A review on organic small-molecule fluorescent probes for gallium(III) ion (Ga^{3+})

Liqiang Yan,[a*] Xianjun Xu,[a] Kaiyue Bao,[a]

[a] *College of Chemistry and Bioengineering, Guilin University of Technology, Guilin, Guangxi 541006, P.R. China*

*Corresponding author, E-mail: liqiangyan@glut.edu.cn.

Table S1. Experimental data of Ga^{3+} fluorescent probes.

Probe	Solvent	λ_{ex} (nm)	λ_{em} (nm)	Mechanism	LOD	Linear range	RSD<	K_a	Coincidence signal	Interference	Masking agent	Application sample	Ref.
1	DMSO/H_2O (1:1, v/v)	350	500	PET, ICT	13.0 nM	0–2 μM	-	8.85 × 10^6 M^{-1}	no	Cu^{2+}, Fe^{3+}	EDTA	Hela cells, A549 cells, zebrafish	40
2a	MeCN/tris buffer (9:1, v/v)	421	510	PET	3.90 nM	0–0.1 μM	-	3.89 × 10^9 M^2	-	Zn^{2+}, Cu^{2+}	PPi	-	41
2b	MeCN/tris buffer (9:1, v/v)	421	513	PET	3.97 nM	0–0.1 μM	0.46 %	8.59 × 10^9 M^2	-	no	PPi	Water	
3a	DMSO/Tris buffer system (9:1, v/v, pH 7.4)	397	471	PET, CHEF	62.3 nM	0.1–0.9 μM	0.35%	8.54 × 10^8 M^2	no	no	-	Water	42
3b	DMSO/Tris buffer (9:1, v/v, pH 7.4)	351	511	PET, CHEF	11.5 nM	0.1–0.7 μM	0.34%	1.06× 10^8 M	no	no	-	Water	
4	DMF/Tris buffer (9:1, v/v, pH 7.4)	383	458	PET	14 nM	1–6 μM	1.7 %	1.17 × 10^5 M^{-2}	no	Pd^{2+}	-	Water, test strips	43
5a	DMSO/Tris buffer (9:1, v/v, pH 7.4)	409	460	PET	8.85×10^{-7} M	1–10 μM	-	-	Al^{3+}	Pd^{2+}	PPi	Water	44
5b	DMSO/Tris buffer (9:1, v/v, pH 7.4)	409	466	PET	1.21×10^{-8} M	1–9 μM	0.50 %	-	no	no	PPi	Water	
6	H_2O/DMSO (v/v = 3/7)	390	447	C=N isomerization	1.18 μM	5–75 μM	-	5.34 × 10^3 M^{-1}	no	no	ATP	MCF-7 cells, zebrafish	45
7	DMSO/EtOH/acetate buffer (pH 3.8)	405	470	-	50 nM	0–1.1 μM	-	1.21 × 10^5 M^{-1}	no	Co^{2+}, Cu^{2+}, Fe^{3+}	EDTA	Water	46
8a	Aqueous medium (0.01% DMSO)	380	500	ESIP	201 nM	1.6–18 μM	-	2.70 × 10^{11} M^{-1}	Al^{3+},	Cu^{2+}	PPi	Logic gate, Test strips, Vero cells	47
8b	Aqueous medium (0.01% DMSO)	320	473	ESIP	852 nM	6–30 μM	-	3.81 × 10^9 M^{-1}	Cu^{2+}	no	PPi	Logic gate, test strips, vero cells	
9	DMSO/MeOH (10:3, v/v)	-	556	CHEF	0.39 μM	0–30μM	-	2.7 × 10^4 M^{-1}	no	Cu^{+}, Ba^{2+}	-	Test kit	48
10	DMSO-acetate buffer (1:1, v/v, pH 5.2)	422	495	ESIPT, C=N isomerization, CHEF	12.89 nM	5–20 μM	5. 83%	1.80 × 10^4 M^{-1}	no	no	-	Human serum, urine, pork, rabbit kidney, rabbit liver, water	49
11	DMF/H_2O (2:3, v/v)	370	482	PET, CHEF	4.28 μM	14–40	-	1.09 ×	Al^{3+}	Cu^{2+}	EDTA	Test paper,	50

						μM		10^4 M^{-1}				smartphone recognition, A549 cells	
12	bis–tris buffer solution (0.3% DMSO)	365	480	ESIPT, PET	58 nM	0–0.5 μM	0.41%	8.5×10^3 M^{-1}	no	no	-	Test strips, water	51
13	PBS buffer solution (containing 0.1% DMF, pH 7.4)	425	602↓/531↑	ESIPT, CHEF	32.1 nM	2–10 μM	0.5%	-	no	no	ATP	Logic gates, Hela cells, nude mice	52
14	MeOH	450	486/516	-	0.10 μM	-	-	2.5×10^6 M^{-1}	Al^{3+}	-	-	-	53
15	MeOH/DMSO	481	570	ICT	-	-	-	5.0×10^7 M^{-2}	Al^{3+}, In^{3+}	Fe^{2+}, Cu^{2+}, Mg^{2+}	-	-	54
16	DMSO/Tris buffer (9:1, v/v, pH 7.4)	415	518	LMCT, PET	3.11nM	1–6 μM	2.19 %	4.71×10^8 M^{-2}	no	no	PPi	Water	55
17	DMSO/Tris buffer (9:1, v/v, pH 7.4)	340	516	PET	20 nM	1–6 μM	-	9.78×10^8 M^{-2}	no	no	-	Water	56
18	CH_3OH	400	457	ICT, CHEF	0.29 nM	0–4 μM	-	1.2×10^5 M^{-1}	no	In^{3+}, Al^{3+}, Pb^{2+}	-	-	57
19	DMSO/MeOH (99:1, v:v)	380	480	PET	0.26 μM	0–6 μM	-	2.5×10^4 M^{-1}	no	Fe^{2+}, Cu^{2+}, Fe^{3+}, Mg^{2+}	-	Test strips	58
20	MeOH/DMSO	452	550	ICT	-	-	-	9.0×10^7 M^{-2}	Al^{3+}, Cr^{3+}	Fe^{3+}, Fe^{2+}	-	-	59
21	EtOH-HEPES buffer (98:2, v/v, pH 7.0)	330	406	ICT	2.37 nM	1–10 μM	-	3.82×10^4 M^{-1}	no	no	-	-	60
22	DMSO	400	488	C=N isomerization	1.89 μM	0–40 μM		1.26×10^4 M^{-1}	no	Cu^{2+}, Fe^{3+}, Hg^{2+}	-	-	61
23	DMSO/PBS (1: 9, v/v, pH 7.4)	380	450	PET, ESIPT	0.11 nM	0–50 μM	-	7.63×10^3 M^{-1}	no	Cu^{2+}	-	A549 cells	62
24	PBS/DMSO (99:1, v/v)	390	526	ESIPT	-	0–1.75 μM	-	-	no	Mg^{2+}, Al^{3+}, Cd^{2+}	EDTA	prokaryotic bacteria, eukaryotic cells, vertebrate zebrafish	63
25	H_2O/ EtOH (99:1, v/v)	450	640	ESIPT	82 nM	0–2 μM	-	-	Al^{3+}, In^{3+}	no	-	RAW264.7 cells, OMC-1 cells, zebrafish	64
26a	MeOH/H_2O (1:1, v/v)	350	465	PET, FRET, CHEF	0.19 μM	0–40 μM	-	2.80×10^4 M-1	Al^{3+}	no	F^-	Test strips, polystyrene	65

												film	
26b	MeOH/H_2O (1:1, v/v)	350	430	PET, FRET, CHEF	1.31 μM	0–150 μM	-	2.24×10^3 M^{-1}	no	no	-	-	
27	EtOH/HEPES buffer (1:1, v/v, pH 7.4)	340	383	PET	10 nM	0–20 μM	-	2.99×10^5 M^{-1}	Al^{3+}	-		Water	66
28	DMSO/H_2O (2:8, v/v)	375	467	PET, C=N isomerization	3.35 nM	0–120 μM	-	7.03×10^4 M^{-1}	no	no	EDTA	T24 cells, molecular logic gate	67
29	EtOH (containing 0.5% THF)	280	429	ICT	1.17 μM	0–50 μM	-	1.56×10^2 M^{-2}	Al^{3+}	-	PPi	Test strips, polystyrene film	68
30	Tris-HCl (pH 7.0)	344	475	C=N isomerization	57.9 nM	0–7 μM	-	3.7×10^4 M^{-1}	no	Al^{3+}, Zn^{2+}	$Na_4P_2O_7$	-	69
31	EtOH/HEPES buffer (9:1, v/v, pH 7.4)	495	530	Spirolactam Ring Opening	29 nM	0–40μM	-	-	Al^{3+}, In^{3+}, Tl^{3+}	no	-	Test paper, water	70
32	MeOH	516	554	-	-	0–1.12 μM	-	-	Fe^{3+}, Cr^{3+}, In^{3+}, Al^{3+}, Cu^{2+}	-	-	Test strips	71
33	EtOH/HEPES buffer (9:1, v/v, pH 7.4)	495	553	Spirolactam ring-opening	10 nM	0–40μM	-	4.79×10^4 M^{-1}	Al^{3+}, In^{3+}, Tl^{3+}	no	-	Water	72
34	DMSO/HEPES buffer (9:1, v/v)	522	584	Spirolactam ring-opening, PET	2.03 nM	10–70 nM	-	5.6×10^3 M^{-1}	no	no	PPi	HaCaT cells	73
35	Acetic/phosphoric/boric acids solution (pH 7)	-	503	-	0.54 μM	0–25 μM	4.4%	-	no	Cd^{2+}, Ni^{2+}, Cu^{2+}	-	Water	74
36	MeCN	365	534↓/414↑	-	2.59 nM	-	-	log K_a =10.79	Al^{3+}, Fe^{3+}, Cr^{3+}, As^{3+}, In^{3+}	-	-	-	75
37	CH_3CN	332	431	ESIPT, CHEF	1 μM	0.5–8 μM	-	6.24×10^4 M^{-1}	Al^{3+}	no	-	-	76
38	DMSO	-	-	-	84 pM	0.1μM–100mM	28.62%	-	no	-	-	Serum, water	26
39	MeOH/H_2O	-	-	-	-	-	-	-	no	Fe^{3+}, Cu^{2+}	-	-	77
40	DMSO/H_2O (5:1, v/v)	350	460↑/535↓	LMCT, ESIPT	53.5 nM	0–1.0 μM	-	-	Al^{3+}, In^{3+}	no	EDTA	HeLa cells, A549 cells, zebrafish	78
41	DMSO/H_2O (9:1, v/v)	450	545	C=N isomerization, PET, CHEF	48.8 nM	8–28 μM	-	2.06×10^4 M^{-1}	no	no	PPi	Onion inner epidermal cells	79

42	DMSO/Tris buffer (9:1, v/v, pH 7.4)	420	496	ICT, CHEF	4.42 nM	10–100 nM	1.68 %	-	In^{3+}, Fe^{3+}	no	-	Water	80
43	DMSO/Tris buffer (9:1, v/v, pH 7.4)	414	471	PET	34 nM	0−30 μM	-	$7.1 \times .10^{6}$ M^{-1}	no	no	EDTA	Water, HCT116 cells	81
44	MeCN:H_2O (9:1,v/v)	300	337	-	1.60 μM	0−32.5 μM	-	1.64×10^{4} M^{-1}	Al^{3+}, In^{3+}, Fe^{3+}	Cu^{2+}, Fe^{3+}, Fe^{2+}	EDTA	Logic gate, Test strips, MCF-7 cells	82

"-" means that it was not mentioned in the literature. "no" indicates that the experiment demonstrated without obvious interference or effect.