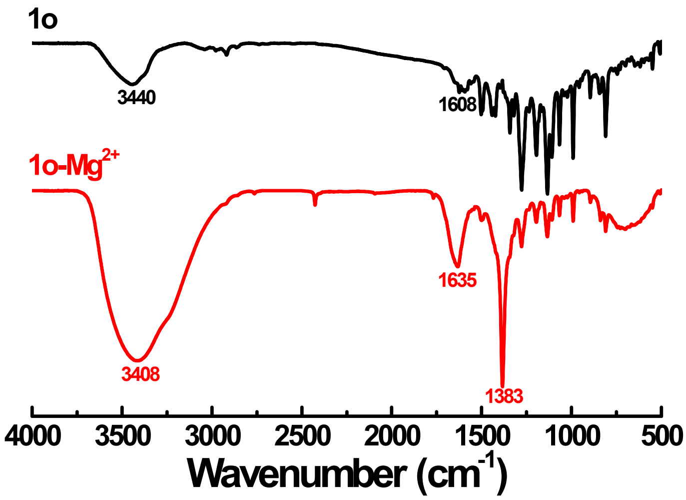

Figure S13. The IR spectra of **1o** and **1o**–Mg^{2+}.

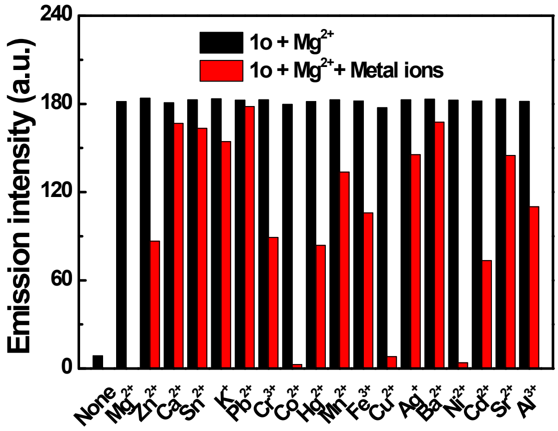

Figure S14. Competitive tests for the fluorescence response of **1o** in the presence of Mg^{2+} and other metal ions in acetonitrile.

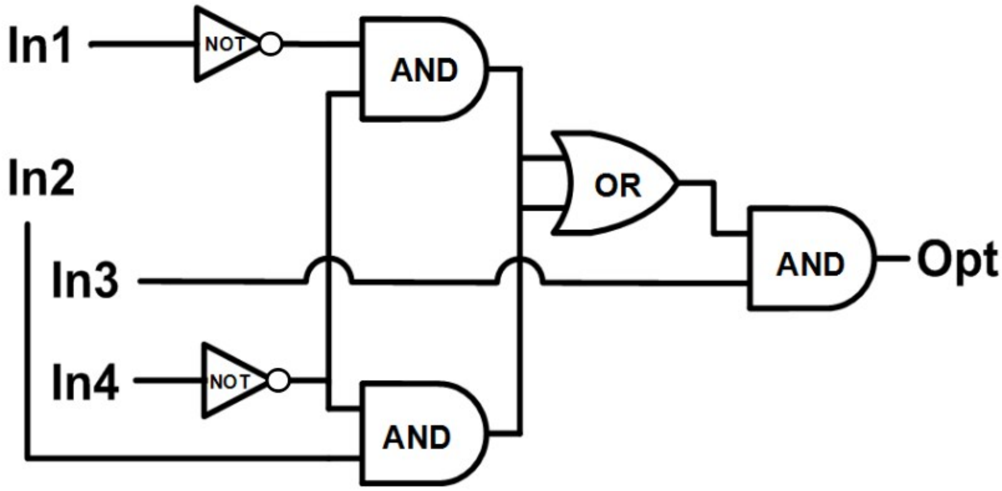

Figure S15. Combinational logic circuits equivalent to the truth table given in Table 1: In1 (UV light), In2 (visible light), In3 (Mg^{2+}), In4 (EDTA).

On the basis of the photoswitching characteristics of **1o** modulated by either UV/vis lights or chemical reagents stimuli in acetonitrile, a logic circuit was constructed with four input signals including In1: 297 nm light, In2: > 500 nm light, In3: Mg^{2+}, In4: EDTA and one output signal (Opt: emission intensity at 552 nm) (**Fig. S15**). The emission intensity of **1o** at 442 nm was taken as the initial value. Meanwhile, the output signal could serve as 'on' with a Boolean value of '1' until the emission intensity at 552 nm was 15.5 fold greater than the initial value, otherwise it was regarded as 'off' with a Boolean value of '0'. For example, when the string is '1, 0, 1, and 0', the corresponding input signals for In1, In2, In3, and In4 are 'on, off, on, and off'. Under these circumstances, **1o** is converted into **1c'** by the stimulus of Mg^{2+} and UV light, meantime its emission intensity increases rarely. Therefore, the output signal is 'off' with the output digit of '0'. Similarly, other different stimulus also resulted in the same on-off fluorescent behaviors. As shown in **Table S1**, all possible logical strings are derived in combinatorial logic.

Table S1. Truth table for all the possible strings of four binary-input data and the corresponding output digit.

Input				output[a]
In1 (UV)	In2 (vis)	In3 (Mg^{2+})	In4 (EDTA)	λ_{em} = 552 nm
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	1	0	0	0
1	1	1	0	1
1	0	1	0	0
1	0	0	1	0
1	0	1	1	0
1	1	1	1	0
1	1	0	1	0
0	1	0	1	0
0	0	1	1	0
0	1	0	0	0

[a]At 552 nm, the emission intensity 15.5 times of the original value is defined as 1, otherwise defined as 0.