Sensors & Diagnostics

Electronic Supplementary Information

Salicylaldehyde-based molecular sensor with one facile step toward visual detection of viscosity

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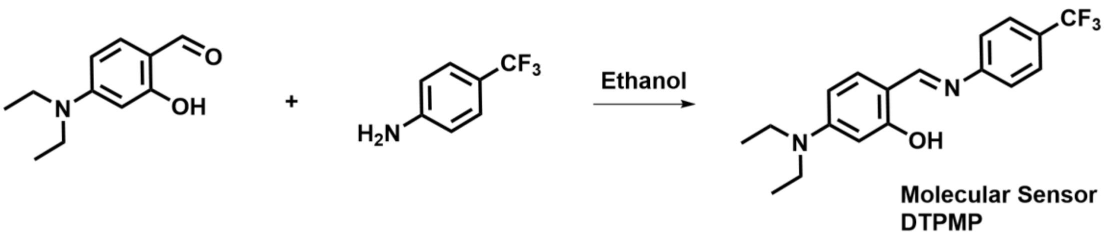


Scheme S1. Synthesis route of the molecular sensor DTPMP.

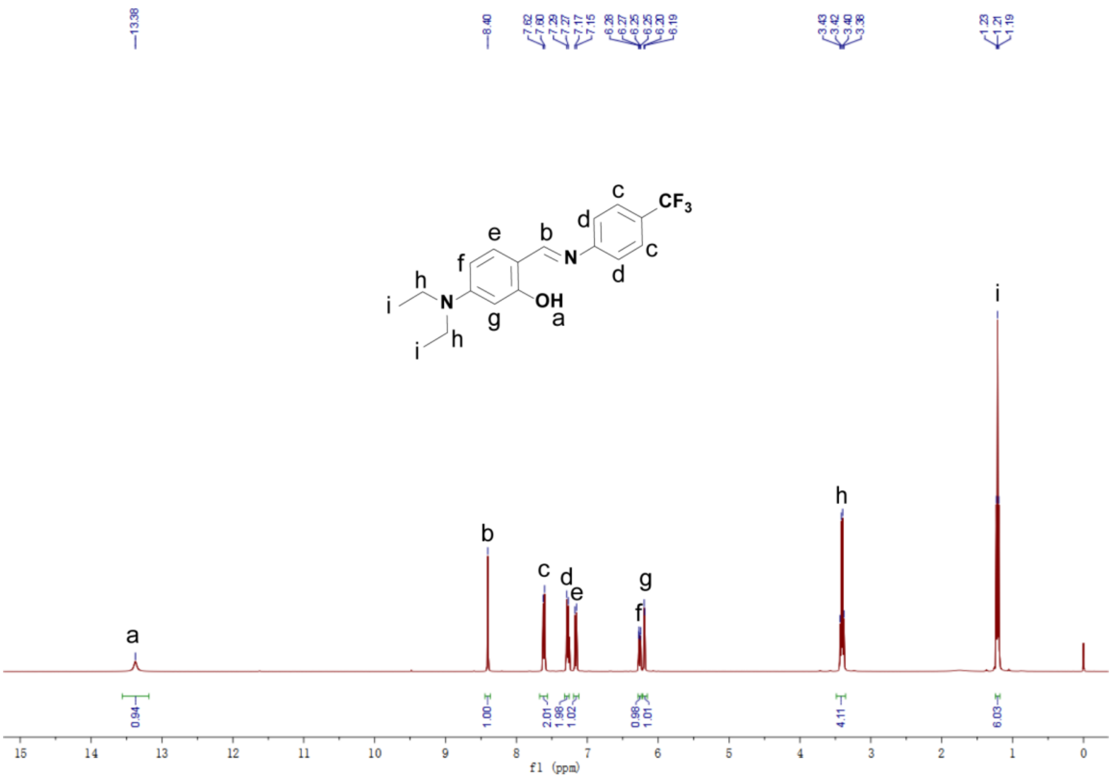


Fig. S1 ^{1}H-NMR spectrum of the molecular sensor DTPMP in $CDCl_3$.

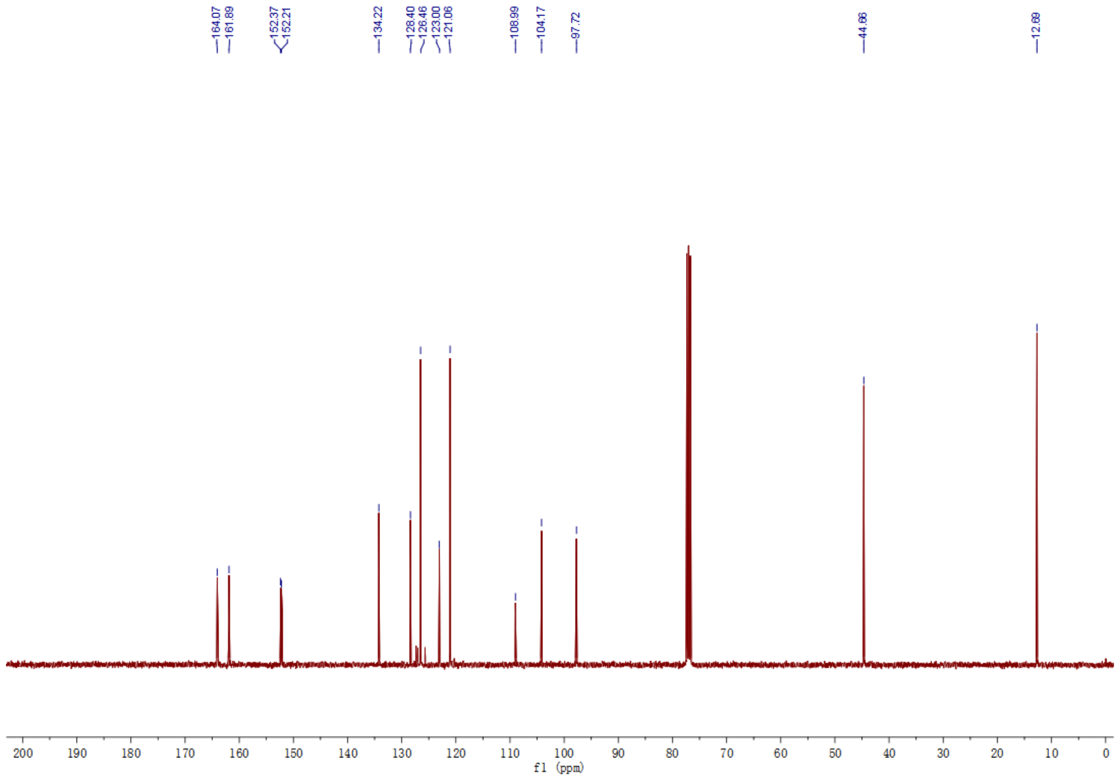


Fig. S2 [13]C-NMR spectrum of the molecular sensor DTPMP in $CDCl_3$.

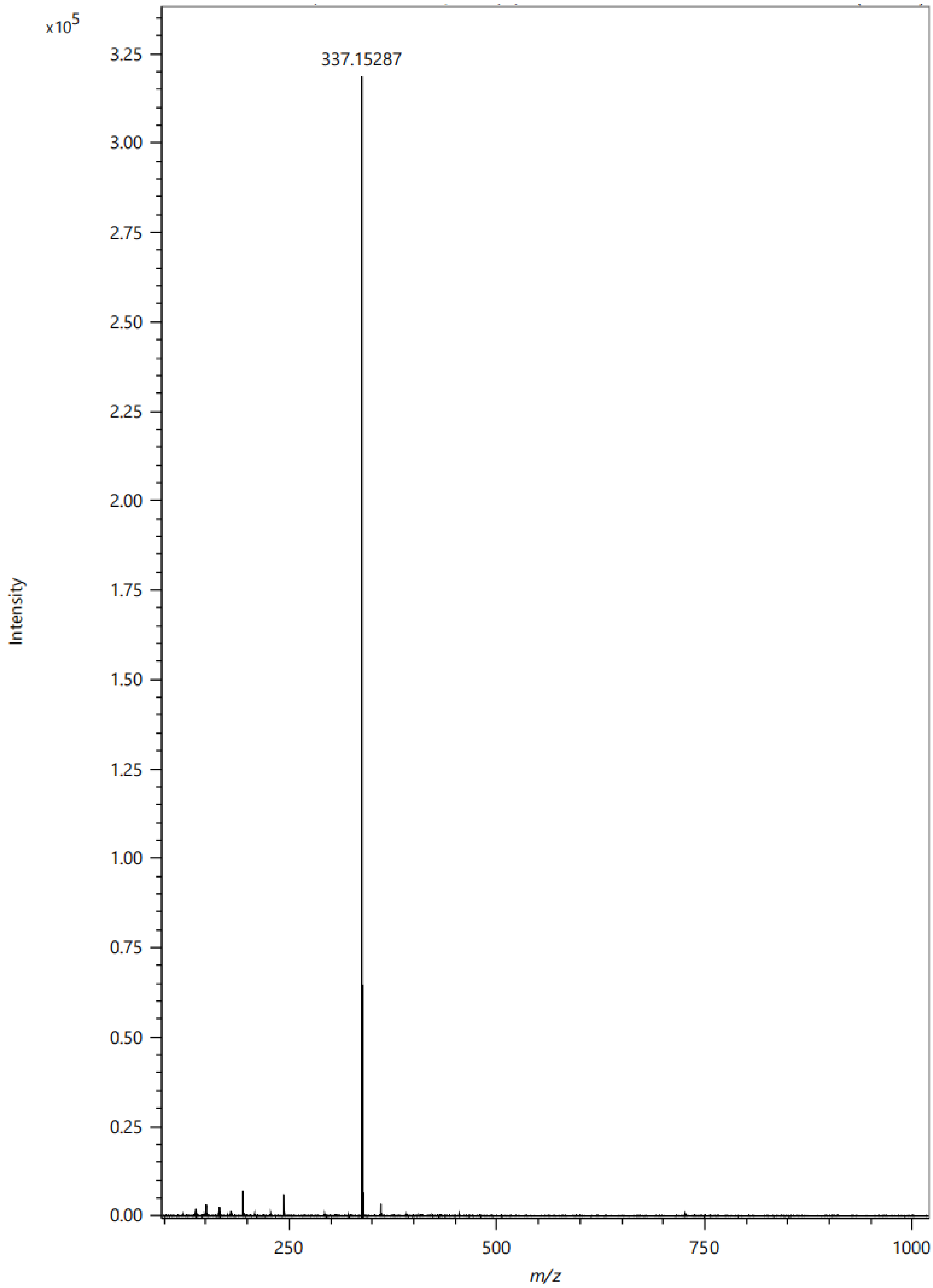


Fig. S3 HR mass spectrum of the molecular sensor DTPMP. MS (ESI): m/z 337.15287 $[M+1]^+$.

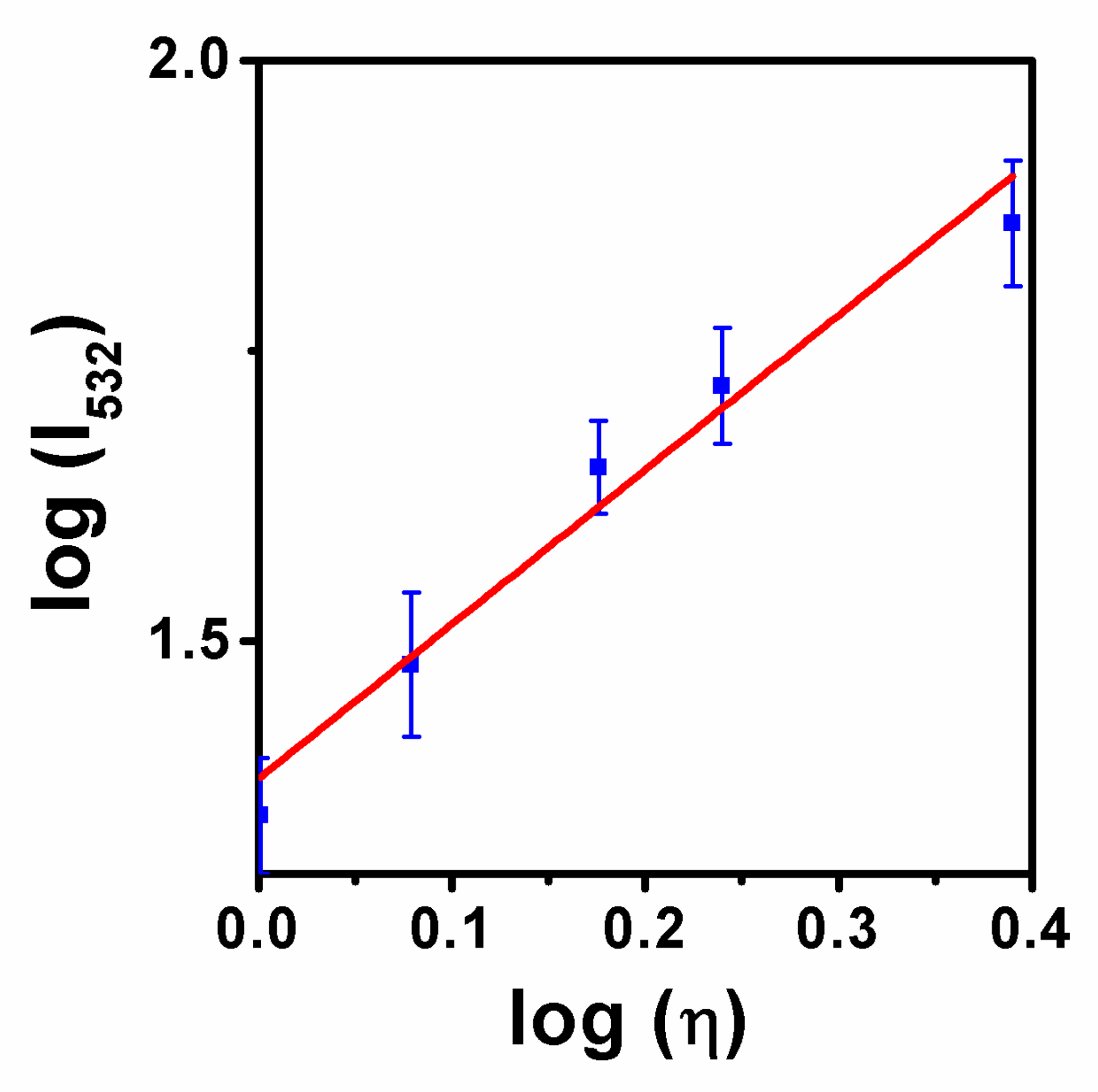


Fig. S4 Detection limit of the sensor DTPMP.

The calibration curve was first obtained from the plot of log (I_{532}) as a function of log (η). Then the regression curve equation was obtained for the lower viscosity part.

The detection limit = 3 × *S.D.*/*k*

Where *k* is the slope of the curve equation, and *S.D.* represents the standard deviation for the log (I_{532}) of molecular sensor DTPMP.

log (I_{532}) = 1.381 + 1.330 × log (η) (R^2 = 0.982)

log (LOD) = 3 × 0.038/1.330 = 0.086

LOD =10^0.086 =1.220 cP

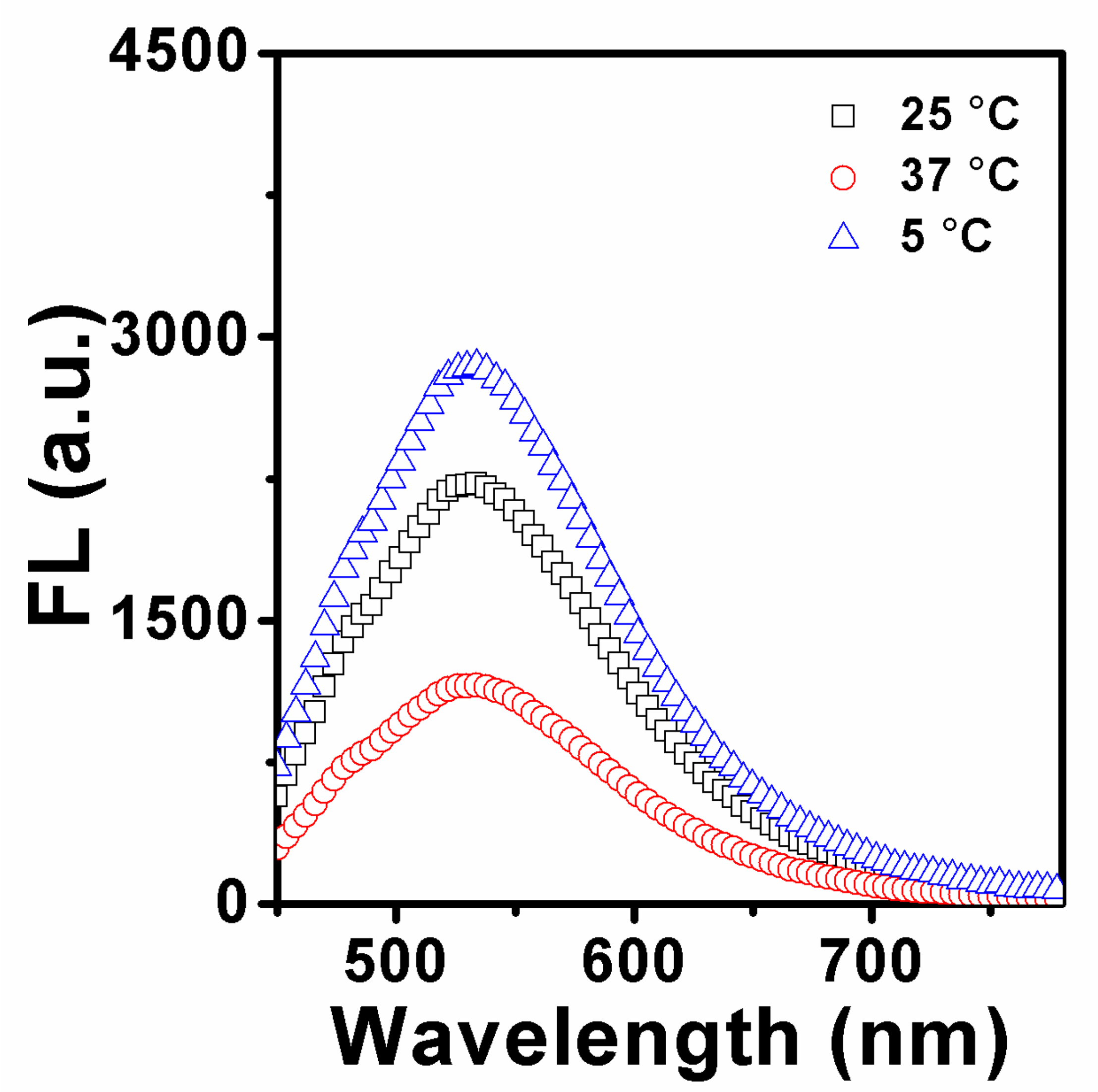


Fig. S5 Fluorescence spectra of the sensor DTPMP (10 μM) in glycerol under different temperature, including the ambient temperature (25 °C), normal body temperature (37 °C), and fresh-maintenance temperature (5 °C).

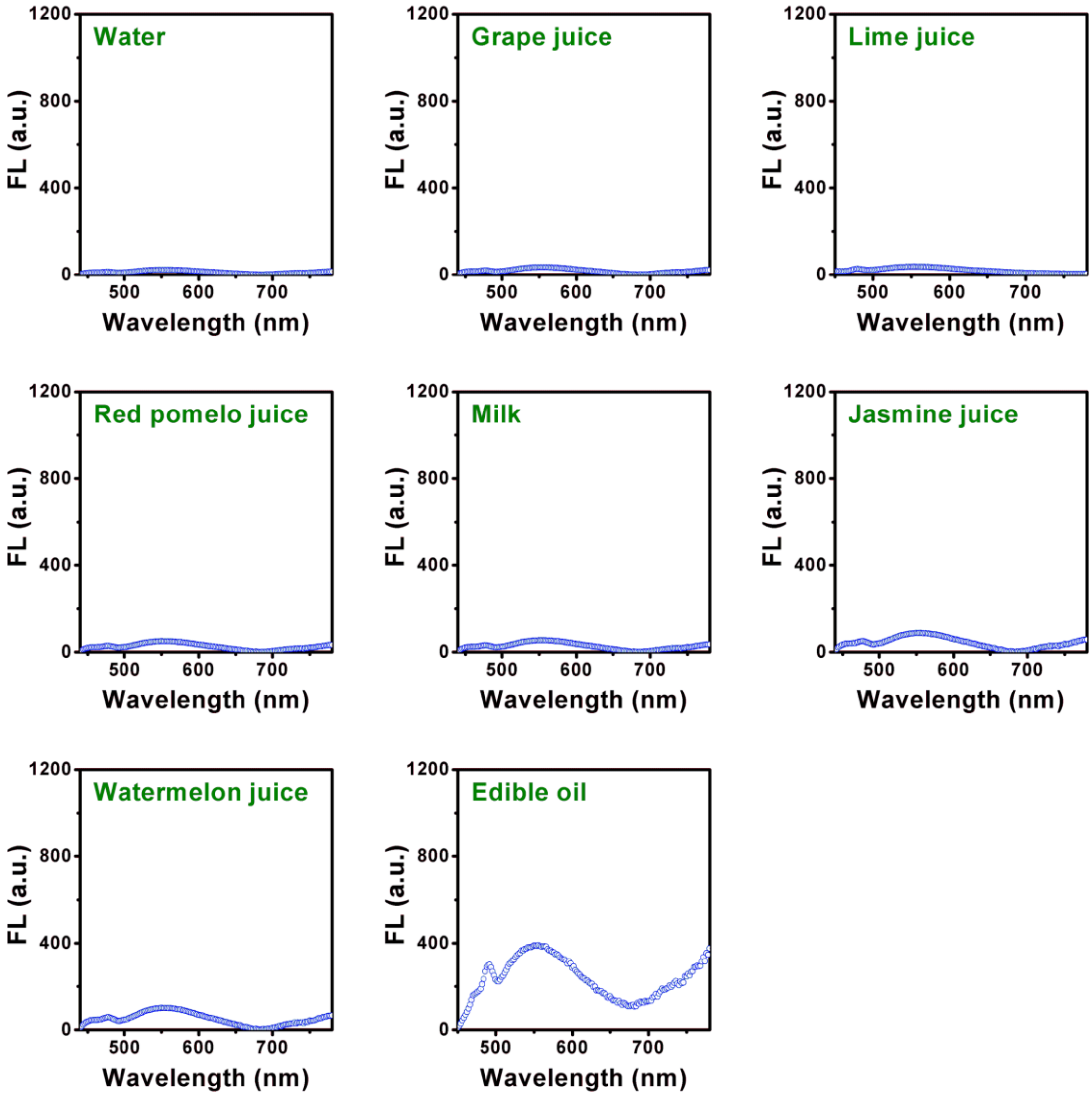


Fig. S6 Fluorescence spectra of the molecular sensor DTPMP (10 μM, containing 1% DMSO) in eight kinds of common liquids, including the water, grape juice, lime juice, red pomelo juice, milk, jasmine juice, watermelon juice and edible oil, λ_{ex}=420 nm.

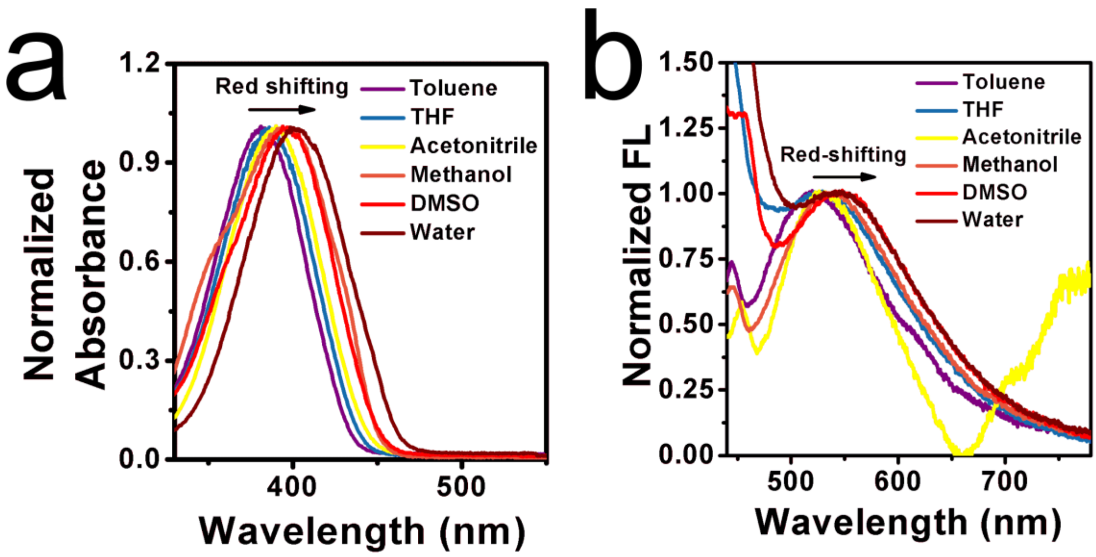


Fig. S7 (a) Normalized fluorescence emission spectra of molecular sensor DTPMP in six kinds of common solvents. (b) Normalized absorption spectra of molecular sensor DTPMP in six kinds of common solvents.

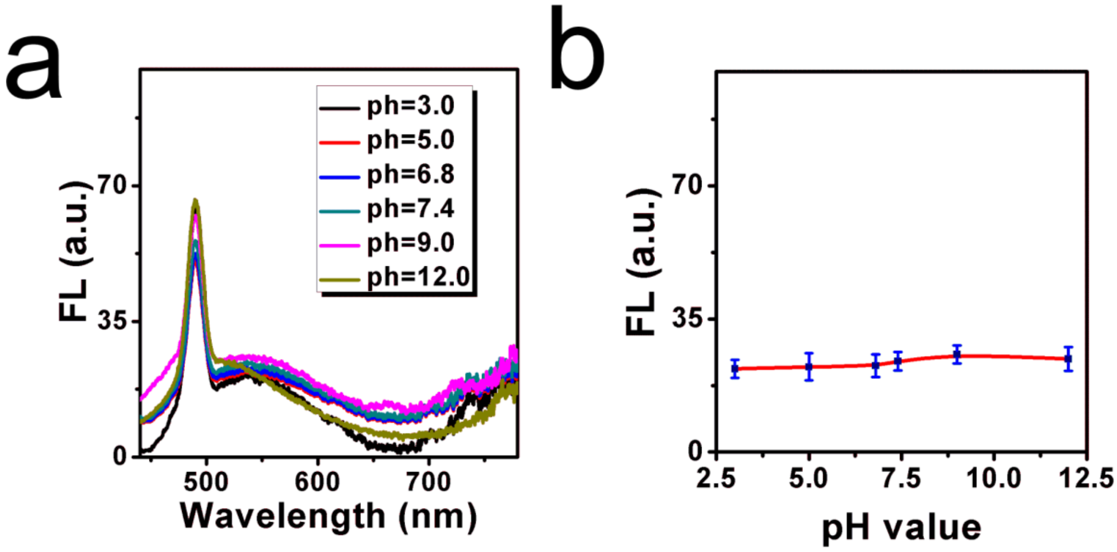


Fig. S8 (a) Fluorescence emission spectra intensity of the molecular sensor DTPMP (10 μM) under various pH values (containing 1% DMSO) in low viscous water. (b) Corresponding fluorescence intensities of molecular sensor DTPMP under various pH values environment, λ_{ex}=420 nm.

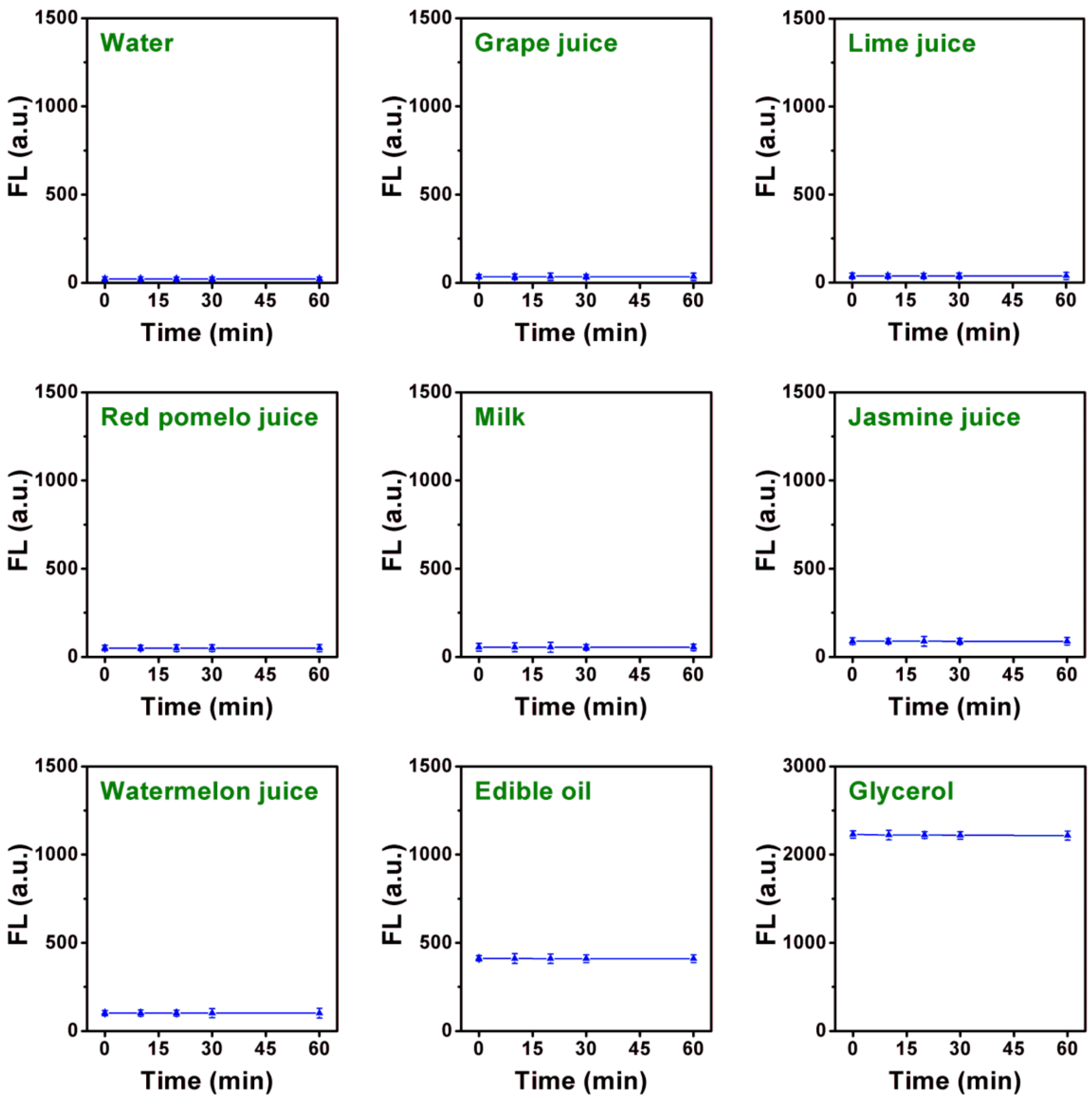
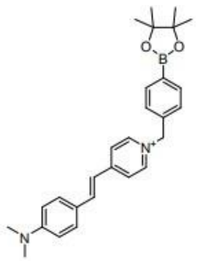
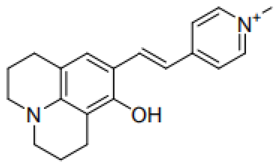
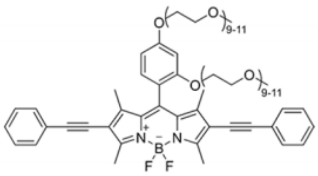
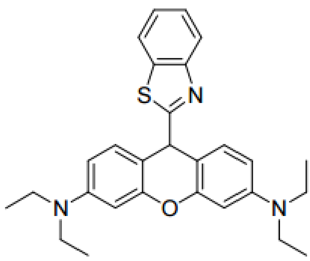
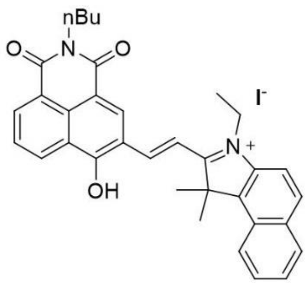
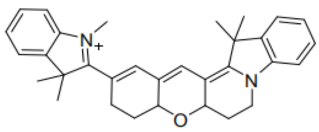
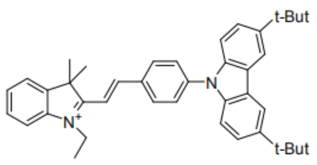
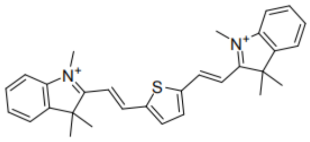
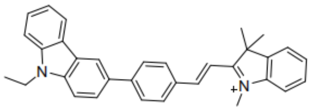
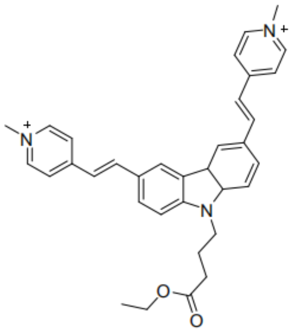
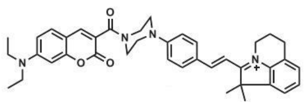
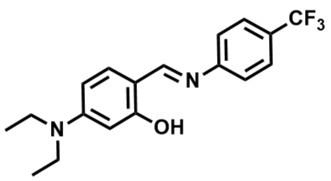


Fig. S9 Photostability analysis of the molecular sensor DTPMP in water (containing 1% DMSO), glycerol (containing 1% DMSO) and other seven kinds of common liquids (containing 1% DMSO). All upon samples were tested under continuous light irradiation with 420 nm UV lamp.

Table S1. Comparison of the representative fluorescence-based probes for viscosity detection reported in recent years.

Probe	λ_{ab}*	λ_{em}**	Stokes shift***	Application	Reference
	500 nm	607 nm	107 nm	Biological system, living cells.	[1]
	530 nm	620 nm	90 nm	Biological system, living cells.	[2]
	560 nm	580 nm	20 nm	Biological system, living cells.	[3]
	600 nm	635 nm	35 nm	Biological system, living cells, in vivo.	[4]
	580 nm	635 nm	55 nm	Biological system, living cells.	[5]
	678 nm	698 nm	20 nm	Biological system, living cells, rat slice.	[6]

	545 nm	628 nm	83 nm	Biological system, living cells.	[7]
	525 nm	595 nm	70 nm	Biological system, living cell.	[8]
	520 nm	610 nm	90 nm	Biological system, living cell, zebra fish, mice.	[9]
	470 nm	560 nm	90 nm	Biological system, living cell.	[10]
	520 nm	580 nm	60 nm	Biological system, living cell.	[11]
	415.6 nm	532.4 nm	116.8 nm	Liquids, food spoilage analysis.	This work

* Absorption peak. The absorption was measured in the glycerol.

** Emission peak. The fluorescence emission was measured in the glycerol.

*** The stokes shift herein was obtained from the absorption and emission measured in the glycerol.

Table S2. Fluorescence intensity of commercial liquids with the molecular sensor DTPMP.

Liquids	Fluorescence intensity
Water	22.50
Grape juice	34.80
Lime juice	37.50
Red pomelo juice	50.75
Watermelon juice	102.14
Milk	55.10
Jasmine juice	89.13
Edible oil	412.10

Table S3. Viscosity values of the liquids determined *via* viscometer and fluorescence technique.

Liquids	Viscosity (cP)	Calculated (cP)
Water	1.00	1.02
Grape juice	1.36	1.34
Lime juice	1.42	1.44
Red pomelo juice	2.44	2.47
Watermelon juice	7.50	7.40
Milk	2.81	2.86
Jasmine juice	6.00	6.09
Edible oil	68.10	68.25

Table S4. Photo-physical properties of the molecular sensor DTPMP in different solvents.

Solvents	Dielectric constant (ε)	η (cP)	Absorption λ_{ab} (nm)	Emission λ_{em} (nm)
Water	78.5	1.0	401.2	543.7
Acetonitrile	37.5	0.4	388.6	527.1
DMSO	46.8	2.1	396.8	541.1
Methanol	32.6	0.6	395.5	530.4
THF	7.4	0.5	384.5	521.2
Toluene	2.4	0.6	381.1	518.3
Ethyl acetate	7.3	0.4	385.3	523.8
Glycerol	45.8	956.0	415.6	532.4

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