Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting Information

Phenothiazine and phenoxazine sensitizers for dye-sensitized solar cells – an investigative review of two complete dye classes

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Contents

Explanations to the tables

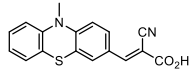
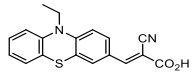
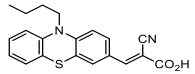
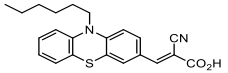
Below are tables containing the complete dataset for the review paper. The compounds are separated into tables based on their geometry. No specific attention has been given to sort the dyes within each geometry, as the complete dataset has been of interest rather than individual dyes. The references of this supplementary information are independent of the main review paper document, but all references to all compounds have been included in the main paper.

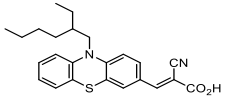
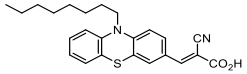
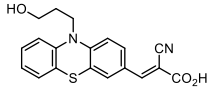
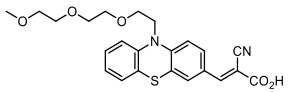
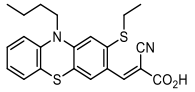
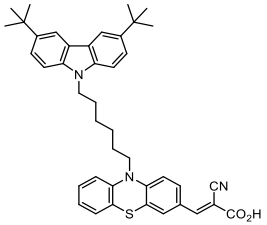
References followed by an asterisk (*) report data which have failed the validation calculations of J_{SC} by methods A and B. These dyes are included in this complete list, but not in the dataset used for the statistical findings.

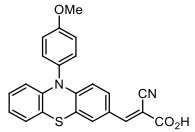
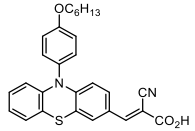
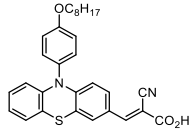
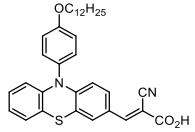
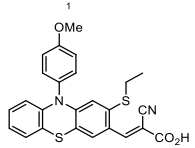
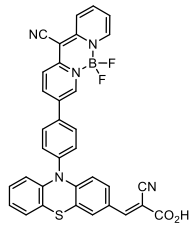
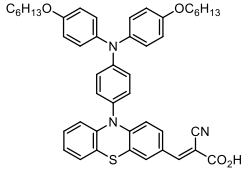
Where solvent mixtures are reported, the ratios reported are volumetric ratios. Table explanations: λ_{sol} – wavelength of maximum absorption in solution, ε – extinction coefficient, λ_{film} – wavelength of maximum absorption on TiO_2 film, λ_{PL} – wavelength of emission, E_{OX} – oxidation potential, E_g – bandgap, vs – reference electrode, $IPCE_{max}$ - wavelength of maximum IPCE, $IPCE_{onset}$ - wavelength of IPCE onset.

Solvent abbreviations: ACN - acetonitrile, THF - tetrahydrofuran, DCM - dichloromethane, MeOH - methanol, DMF – *N*,*N*-dimethylformamide, $CHCl_3$ - chloroform, EtOH - ethanol, DCB – dichlorobenzene.

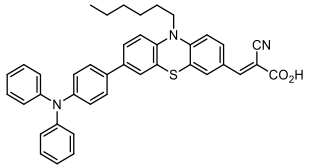
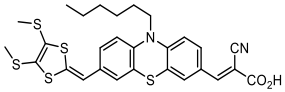
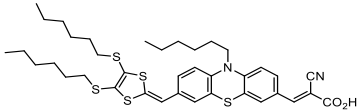
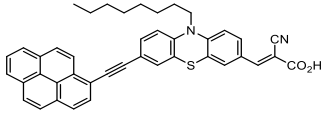
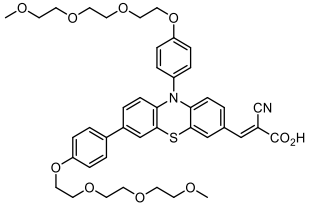
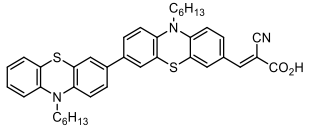
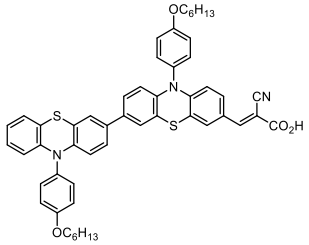
D-A dyes

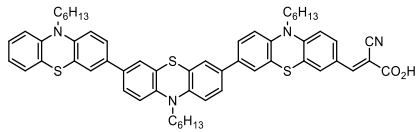
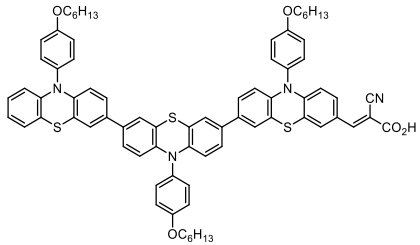
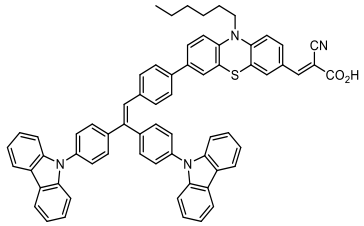
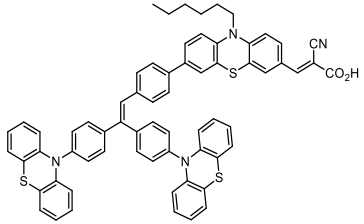
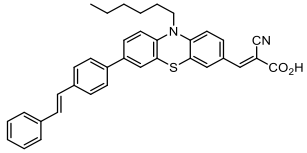
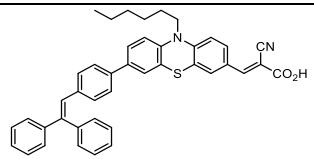
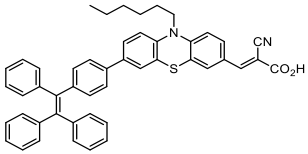
		Photophysical parameters					Electrochemistry			Photovoltaic parameters							
Dye	**Dye name**	**λ_{sol}**	**ε (10^3 M^{-1} cm^{-1})**	**Solvent**	**λ_{film}**	**λ_{PL}**	**E_{OX}**	**E_g**	**vs**	**J_{SC}**	**V_{OC}**	**FF**	**PCE**	**IPCE max**	**IPCE onset**	**Structure**	**Ref**
1	**Type 1**									6.50	660	0.75	3.21				[1]
2	**D3**	400	14.1	ACN	426	573	0.52	2.44	NHE	13.35	669	0.62	5.53	82	625		[2]
2	**SB**	439	16.0	THF		586				6.13	709	0.67	2.91				[3]
2	**AC-8**	440	12.1	THF	421	615	0.35			2.39	574	0.58	0.81	1	525		[4]
3	**T2-1**	452	19.4	DCM	425	592	1.10	2.37	NHE	10.90	712	0.71	5.50	77	650		[5]
3	**T2-1**									9.47	752	0.74	5.29	75	630		[6]
3	**TH202**									11.10	730	0.78	6.30	85	625		[7]
3	**T2-1**	456	16.3	DCM	422	639	0.94	2.26	NHE	10.98	731	0.72	5.78	85	640		[8]
3	**T2-1**	437	16.2	THF	465	620	0.97	2.32	NHE	8.60	730	0.70	4.39	63	600		[9]
4	**PT1a**	459	14.0	DCM	428	660	0.73	2.32	NHE	12.91	680	0.62	5.45	83	610		[10]
4	**H-PTZ**	455	28.0	DCM/MeOH (29:1)	470		0.85	2.31	NHE	7.76	700	0.65	3.57	70	600		[11]
4	**Pt-C6**	438	14.9	THF	392		0.73	2.32	NHE	10.73	650	0.64	4.49	77	670		[12]

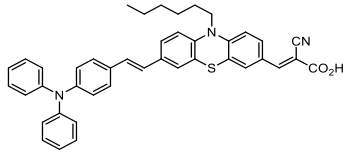
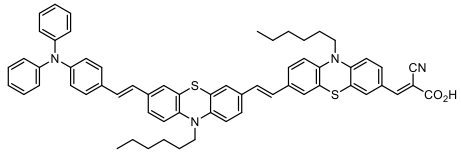
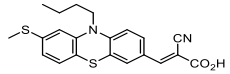
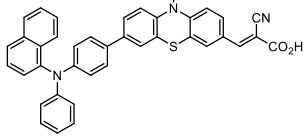
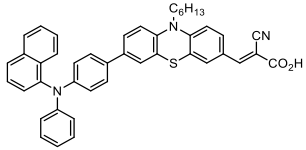
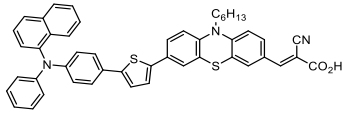
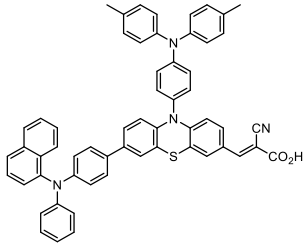
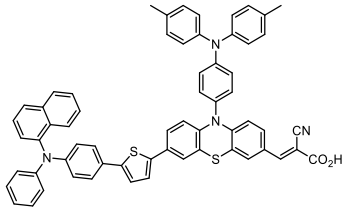
4	**PT5**	460	14.3	DCM	348		0.58	2.22	NHE	9.50	714	0.64	4.37	62	600		[13]
4	**1(PTZCA)**	424	12.0	DMF	426		0.83	2.51		9.03	631	0.63	3.57	61	625		[14]
4	**CS1A**	440	14.0	THF		635				10.80	779	0.75	6.30	84	630		[15]
4	**WR7**	453	16.5	DCM			1.01	2.29	NHE	12.96	710	0.71	6.63	86	660		[16]
4	**R2**	437	15.1	THF	393		1.06	2.45	NHE	11.56	650	0.67	4.97	68	640		[17]
4	**C6PTZ**	420	18.1	MeOH	467	553	1.27	2.46	NHE	8.33	703	0.71	4.16	62	625		[18]
4	**T0**	392	24.3	DMF/MeOH (1:3)	399		1.35	2.57	NHE	8.78	720	0.67	4.24	42	590		[19]
4	**PTZ-S**	396	8.0		432					6.58	670	0.70	3.14	48	600		[20]
4	**PTZ-1**	458	14.1	DCM	440	650	1.32	2.2	NHE	8.33	710	0.69	4.04	54	600		[21]
4	**2**									14.74	650	0.54	5.17	57	600		[22]*
4	**5**	448		DCB		620	1.17	2.38	NHE	11.50	650	0.63	4.9	49	605		[23]
5	**OMS1**	389	10.1	THF		552		2.55		2.09	570	0.57	0.68	12	550		[24]
5	**PR6C1**	462	18.1	DCM						12.52	675	0.68	5.6				[25]
6	**SP**	439	13.7	DCM/THF (1:1)	402		0.97	2.42	NHE	9.01	758	0.71	4.87	55	600		[26]
7	**Type 2**									8.03	650	0.75	3.88				[1]
8	**Type 3**									8.36	660	0.74	4.07	72	600		[1]
9	**SH-2**	472	23.6	DCM	428	652	1.01	2.17	NHE	10.26	769	0.72	5.70	84	650		[8]
10	**CSORG1**	435	19.0	THF		626				10.50	719	0.76	5.80	96	630		[15]
11	**Z1**	420	7.8	THF/DCM (1:1)	450	550	1.54	2.51	NHE	8.56	773	0.69	4.53	38	615		[27]

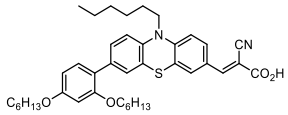
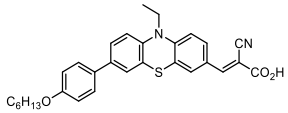
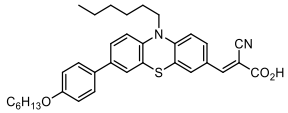
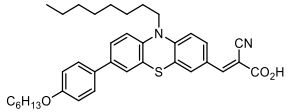
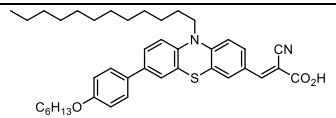
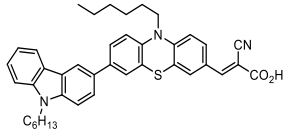
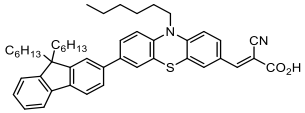
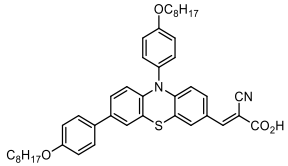
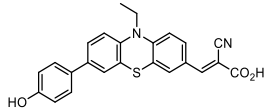
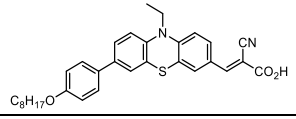
11	**SH-1**	476	21.0	DCM	438	637	1.02	2.18	NHE	10.20	782	0.76	6.02	86	630		[8]
12	**PT1b**	475	16.2	DCM	437	655	0.73	2.15	NHE	13.47	700	0.66	6.21	85	625		[10]
13	**Z2**	459	11.9	THF/DCM (1:1)	463	566	1.35	2.44	NHE	8.65	785	0.71	4.79	39	610		[27]
14	**Z3**	428	8.3	THF/DCM (1:1)	465	552	1.46	2.50	NHE	8.47	768	0.70	4.54	49	610		[27]
15	**SH-3**	492	26.9	DCM	454	649	1.00	2.12	NHE	9.23	819	0.76	5.74	86	650		[8]
16	**K8**	458	49.2	THF	458		1.01	2.49	NHE	12.15	660	0.64	5.12	76	660		[17]
17	**PTH-TPA**	464		THF		601				10.22	702	0.59	4.21	87	620		[28]

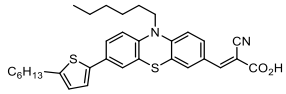
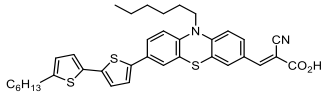
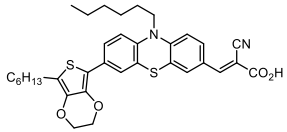
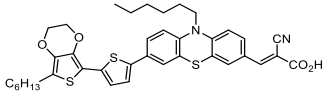
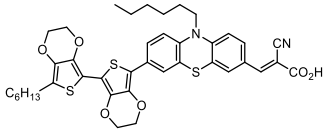
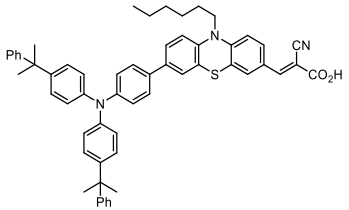
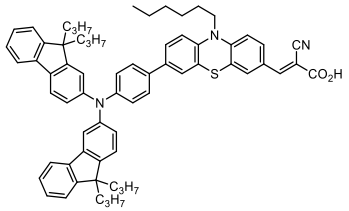
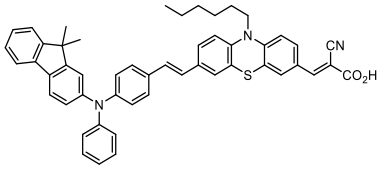
D-D-A dyes

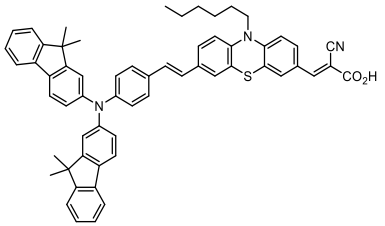
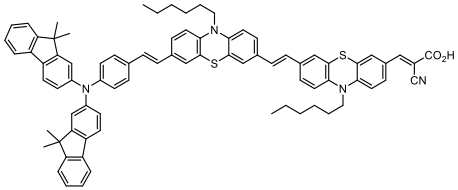
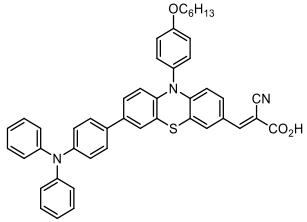
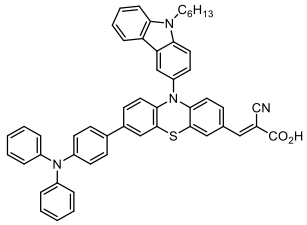
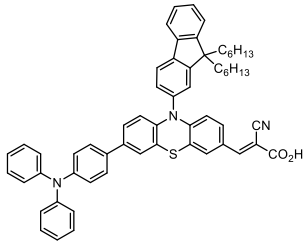
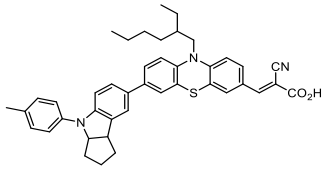
		Photophysical parameters					Electrochemistry			Photovoltaic parameters							
Dye	**Dye name**	**λ_{sol}**	**ε (10^3 M^{-1} cm^{-1})**	**Solvent**	**λ_{film}**	**λ_{PL}**	**E_{OX}**	**E_g**	**vs**	**J_{SC}**	**V_{OC}**	**FF**	**PCE**	**IPCE max**	**IPCE onset**	**Structure**	**Ref**
18	**TP1**	469	21.7	DCM	436		0.70	2.21	NHE	14.87	778	0.67	7.71	72	620		[29]*
18	**R1**	450	16.4	THF	433		1.00	2.40	NHE	13.17	650	0.61	5.18	68	680		[17]
19	**WD14**	430	19.2	MeOH	456	558	1.00	2.40	NHE	10.77	718	0.76	5.87	70	650		[18]
19	**PTZ-2**	472	14.1	DCM	463	666	0.86	2.19	NHE	12.63	640	0.72	5.81	57	660		[21]
20	**DP-1**	467	14.9	THF	485	642	0.71	2.28	NHE	9.33	670	0.73	4.56	63	640		[30]
20	**WD15**	435	20.6	MeOH	447	548	0.93	2.39	NHE	12.01	746	0.74	6.63	78	660		[18]
21	**Dye 2**	418	27.6	THF		585	1.06	2.42		8.91	830	0.70	5.16	77	630		[31]
21	**Dye 2**	438	23.5	ACN			0.58	2.34		24.20	846	0.59	12.10	75	600		[32]*
22	**EO3**	469	15.1	THF		614	1.08	2.25	NHE	17.81	820	0.68	9.98	88	670		[33]*
22	**EO3**	446	14.4	THF	451	584	1.07	2.38	SHE	7.17	829	0.78	4.53	70	620		[34]
23	**PT2a**	477	17.0	DCM	448	676	0.59	2.24		13.20	690	0.62	5.63	84	630		[10]
24	**PT2b**	495	20.5	DCM	461	662	0.57	2.10		14.48	710	0.61	6.30	87	630		[10]

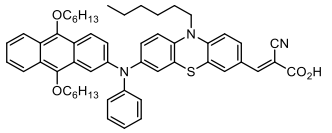
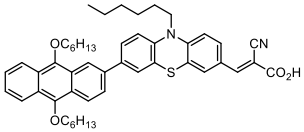
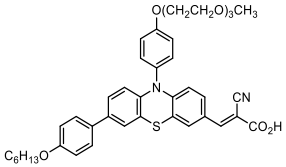
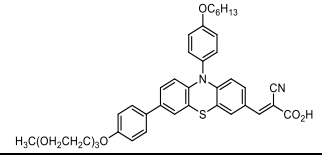
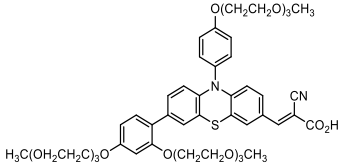
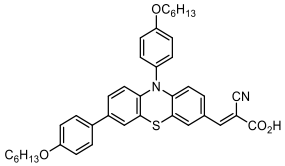
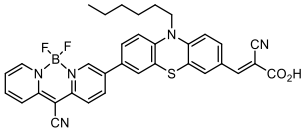
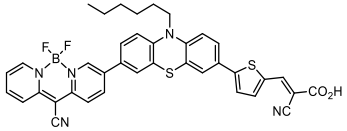
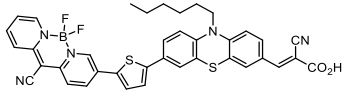
25	**PT3a**	478	16.1	DCM	446	675	0.58	2.19		12.09	700	0.59	5.01	73	610		[10]
26	**PT3b**	496	19.0	DCM	459	661	0.50	2.03		11.93	720	0.58	5.01	82	640		[10]
27	**C2**	462	13.0	DCM		537				10.76	793	0.64	5.51	72	660		[35]
28	**P3**	466	14.0	DCM		629				12.18	826	0.65	6.55	79	660		[35]
29	**VP2**	471	16.0	DCM						11.82	759	0.65	5.84	78	660		[36]
30	**VP3**	474	20.0	DCM						12.62	789	0.63	6.29	80	660		[36]
31	**VP4**	474	20.0	DCM						11.41	804	0.63	5.76	74	660		[36]

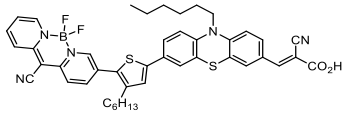
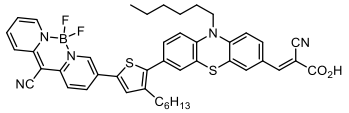
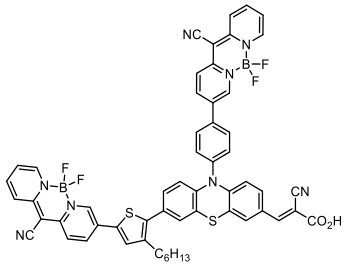
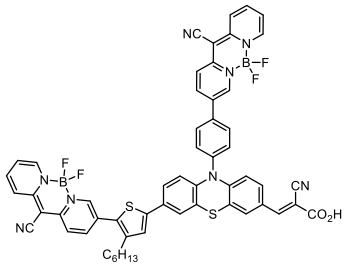
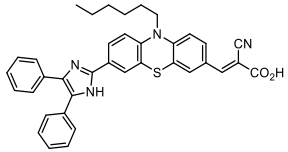
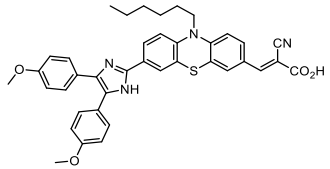
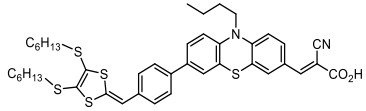
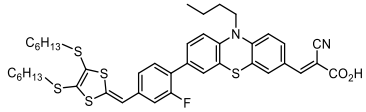
32	**D-PTZ-A**	476	18.7	DCM		1.02	2.55	SCE	14.10	746	0.58	6.10	72	660		[37]
33	**D-PTZ1-PTZ2-A**	468	15.9	DCM		0.84	2.48	SCE	12.20	759	0.58	5.30	65	660		[37]
34	**V5**	451	11.5	DCM	644	1.09	2.03	NHE	11.20	768	0.75	6.53	85	630		[38]
35	**NPt-C1**	437	17.1	THF	406	0.67	2.22	NHE	11.12	660	0.63	4.60	82	630		[12]
36	**NPt-C6**	453	18.2	THF	450	0.65	2.19	NHE	13.66	670	0.61	5.60	83	670		[12]
37	**NSPt-C6**	442	19.3	THF	439	0.67	2.23	NHE	14.42	690	0.63	6.22	88	650		[12]
38	**NPt-T**	474	17.8	THF	462	0.63	2.15	NHE	11.65	710	0.63	5.22	84	640		[12]
39	**NSPt-T**	472	21.1	THF	460	0.67	2.13	NHE	11.12	710	0.61	4.80	84	640		[12]

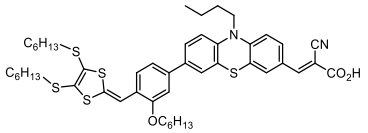
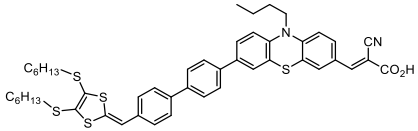
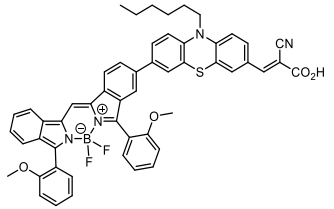
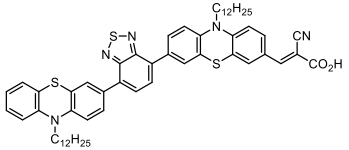
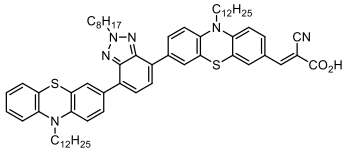
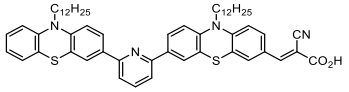
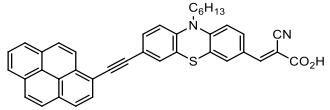
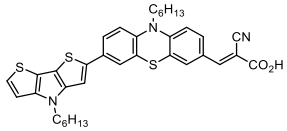
40	**CM501**	477	25.8	DCM	454		0.85	2.21	NHE	11.85	756	0.72	6.40	87	620		[39]
41	**PT-C2**	464	18.2	DCM	444		0.61	2.18	NHE	14.97	723	0.64	6.87	70	660		[40]
42	**PT-C6**	474	20.6	DCM	448		0.62	2.19	NHE	15.32	775	0.69	8.18	73	655		[40]
42	**S1**									16.12	760	0.66	8.02	90	640		[33]*
43	**PT-C8**	449	19.0	DCM	439		0.67	2.12	NHE	14.75	797	0.69	8.08	73	640		[40]
44	**PT-C12**	458	17.7	DCM	445		0.70	2.10	NHE	13.31	799	0.71	7.57	75	620		[40]
45	**PT1**	473	8.9	DCM	447		0.59	2.12	NHE	12.38	829	0.66	6.72	70	645		[13]
45	**WR8**	470	23.2	DCM			0.88	2.24	NHE	14.02	748	0.68	7.13	85	660		[16]
46	**PT2**	465	15.4	DCM	445		0.64	2.13	NHE	12.43	767	0.64	6.13	73	630		[13]
47	**Z4**	459	14.7	THF/DCM (1:1)	470	570	1.44	2.37	NHE	10.35	802	0.69	5.73	60	630		[27]
48	**POH**	446	18.8	THF/DCM (1:1)	427	572	1.35	2.39	NHE	11.28	677	0.69	5.23	85	620		[41]
49	**POCT**	460	16.1	THF/DCM (1:1)	454	611	1.47	2.29	NHE	12.47	741	0.68	6.32	88	640		[41]

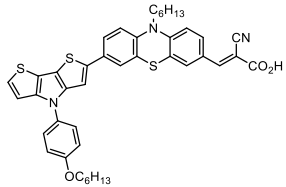
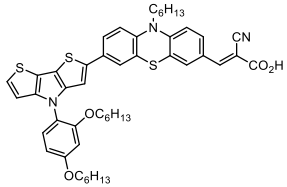
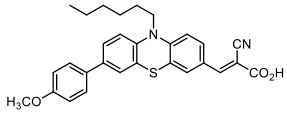
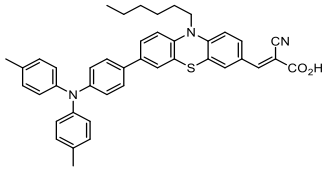
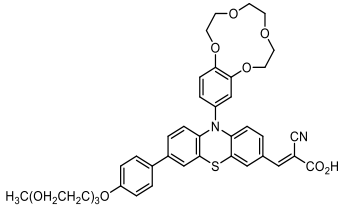
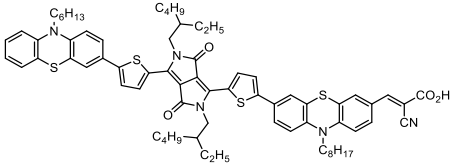
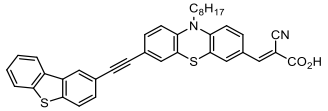
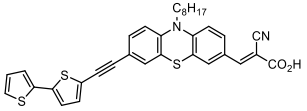
50	**TP**	457	25.7	DCM	452		0.64	2.27	NHE	15.18	783	0.68	8.07	74	650		[42]*
50	**CSORG6**	444	17.9	THF	442	645	1.09	2.26	NHE	9.19	645	0.73	4.30	74	670		[43]
51	**TTP**	466	26.0	DCM	460		0.57	2.19	NHE	16.65	746	0.64	7.98	73	650		[42]*
51	**CSORG8**	449	19.8	THF	445	645	1.13	2.28	NHE	10.84	694	0.72	5.40	79	680		[43]
52	**EP**	470	22.4	DCM	466		0.62	2.23	NHE	16.13	717	0.68	7.87	74	660		[42]*
53	**ETP**	481	23.9	DCM	467		0.51	2.12	NHE	12.01	672	0.70	5.62	66	650		[42]*
54	**EEP**	489	25.2	DCM	472		0.42	2.04	NHE	5.93	559	0.68	2.24	41	640		[42]*
55	**WR9**	478	25.8	DCM			0.82	2.28	NHE	12.63	705	0.69	6.14	83	650		[16]
56	**WR10**	464	17.6	DCM			1.00	2.36	NHE	13.01	734	0.68	6.49	84	655		[16]
57	**B**	485	17.7	DCM			0.98	2.07	NHE	11.40	783	0.71	6.29	84	660		[44]

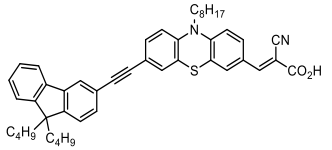
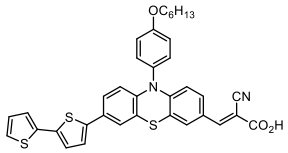
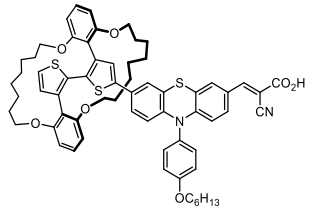
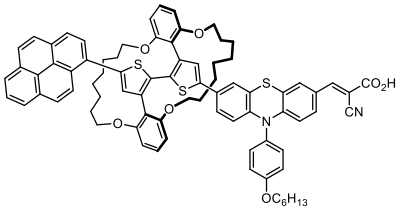
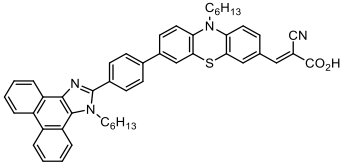
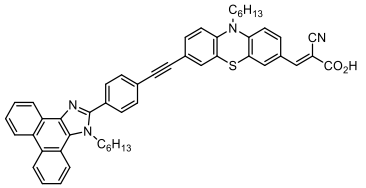
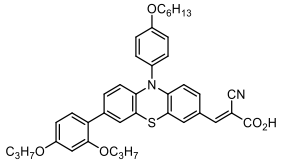
58	**C**	470	23.4	DCM		1.01	2.08	NHE	11.10	770	0.72	6.17	79	650		[44]
59	**D**	474	24.1	DCM		0.91	2.07	NHE	8.50	690	0.74	4.44	78	645		[44]
60	**TP2**	478	19.9	DCM	465	0.78	2.18	NHE	14.21	790	0.69	7.70	70	640		[29]*
61	**TP3**	491	22.8	DCM	481	0.80	2.14	NHE	14.06	791	0.72	8.00	69	640		[29]*
62	**TP4**	487	18.9	DCM	480	0.76	2.15	NHE	12.68	801	0.69	7.05	68	640		[29]*
63	**VG12**								16.50	710	0.61	7.20	92	600		[45]*

64	**MD3**	440	15.7	THF	559	1.00	2.39	NHE	15.14	730	0.65	7.13	77	675		[46]
65	**MD5**	422	16.4	THF	546	1.17	2.45	NHE	10.37	610	0.65	4.09	54	660		[46]
66	**EO1**	468	14.8	THF	614	1.08	2.27	NHE	15.65	770	0.68	8.22	79	655		[33]*
67	**EO2**	467	16.8	THF	616	1.08	2.25	NHE	16.50	800	0.68	9.02	84	670		[33]*
68	**EO4**	472	13.0	THF	615	1.05	2.24	NHE	17.67	810	0.68	9.79	86	675		[33]*
69	**EO5**	470	16.5	THF	613	1.08	2.30	NHE	15.70	770	0.68	8.18	85	645		[33]*
70	**K1**	466	46.3	THF	466	1.01	2.44	NHE	14.05	690	0.63	6.02	76	655		[17]
71	**K2**	466	57.4	THF	465	0.92	2.43	NHE	12.58	630	0.61	4.81	68	695		[17]
72	**K3**	481	86.1	THF	478	1.00	2.41	NHE	15.43	690	0.62	6.58	78	690		[17]

73	**K4**	465	75.4	THF	466		1.00	2.42	NHE	14.57	720	0.58	6.10	72	670		[17]
74	**K5**	475	82.1	THF	472		1.02	2.42	NHE	14.06	700	0.58	5.74	72	660		[17]
75	**K6**	460	138.6	THF	463		1.02	2.51	NHE	9.76	630	0.59	3.60	66	660		[17]
76	**K7**	460	121.1	THF	459		1.02	2.48	NHE	11.67	680	0.62	4.91	66	630		[17]
77	**WY5**	406	16.9	DMF/MeOH (1:3)	453		1.22	2.51	NHE	10.58	700	0.66	4.87	57	625		[19]
78	**WY6**	403	22.7	DMF/MeOH (1:3)	452		1.01	2.52	NHE	11.50	690	0.69	5.52	63	640		[19]
79	**DPP-1**	450	17.9	THF	481	634	0.68	2.26	NHE	10.02	680	0.73	4.97	68	630		[30]
80	**DPP-2**				443	608	0.76	2.31	NHE	11.86	780	0.73	6.75	79	640		[30]

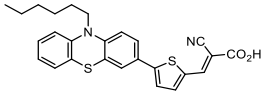
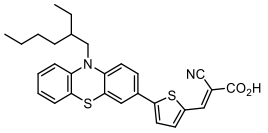
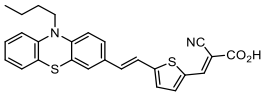
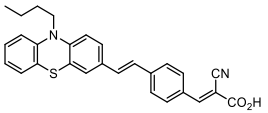
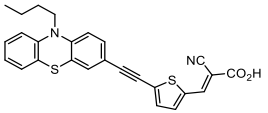
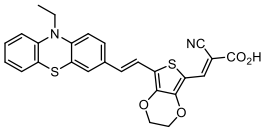
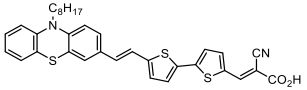
81	**DPP-3**				431	615	1.06	2.29	NHE	11.51	720	0.73	6.05	76	630		[30]
82	**DPP-4**				415	611	0.70	2.30	NHE	13.84	780	0.71	7.66	88	650		[30]
83	**1**	638	123.0	THF						19.09	720	0.56	7.69	42	750		[22]*
84	**AI-1**	486	24.0			663	0.29		NHE	15.42	780	0.68	8.50	87	660		[47]
85	**AI-2**	474	22.0			580	0.32		NHE	12.80	780	0.68	7.00	79	650		[47]
86	**AI-3**	472	16.0			613	0.26		NHE	11.57	820	0.68	6.70	83	650		[47]
87	**Dye 1**	438	20.0	ACN			0.59	2.40		21.30	846	0.58	10.45	71	630		[32]*
88	**W21**	488	23.2	DCM			0.89	2.19		14.20	610	0.67	5.80	88	685		[48]

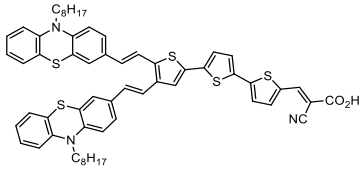
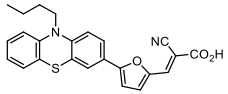
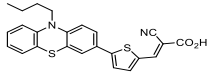
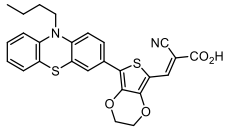
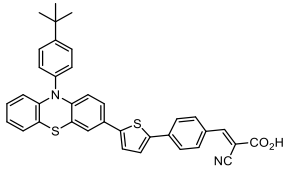
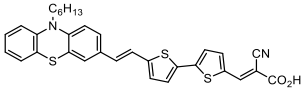
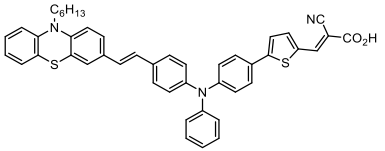
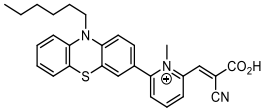
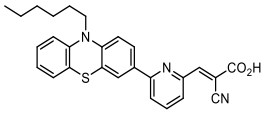
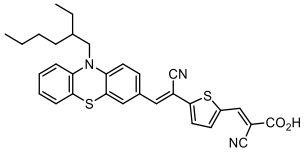
89	**W22**	473	15.0	DCM			0.91	2.20		13.50	640	0.66	5.70	86	685		[48]
90	**W23**	483	17.5	DCM			0.87	2.22		13.00	670	0.66	5.75	83	685		[48]
91	**AFB-1**	475	14.0	DCM	412	649	0.88	2.18	NHE	8.64	680	0.71	4.15	77	645		[49]
92	**TP**	466	13.7	$CHCl_3$	417		0.99	2.21	NHE	7.07	680	0.71	3.41	67	605		[50]
93	**DCE1**	457	8.0	THF			1.08	2.42	NHE	11.95	659	0.69	5.44	72	600		[51]
94	**D2**	604	46.4	DCM	599		1.02	1.91	NHE	5.62	700	0.73	2.83	29	790		[52]
95	**2a**	440	8.7	$CHCl_3$	465		0.4	2.3		17.96	700	0.48	6.22	65	625		[53]*
96	**2b**	453	14.0	$CHCl_3$	385		0.42	2.25		11.87	631	0.54	4.22	18	600		[53]*

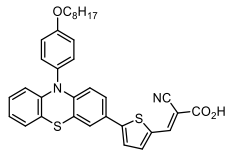
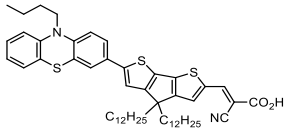
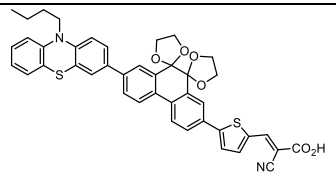
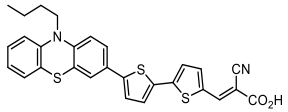
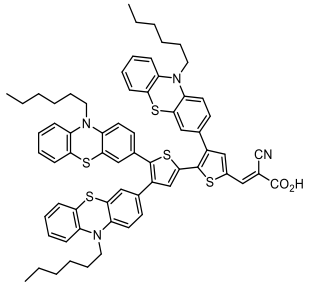
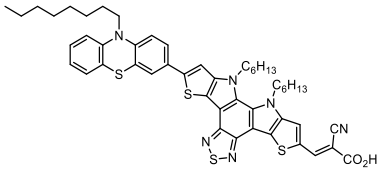
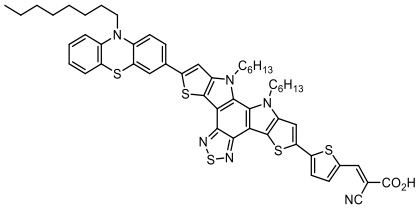
97	**2c**	424	63.0	$CHCl_3$	420		0.47	2.24		12.08	703	0.56	4.8	28	625		[53]*
98	**PH1**	493		DCM	466		0.94	2.15	NHE	11.2	730	0.69	5.64	61	690		[54]
99	**PH2**	506	23.9	DCM	492		0.95	2.16	NHE	13.4	760	0.69	7.08	68	690		[54]
100	**PH3**	508	28.9	DCM	466		1.14	2.24	NHE	12.68	770	0.67	6.51	64	690		[54]
101	**D1**	458	11.0	THF	462	663	0.78	2.27	SCE	19.18	790	0.66	9.97	90	640		[55]*
102	**D2**	459	13.7	THF	462	663	0.79	2.24	SCE	19.97	790	0.65	10.22	93	625		[55]*
103	**DMA-0**	472	11.2	DCM	444	647	1.04	2.14		10.10	830	0.68	5.70	85	640		[56]

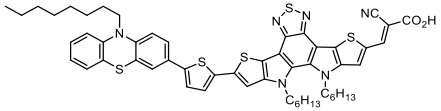
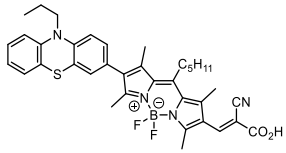
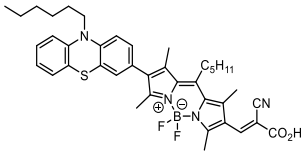
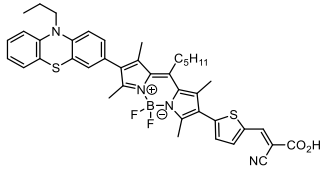
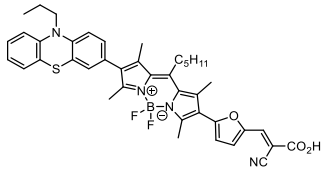
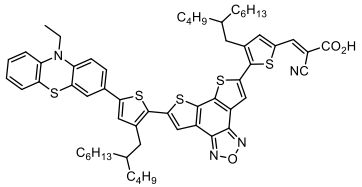
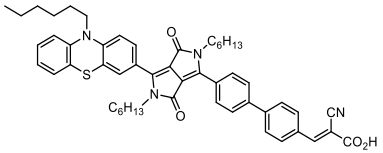
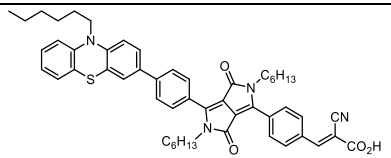
104	**PTZ2**	436	22.4		1.06		2.60	539	0.55	0.91			[57]
105	**2a**	439	11.0	$CHCl_3$	572		15.38	730	0.45	5.03			[58]
106	**2b**	444	10.0	$CHCl_3$	574		16.74	759	0.49	6.21			[58]
107	**Dye 1**	456	35.8	$CHCl_3$		2.22	12.21	648	0.62	4.91	45	615	[59]
108	**Dye 2**	456	35.7	$CHCl_3$		2.22	10.29	654	0.68	4.57	38	615	[59]
109	**IPT dye**	460	18.0	THF			8.87	720	0.69	4.39			[60]

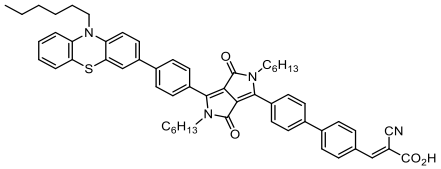
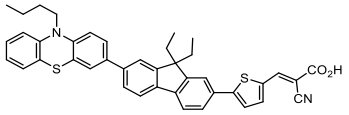
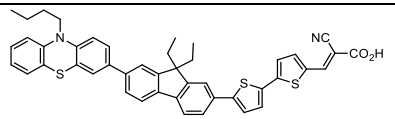
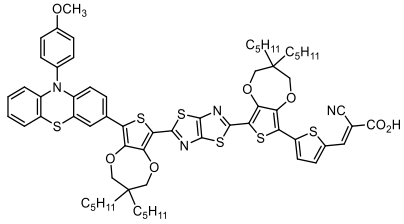
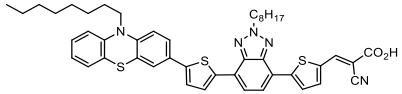
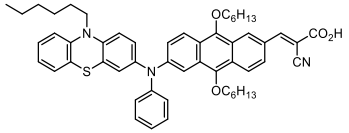
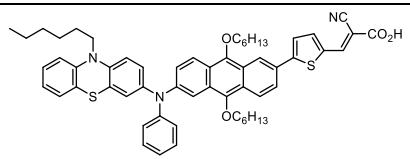
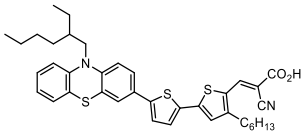
D-π-A dyes

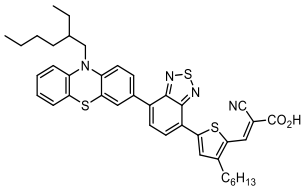
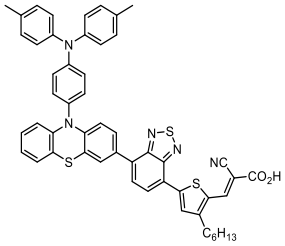
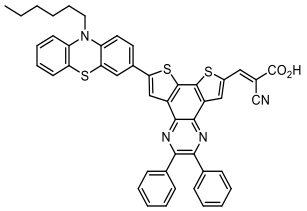
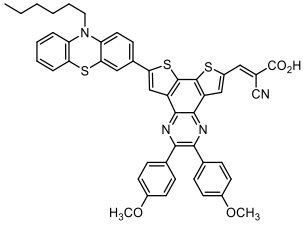
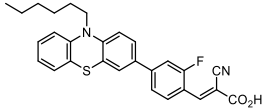
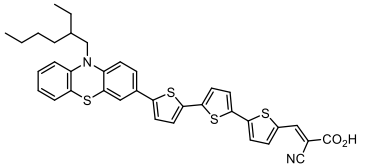
		Photophysical parameters					Electrochemistry			Photovoltaic parameters							
Dye	**Dye name**	**λ_{sol}**	**ε (10^3 M^{-1} cm^{-1})**	**Solvent**	**λ_{film}**	**λ_{PL}**	**E_{OX}**	**E_g**	**vs**	**J_{SC}**	**V_{OC}**	**FF**	**PCE**	**IPCE max**	**IPCE onset**	**Structure**	**Ref**
110	**P6H1T1A**	416	18.8	DMF	432		0.61	2.58	NHE	10.20	738	0.69	5.20	73	650		[61]
110	**CVHTC**	390	20.2	DMF	476		0.64	2.75		2.52	600	0.74	1.12				[62]
110	**AFB-20**	435	24.4	THF	430	618	1.08	2.38	SHE	9.13	778	0.76	5.34	64	660		[63]
110	**AFB-20**	436	20.1	THF	426	624	1.01	2.36	SHE	8.21	760	0.72	4.51	67	640		[31]
110	**6m**	478	22.0	DCM			0.78	1.94	NHE	11.83	678	0.66	5.25	65	675		[64]
111	**PTZ**									11.71	689	0.68	5.48				[65]
111	**QX06**	467	25.9	DCM			1.00	2.06	NHE	14.00	705	0.69	6.82	82	650		[66]
112	**TH208**	494	27.0	DCM	454	704	0.88	2.15	NHE	11.99	643	0.74	5.73	67	680		[67]
112	**TH208**	494	27.0	DCM	454	704	0.88	2.15	NHE	13.40	685	0.70	6.40	85	700		[68]
113	**T2-2**	457	13.1	DCM	416	653	0.92	2.25	NHE	10.70	673	0.67	4.80	76	650		[5]
114	**TC104**	465	17.5	DCM	449	579	0.96	2.27	NHE	8.84	610	0.74	4.00	72	640		[67]
115	**TMH15**	473	33.7	DMF	481	595	0.47	2.29	NHE	15.18	645	0.69	6.72	72	670		[69]
116	**PTZ-1**	496	30.3	DCM			0.84	2.13	NHE	11.69	708	0.65	5.40	73	685		[70]

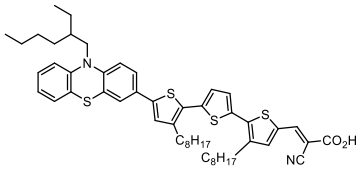
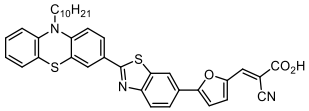
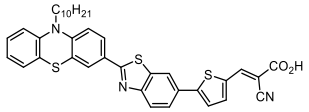
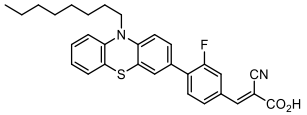
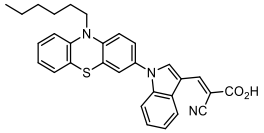
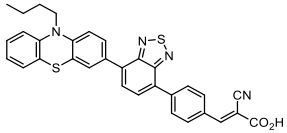
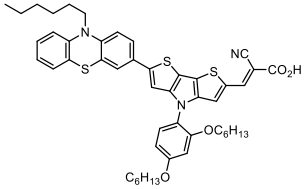
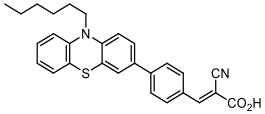
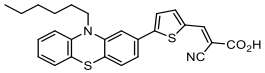
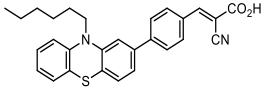
117	**PTZ-2**	508	31.7	DCM			0.77	2.03	NHE	7.14	706	0.56	2.80	44	685		[70]
118	**SH-6**	442	15.1	DCM	412	641	0.78	2.26	NHE	12.18	772	0.70	6.58	78	675		[6]
119	**SH-7**	448	16.2	DCM	416	634	0.89	2.24	NHE	12.05	725	0.72	6.32	75	675		[6]
120	**SH-8**	466	26.0	DCM	426	546	0.87	2.20	NHE	11.68	746	0.70	6.09	75	675		[6]
121	**PT-PSP**	446	33.9	THF	408		0.56	2.39	NHE	14.12	680	0.64	6.32	77	675		[71]
122	**H-PTZ-BT**	490	70.7	DCM/MeOH (29:1)	480		0.68	2.09	NHE	10.37	610	0.59	3.76	52	690		[11]
123	**H-PTZ-TPA-T**	475	50.5	DCM/MeOH (29:1)	460		0.53	2.22	NHE	9.64	690	0.60	4.01	67	615		[11]
124	**CM401**	487	24.3	DCM	482		0.87	2.04		12.82	730	0.74	6.90	85	670		[72]
125	**CMR401**	456	21.2	DCM	438		0.91	2.48		11.35	743	0.76	6.30	86	640		[72]
126	**OMS2**	453	15.0	THF		653		2.29		7.18	660	0.68	3.23	27	660		[24]

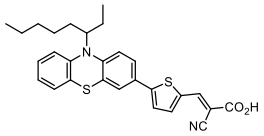
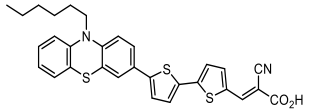
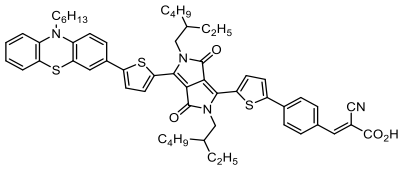
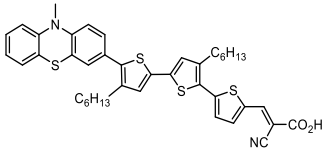
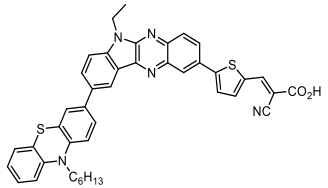
127	**PTA**	433	12.4	THF/DCM (1:1)	423	561	1.63	2.37	NHE	13.35	721	0.66	6.34	86	675		[73]
128	**V11**	532	46.5	DCM		610	0.97	2.20	NHE	12.90	774	0.70	7.00	82	665		[74]
129	**JH203**	460	29.1	DCM	431		0.77	2.33	NHE	11.10	720	0.75	6.00	87	660		[75]
130	**GJ5**	444	25.4	THF	498	572	1.06	2.38	NHE	5.46	519	0.58	1.63	44	625		[76]
131	**DH-46**	487	8.8	DCM	425	629	0.58	1.97		5.73	640	0.66	2.43	17	600		[77]
132	**DTP1**	507	47.5	DCM/MeOH (1:1)	500	554		2.24		12.54	664	0.60	5.02	68	725		[78]
133	**DPT2**	519	45.8	DCM/MeOH (1:1)	494	568		2.18		9.86	599	0.60	3.54	49	775		[78]

134	**DPT3**	512	61.7	DCM/MeOH (1:1)	476	558		2.22		11.15	622	0.63	4.39	62	725		[78]
135	**UY1**	532	65.0	$CHCl_3$	530		0.90	2.01	NHE	6.17	490	0.71	2.14	39	690		[79]
135	**UY1**	530	63.0	DCM	529		0.90	2.14	NHE	7.70	512	0.67	2.65	44	690		[80]
136	**UY2**	532	73.0	$CHCl_3$	531		0.91	2.05	NHE	6.46	500	0.71	2.28	47	690		[79]
137	**UY5**	536	72.4	$CHCl_3$	535		0.92	2.01	NHE	11.85	580	0.67	4.61	68	680		[81]
138	**UY7**	553	76.0	$CHCl_3$	549		0.93	1.91	NHE	13.64	590	0.66	5.31	72	700		[81]
139	**JH-2**	464	31.4	THF	504	690	0.99	2.35	NHE	4.36	630	0.69	1.91	15	630		[82]
140	**PTZ1**	526	24.9	DCM	532		0.86	2.10	NHE	11.65	656	0.68	5.16	64	680		[83]
141	**PTZ2**	523	20.7	DCM	529		0.78	2.14	NHE	6.94	628	0.75	3.26	30	710		[83]

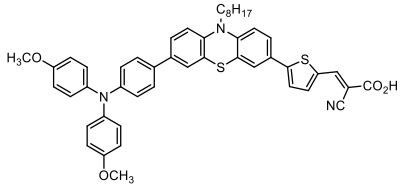
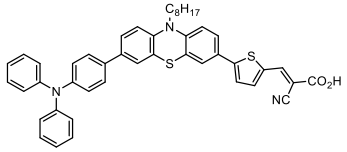
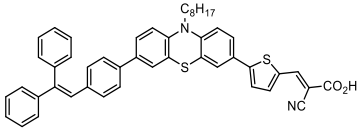
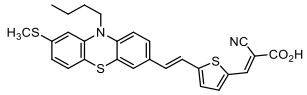
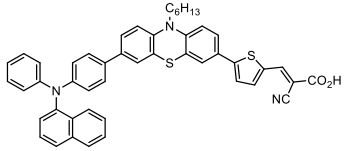
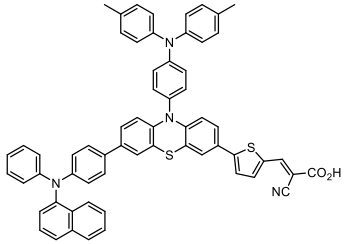
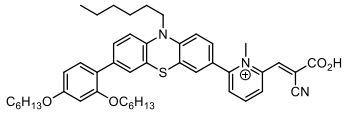
142	**PTZ3**	500	21.2	DCM	521		0.73	2.31	NHE	9.68	638	0.74	4.56	57	700		[83]
143	**7a**	441	25.7	DCM	514		0.23	2.33	NHE	4.54	595	0.63	1.70	43	625		[84]
144	**7b**	471	35.1	DCM	488		0.22	2.19	NHE	7.70	611	0.63	2.96	64	650		[84]
145	**TTZ7**	513	96.7	THF	492	596	0.85	2.22	NHE	17.22	689	0.58	6.94	72	685		[85]
146	**SB-B**	488	41.2	DCM/THF (1:1)	454	557	0.89	2.23	NHE	10.60	683	0.60	4.32	62	700		[86]
147	**MD1**	494	14.4	THF		558	0.88	2.34	NHE	8.94	610	0.68	3.66	41	630		[46]
148	**MD2**	504	19.7	THF		565	0.87	2.30	NHE	12.27	650	0.66	5.21	63	660		[46]
149	**DX1**	494	26.2	$CHCl_3$	450	641	0.96	2.24	NHE	11.46	690	0.72	5.69	72	655		[87]

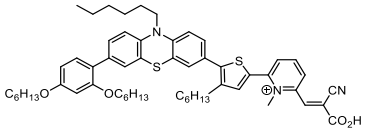
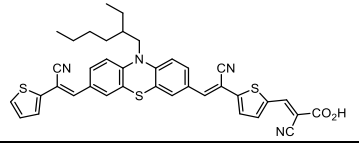
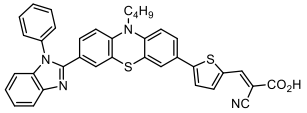
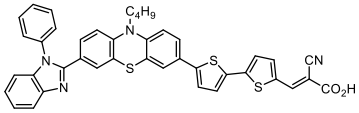
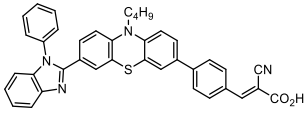
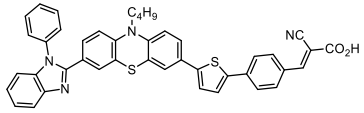
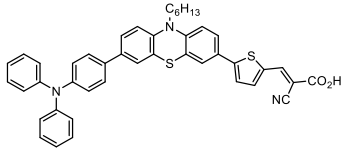
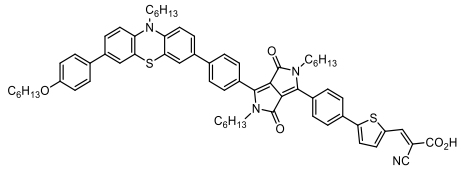
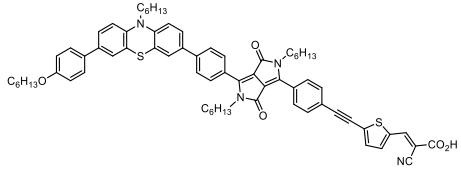
150	**DX2**	507	22.1	$CHCl_3$		582	0.98	2.27	NHE	8.01	620	0.70	3.43	38	700		[87]
151	**DX3**	524	17.0	$CHCl_3$		572	0.90	2.25	NHE	10.28	610	0.70	4.41	47	750		[87]
152	**QBT-1**	474	23.4	THF	470	605	1.02	2.33	NHE	13.76	729	0.73	7.36	70	690		[88]
153	**QBT-2**	462	24.3	THF	480	609	1.01	2.34	NHE	13.29	740	0.71	6.97	75	650		[88]
154	**3b**	441	16.2	$CHCl_3$	571		0.97	2.63	NHE	6.53	625	0.65	2.67	35	720		[89]
155	**JY31**	500	55.7	DCM			0.78	1.91	NHE	14.63	661	0.63	6.14	72	690		[90]

156	**JY32**	488	36.3	DCM			0.80	1.92	NHE	15.40	688	0.62	6.56	82	700		[90]
157	**MCG3**	413	29.2	DMF		572		2.10		13.32	615	0.70	5.71	87	710		[91]
158	**MCG4**	405	83.1	DMF		530		2.12		13.54	662	0.72	6.46	91	690		[91]
159	**Pzin-dye**	423	3.6	DCM	561					5.74	691	0.65	2.60				[92]
160	**WY2**	379	21.3	EtOH	383		1.20	2.95	NHE	6.22	760	0.69	3.30	54	550		[93]
161	**PZ-1**	452	17.0	THF	463	588	0.85	2.37	NHE	11.86	690	0.72	5.89	79	650		[9]
162	**W24**	513	48.7	DCM			0.85	2.14	NHE	15.50	720	0.69	7.70	90	730		[48]
163	**AFB-22**	396	17.9	THF	394	596	1.04	2.56	SHE	7.11	785	0.74	4.06	70	630		[63]
164	**AFB-23**	433	14.7	THF		639	1.07	2.36	SHE	6.57	721	0.75	3.48	56	640		[63]
165	**AFB-24**	393	7.8	THF		609	1.03	2.57	SHE	4.17	753	0.74	2.27	50	570		[63]

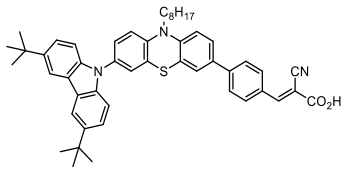
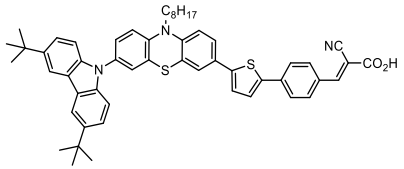
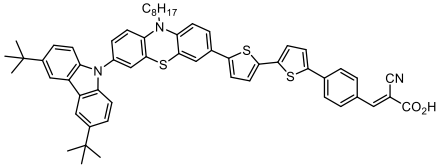
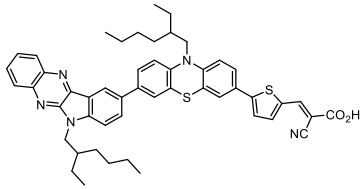
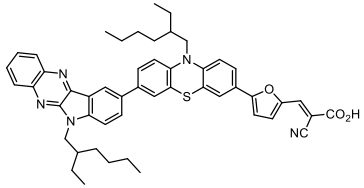
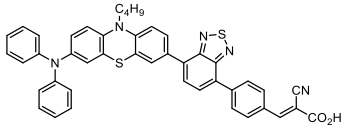
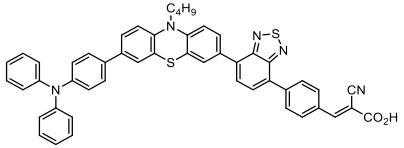
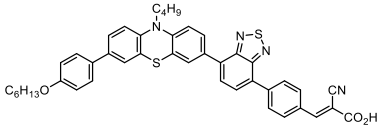
166	**PTZ-2**	438	19.8	THF	590		2.38		9.06	722	0.74	4.90	81	625		[94]
167	**6n**	490	31.4	DCM		0.80	1.93	NHE	14.36	750	0.64	6.91	78	675		[64]
168	**D3**	604	75.5	DCM	578	0.98	1.86	NHE	7.55	630	0.62	2.94	33	820		[52]
169	**TD2**	436	76.6	ACN	407	1.02	2.1	NHE	13.2	732	0.56	5.4	67	670		[95]
170	**FS12**	411		DMF	507	0.83	2.42	NHE	11.84	638	0.65	4.92	72	590		[96]

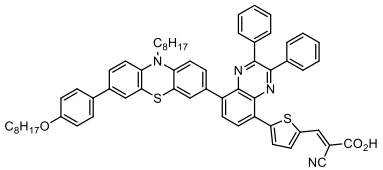
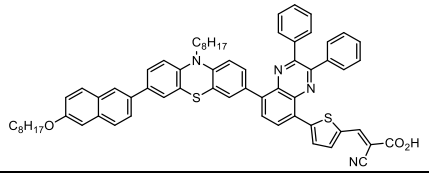
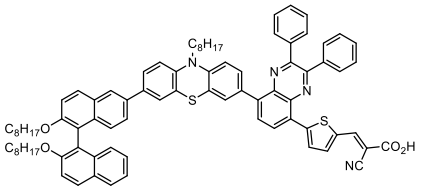
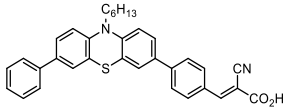
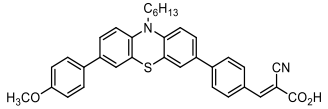
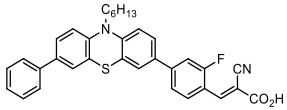
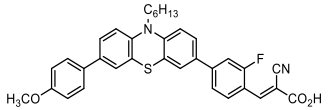
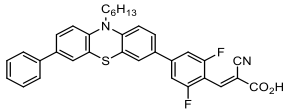
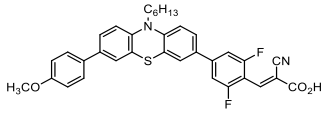
D-D-π-A dyes

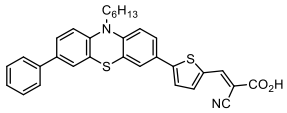
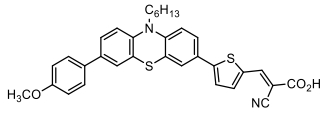
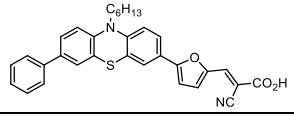
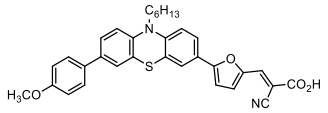
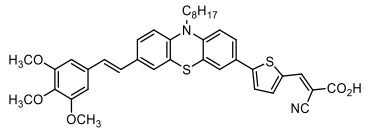
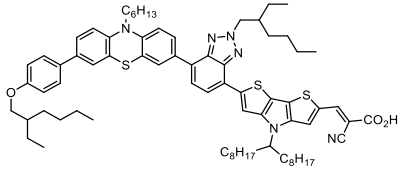
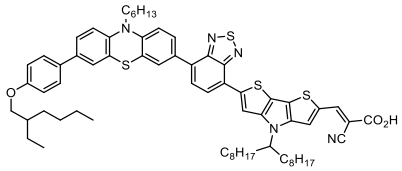
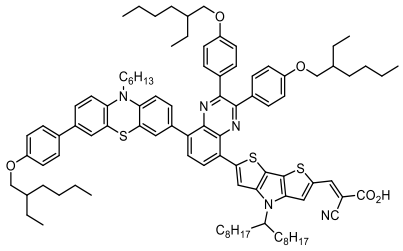
		Photophysical parameters					Electrochemistry			Photovoltaic parameters							
Dye	**Dye name**	**λ_{sol}**	**ε (10^3 M^{-1} cm^{-1})**	**Solvent**	**λ_{film}**	**λ_{PL}**	**E_{OX}**	**E_g**	**vs**	**J_{SC}**	**V_{OC}**	**FF**	**PCE**	**IPCE max**	**IPCE onset**	**Structure**	**Ref**
171	**P1**	460	24.0	DCM	476		0.68	2.17	NHE	9.43	584	0.69	3.78	85	600		[97]
171	**P1**	460	24.0	DCM	483					9.66	761	0.65	4.80	89	650		[98]
172	**P2**	450	31.0	DCM	475		0.90	2.26	NHE	10.84	592	0.69	4.41	84	635		[97]
172	**P2**	450	31.0	DCM	477					10.36	730	0.70	5.31	90	630		[98]
173	**P3**	449	23.0	DCM	480		1.23	2.34	NHE	7.39	505	0.66	2.48	83	590		[97]
174	**V7**	478	29.3	DCM		665	0.97	1.85	NHE	15.20	691	0.70	7.44	86	730		[38]
175	**NPtS-C6**	463	22.7	THF	451		0.55	2.10	NHE	5.99	570	0.60	2.04	60	650		[12]
176	**NPtS-T**	480	22.4	THF	465		0.52	2.05	NHE	10.90	630	0.62	4.24	72	640		[12]
177	**CM402**	496	25.0	DCM	490		0.80	1.95	NHE	13.86	740	0.75	7.70	88	680		[72]

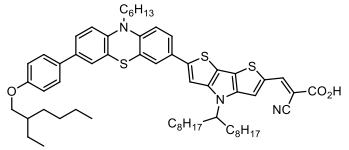
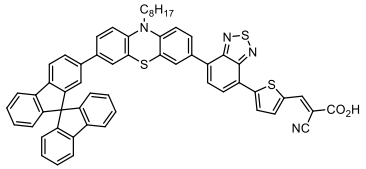
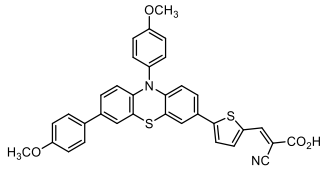
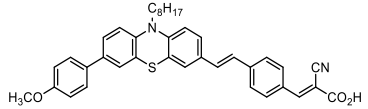
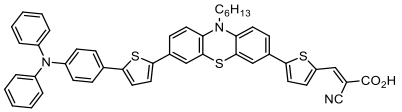
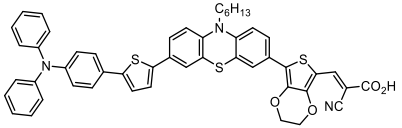
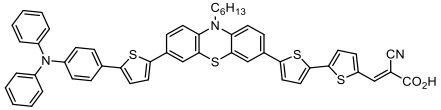
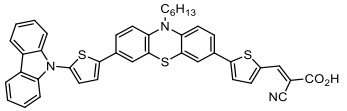
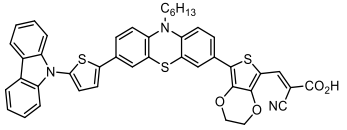
178	**CM403**	504	24.1	DCM	502		0.82	1.92	NHE	14.56	748	0.75	8.10	92	700		[72]
179	**OMS3**	484	22.6	THF		644		2.19		8.72	660	0.69	4.00	44	700		[24]
180	**GJ1**	438	18.4	THF	466	562	1.13	2.56	NHE	9.09	606	0.66	3.66	68	640		[76]
181	**GJ2**	459	34.2	THF	486	584	1.10	2.32	NHE	9.26	604	0.64	3.60	72	650		[76]
182	**GJ3**	402	18.0	THF	420	539	1.13	2.61	NHE	7.47	646	0.69	3.31	56	600		[76]
183	**GJ4**	399	23.4	THF	452	538	1.09	2.62	NHE	7.53	630	0.68	3.24	58	600		[76]
184	**LC1**	446	18.1	THF		608	0.61	2.32	NHE	11.75	650	0.64	4.86	70	580		[99]*
185	**XS1**	522	33.2	THF		639	0.63	2.19	NHE	15.84	672	0.68	7.27	80	700		[100]
186	**XS2**	519	45.6	THF		608	0.63	2.14	NHE	16.12	653	0.66	6.95	87	680		[100]
187	**XS3**	516	46.5	THF		602	0.66	2.18	NHE	15.73	748	0.68	8.02	85	680		[100]

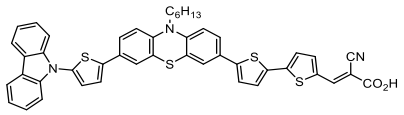
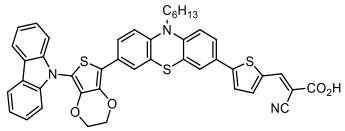
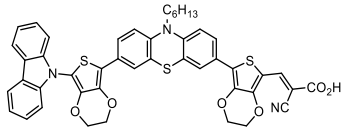
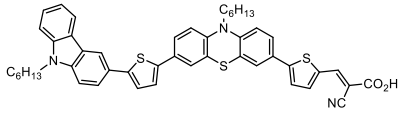
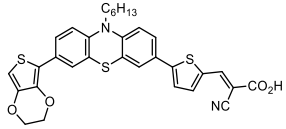
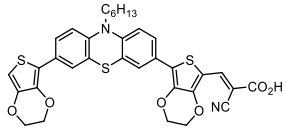
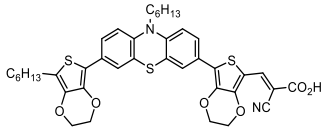
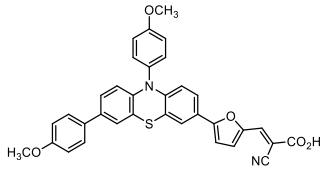
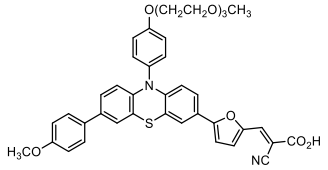
187	**XS3**									15.69	739	0.69	7.94			[101]
188	**JH305**	457	33.5	DCM	438		0.61	2.38	NHE	16.36	706	0.65	7.50	92	720	[102]
189	**JH307**	498	16.2	DCM	465		0.62	2.01	NHE	14.71	645	0.67	6.40	70	790	[102]
190	**SGT-204**	671	81.0	THF		805	0.91	1.65	NHE	6.00	429	0.73	1.90			[103]
191	**MD4**	448	17.2	THF		560	0.99	2.38	NHE	14.22	710	0.66	6.66	69	700	[46]
192	**JY33**	476	29.4	DCM			0.77	1.88	NHE	17.18	742	0.59	7.48	73	690	[90]
193	**TLEP-1**	473	24.2	THF/DCM (1:1)	471	596	1.24	2.36	NHE	12.61	816	0.63	6.44	85	630	[104]
194	**TLEP-2**	476	40.4	THF/DCM (1:1)	478	571	1.23	2.38	NHE	14.87	777	0.63	7.33	89	650	[104]

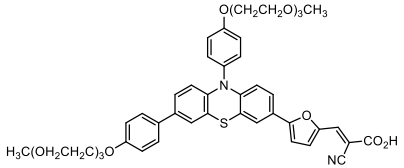
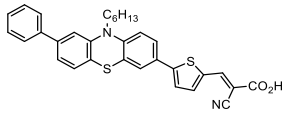
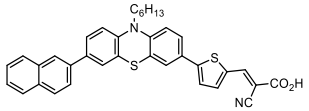
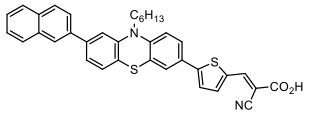
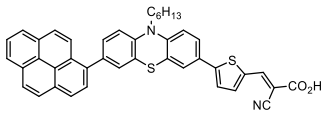
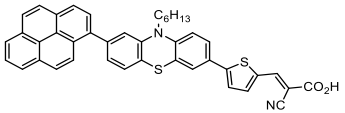
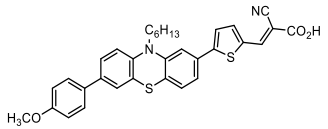
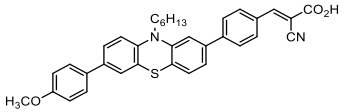
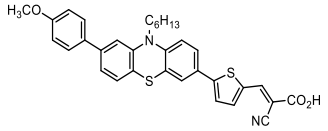
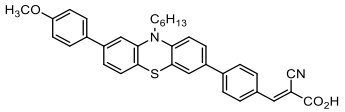
195	**CPhPA**	426	14.4	DCM	417	482	0.67	2.37		11.46	740	0.69	5.88	78	610		[105]*
196	**CPhTPA**	432	22.2	DCM	431	531	0.64	2.35		12.69	730	0.68	6.33	85	620		[105]*
197	**CPhT2PA**	455	28.5	DCM	448	541	0.60	2.29		15.22	740	0.69	7.78	91	630		[105]*
198	**QX07**	484	27.2	DCM			0.96	2.01	NHE	15.30	757	0.71	8.28	87	690		[66]
199	**QX08**	456	21.1	DCM			0.97	2.08	NHE	14.20	745	0.71	7.56	86	650		[66]
200	**PZ-2**	469	13.3	THF	472	588	0.67	2.47	NHE	6.11	640	0.67	2.62	50	650		[9]
201	**PZ-3**	464	15.8	THF	487	554	0.79	2.50	NHE	10.59	680	0.69	4.97	67	680		[9]
202	**PZ-4**	462	16.6	THF	481	612	0.79	2.33	NHE	13.53	690	0.68	6.35	84	690		[9]

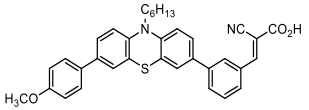
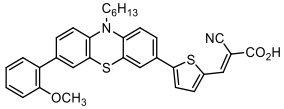
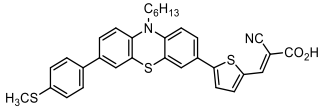
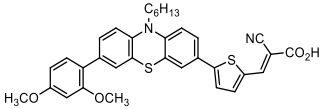
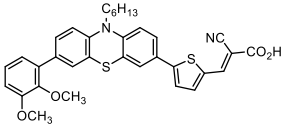
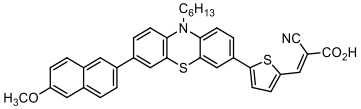
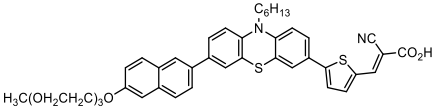
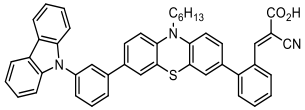
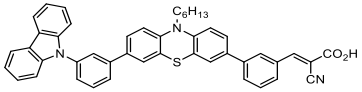
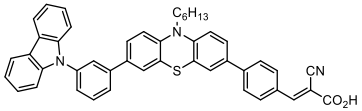
203	**ZHG5**	471	19.8	THF	491		1.28	2.10	NHE	12.63	730	0.62	5.64	89	670		[106]
204	**ZHG6**	466	17.7	THF	497		1.31	2.16	NHE	12.06	734	0.60	5.32	85	670		[106]
205	**ZHG7**	472	15.7	THF	499		1.30	2.12	NHE	7.12	706	0.55	2.74	59	650		[106]
206	**AFB-2**	425	11.4	DCM	412	631	0.75	2.33	NHE	7.83	660	0.68	3.53	75	650		[49]
207	**AFB-3**	429	12.7	DCM		633	0.80	2.33	NHE	7.83	660	0.67	3.46	75	650		[49]
207	**AFB-3**	406	18.5	THF	409	614	1.00	2.51	SHE	7.65	807	0.71	4.37	69	640		[63]
208	**AFB-4**	432	13.0	DCM		632	0.73	2.33	NHE	7.63	650	0.69	3.43	71	670		[49]
209	**AFB-5**	441	12.1	DCM		641	0.68	2.34	NHE	7.87	650	0.67	3.41	69	680		[49]
210	**AFB-6**	420	10.7	DCM		626	0.76	2.37	NHE	6.28	650	0.68	2.79	67	650		[49]
211	**AFB-7**	424	9.7	DCM		635	0.74	2.38	NHE	6.77	660	0.67	2.96	67	650		[49]
212	**AFB-8**	467	18.1	DCM	413	658	0.75	2.12	NHE	9.14	630	0.68	3.87	71	680		[49]
212	**AFB-8**	441	23.8	THF	438	623	1.01	2.34	SHE	10.31	781	0.74	5.99	73	675		[107]

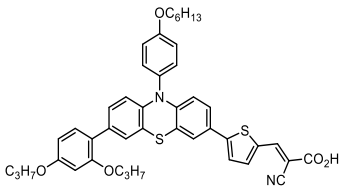
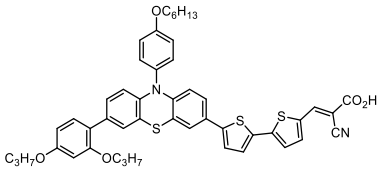
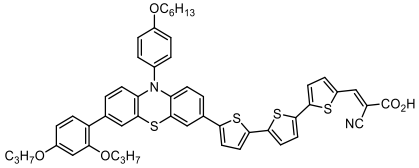
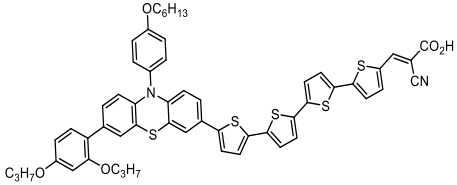
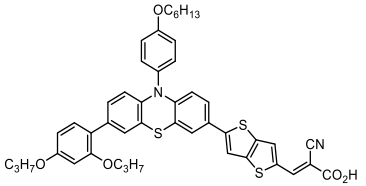
212	**AFB-8**	441	22.2	THF	432	626	0.94	2.32		9.12	780	0.67	4.76	70	670		[31]
213	**AFB-9**	471	15.2	DCM	411	659	0.81	2.12	NHE	9.56	620	0.68	4.03	73	700		[49]
213	**AFB-9**	442	23.6	THF	442	634	1.01	2.31	SHE	10.20	775	0.75	5.82	69	700		[63]
213	**AFB-9**	439	20.6	THF	441	637	0.90	2.33		8.89	780	0.70	4.81	68	670		[31]
214	**AFB-10**	480	19.2	DCM	415	634	0.75	2.18	NHE	9.44	670	0.69	4.34	77	690		[49]
215	**AFB-11**	473	14.8	DCM	408	640	0.67	2.19	NHE	9.15	650	0.67	3.97	74	690		[49]
216	**TMPTZT**	459	40.9	$CHCl_3$			0.96	2.21		10.10	676	0.74	5.10	65	710		[108]
217	**JY53**	506	79.1	DCM	505		0.78	2.16	NHE	18.94	814	0.61	9.42	85	690		[109]*
218	**JY54**	543	60.8	DCM	539		0.79	2.01	NHE	19.46	760	0.63	9.25	80	745		[109]*
219	**JY55**	521	63.1	DCM	520		0.77	2.11	NHE	19.18	829	0.63	10.06	85	690		[109]*

220	**JY56**	490	68.5	DCM	473	0.77	2.24	NHE	16.41	816	0.61	8.19	85	680		[109]*
221	**JA6**	508	10.2	DCM		0.95	1.82	NHE	13.93	800	0.66	7.34	70	720		[110]
222	**RD-SC**	473	21.3	DCM/EtOH (9:1)	462	0.88	1.98	NHE	9.93	651	0.70	4.52	66	680		[111]
222	**R-SB**	473	21.3	DCM/EtOH (9:1)		0.80	1.98	NHE	10.12	661	0.72	4.84	71	680		[112]
223	**D3d**	461	41.0	$CHCl_3$	442	1.10	2.33		5.52	816	0.70	3.14				[113]
224	**6a**	470	17.5	DCM		0.81	1.93	NHE	12.66	726	0.72	6.66	62	725		[64]
225	**6b**	484	22.4	DCM		0.75	1.97	NHE	12.15	727	0.73	6.48	65	700		[64]
226	**6c**	634	7.2	DCM		0.72	1.96	NHE	13.69	670	0.66	6.07	74	710		[64]
227	**6d**	481	21.9	DCM		0.81	1.98	NHE	15.91	770	0.73	8.90	85	700		[64]
228	**6e**	495	25.1	DCM		0.78	1.96	NHE	14.79	784	0.74	8.53	82	710		[64]

229	**6f**	467	25.7	DCM			0.89	2.01	NHE	13.10	726	0.72	6.85	73	690		[64]
230	**6g**	490	25.0	DCM			0.77	1.94	NHE	14.72	736	0.71	7.70	80	700		[64]
231	**6h**	498	27.8	DCM			0.80	1.93	NHE	15.67	755	0.71	8.36	82	720		[64]
232	**6i**	462	20.6	DCM			0.78	1.96	NHE	13.59	694	0.63	6.05	70	685		[64]
233	**6j**	480	17.1	DCM			0.73	1.93	NHE	13.48	737	0.72	7.19	68	700		[64]
234	**6k**	486	19.7	DCM			0.72	1.90	NHE	14.38	667	0.66	6.33	75	700		[64]
235	**6l**	490	20.1	DCM			0.77	1.90	NHE	13.90	748	0.71	7.42	71	700		[64]
236	**AFB-30**	449	20.6	THF	446	603	0.96	2.38	SHE	10.41	783	0.73	5.86	77	680		[34]
237	**AFB-31**	454	19.8	THF	454	605	0.93	2.39	SHE	8.95	764	0.73	4.91	70	680		[34]

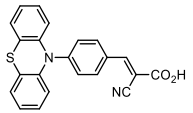
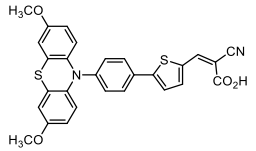
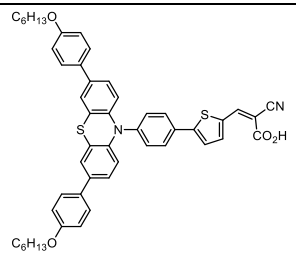
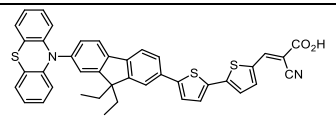
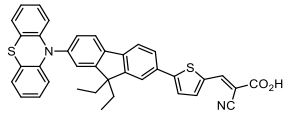
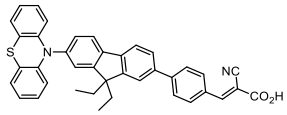
238	**AFB-32**	451	19.4	THF	451	600	0.93	2.39	SHE	9.30	763	0.75	5.25	73	680		[34]
239	**AFB-33**	433	22.5	THF	433	621	1.05	2.37	SHE	9.67	790	0.75	5.77	68	655		[107]
240	**AFB-16**	456	19.8	THF	442	610	0.99	2.35	SHE	11.27	754	0.71	6.08	75	690		[107]
240	**AFB-16**	455	21.4	THF	445	618	0.93	2.34		9.90	730	0.68	4.90	73	670		[31]
241	**AFB-34**	434	21.1	THF	440	615	1.04	2.37	SHE	10.55	770	0.70	5.72	72	670		[107]
242	**AFB-19**	440	24.1	THF	441	622	1.03	2.34	SHE	9.43	810	0.74	5.68	67	675		[107]
242	**AFB-19**	441	24.5	THF	441	620	0.92	2.36		9.00	780	0.72	5.00	70	655		[31]
243	**AFB-35**	451	23.4	THF	439	634	1.07	2.32	SHE	10.10	771	0.75	5.88	73	670		[107]
244	**AFB-25**	442	10.8	THF		649	1.05	2.32	SHE	8.10	747	0.72	4.27	58	660		[63]
245	**AFB-26**	419	5.6	THF		611	1.01	2.48	SHE	6.08	781	0.74	3.43	61	640		[63]
246	**AFB-27**	449	23.6	THF	437	629	1.04	2.32	SHE	10.11	774	0.75	5.78	68	690		[63]
247	**AFB-28**	404	15.4	THF		590	1.02	2.54	SHE	8.01	796	0.75	4.67	69	640		[63]

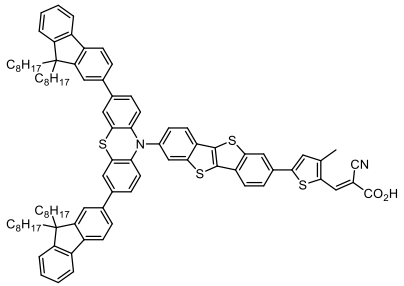
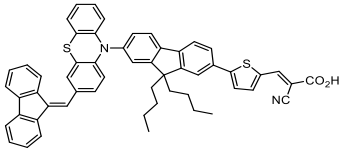
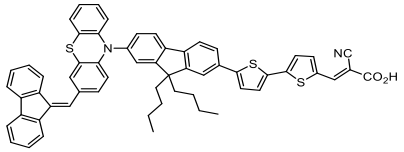
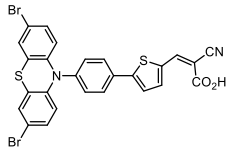
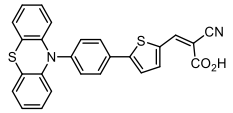
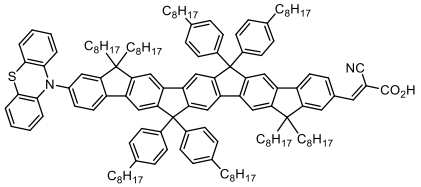
248	**AFB-29**	358	13.4	THF		471	0.98	2.85	SHE	1.95	713	0.78	1.06	46	550		[63]
249	**AFB-12**	459	19.1	THF	444	601	0.91	2.36		9.03	750	0.69	4.67	70	670		[31]
250	**AFB-13**	442	23.3	THF	443	629	0.92	2.32		9.40	760	0.70	4.95	70	670		[31]
251	**AFB-14**	457	22.6	THF	444	618	0.87	2.32		9.32	750	0.68	4.76	73	670		[31]
252	**AFB-15**	443	22.6	THF	431	617	0.86	2.36		8.65	790	0.71	4.84	71	655		[31]
253	**AFB-17**	450	19.9	THF	440	629	0.90	2.30		9.46	740	0.70	4.90	70	670		[31]
254	**AFB-18**	437	20.2	THF	430	594	0.90	2.32		8.75	780	0.70	4.79	68	660		[31]
255	**CBPTZ-*o***	434	32.5	DCM			0.87	2.61		5.94	780	0.65	2.99	62	550		[114]
256	**CBPTZ-*m***	530	39.3	DCM			0.87	2.2		7.33	850	0.66	4.13	73	630		[114]
257	**CBPTZ-*p***	438	51.8	DCM			0.88	2.2		12.07	890	0.62	6.63	87	650		[114]

258	**DMA-1**	430	19.3	DCM	379	684	0.93	2.23	10.60	770	0.69	5.60	80	670		[56]
259	**DMA-2**	478	26.3	DCM	421	632	0.95	2.18	10.90	772	0.67	5.60	74	670		[56]
260	**DMA-3**	452	25.8	DCM	419	569	0.96	2.38	11.00	700	0.68	5.20	77	690		[56]
261	**DMA-4**	461	21.6	DCM	441	625	0.92	2.21	7.30	628	0.68	3.10	55	690		[56]
262	**DMA-5**	446	33.5	DCM	402	587	0.92	2.40	10.30	740	0.69	5.30	73	660		[56]

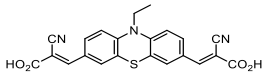
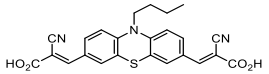
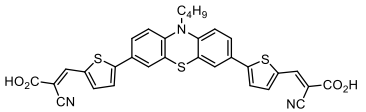
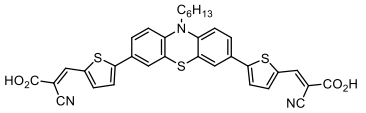
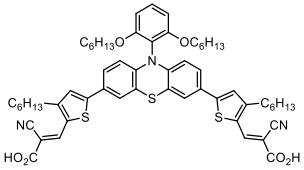
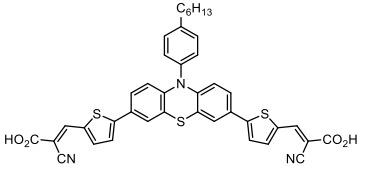
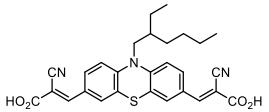
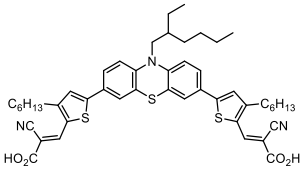
10*H*-Phenothazine dyes

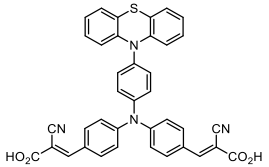
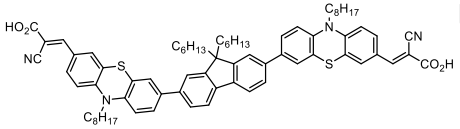
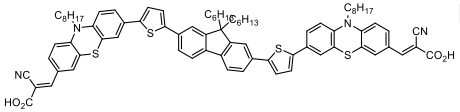
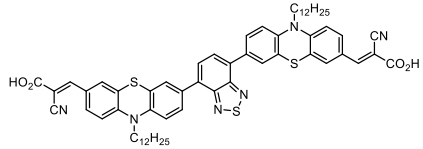
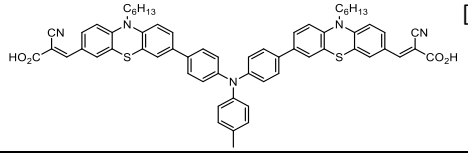
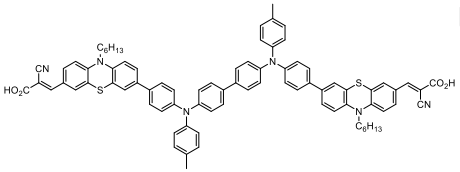
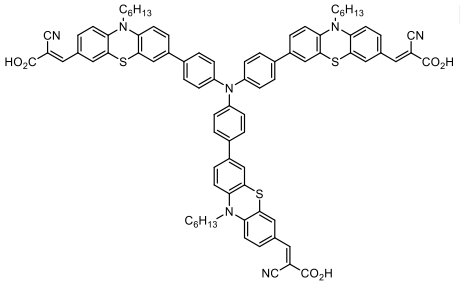
[a] For reference 116, the PCE calculated from the photovoltaic parameters do not match the reported PCE value.

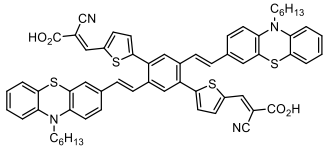
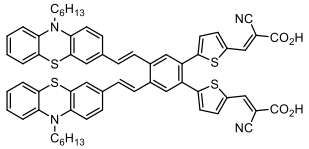
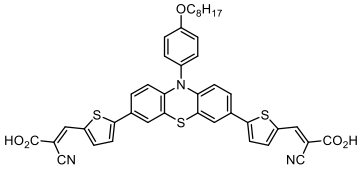
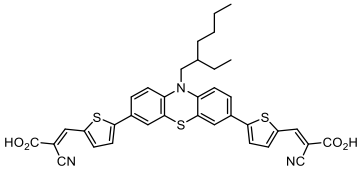
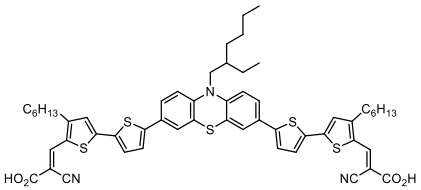
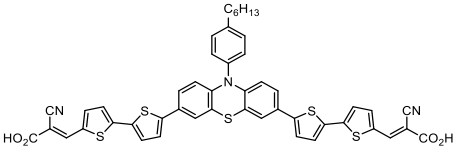
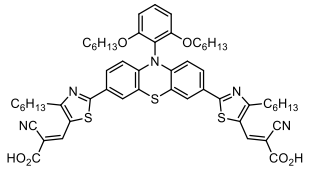
		Photophysical parameters					Electrochemistry			Photovoltaic parameters							
Dye	**Dye name**	**λ_{sol}**	**ε (10^3 M^{-1} cm^{-1})**	**Solvent**	**λ_{film}**	**λ_{PL}**	**E_{OX}**	**E_g**	**vs**	**J_{SC}**	**V_{OC}**	**FF**	**PCE**	**IPCE max**	**IPCE onset**	**Structure**	**Ref**
263	**Type 4**	381		DCB						2.75	620	0.77	1.30	68	510		[1]
263	**WD-5**	408	23.1	DCM	449		1.05	2.80	NHE	4.45	587	0.70	1.83	49	485		[115]
264	**Dye-OMe**	411	13.0	ACN		572	0.78	2.56	NHE	8.70	745	0.72	4.30 [a]	62	600		[116]
264	**PTZ**	411	13.0	ACN		572	0.78	2.56	NHE	8.20	745	0.75	5.57				[117]
265	**7a**	465	11.4	DCM		626	0.87	2.31		8.18	747	0.47	2.87	90	600		[118]
266	**4b**	465	22.7	DCM	485		1.63	2.83	NHE	10.47	599	0.64	4.01	81	620		[84]
267	**4a**	429	35.9	DCM	445		1.16	2.59	NHE	9.36	690	0.69	4.47	85	620		[84]
268	**4c**	374	30.8	DCM	406		0.76	2.40	NHE	5.67	616	0.57	2.01	69	520		[84]

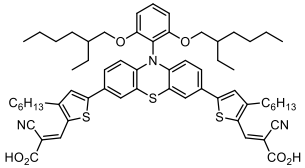
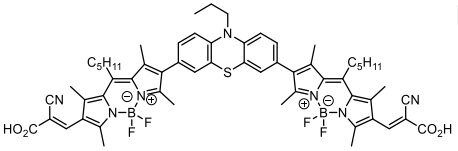
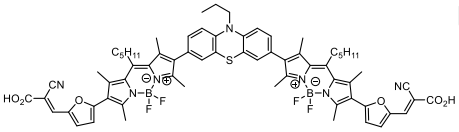
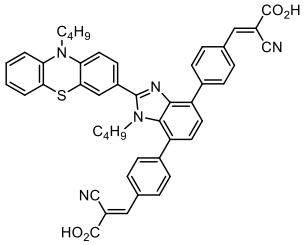
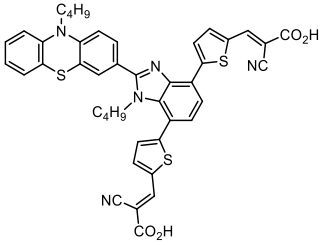
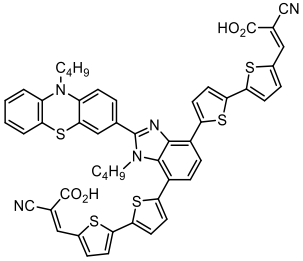
269	**21**	420	69.8	$CHCl_3$			0.75	2.50	NHE	9.67	719	0.72	5.00	65	600		[119]
270	**5a**	427	39.6	DCM	470		1.02	2.58	NHE	7.01	679	0.70	3.31	73	620		[120]
271	**5b**	453	41.2	DCM	520		1.03	2.51	NHE	6.71	635	0.66	2.83	50	650		[120]
272	**Dye-Br**	370	14.0	ACN		531	1.16	2.98	NHE	5.20	720	0.78	2.70 [a)]	56	560		[116]
273	**Dye-H**	384	11.0	ACN		565	1.02	2.63	NHE	7.30	740	0.75	3.80 [a)]	62	580		[116]
274	**2**	442	70.8	DCM	405		1.06	2.48	NHE	6.83	526	0.5	1.8	73	570		[121]

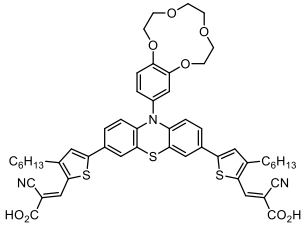
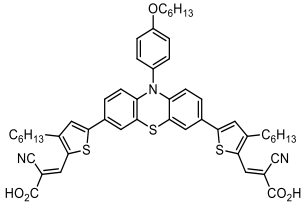
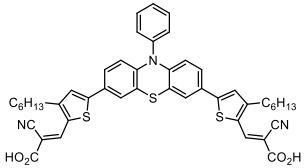
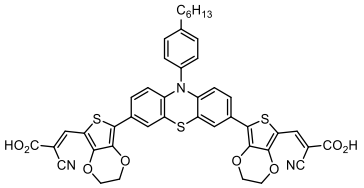
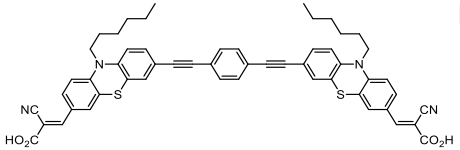
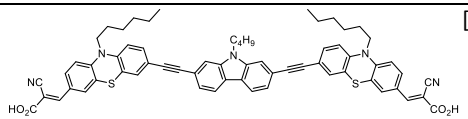
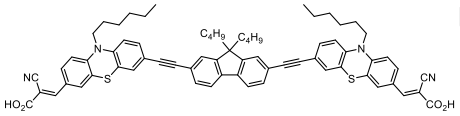
Multianchored dyes

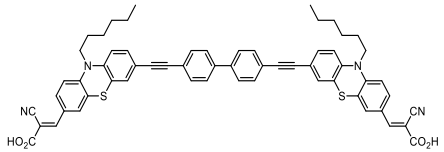
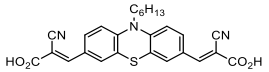
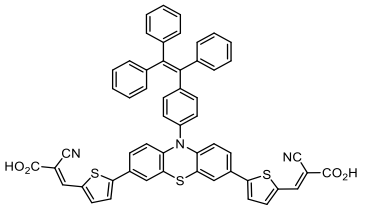
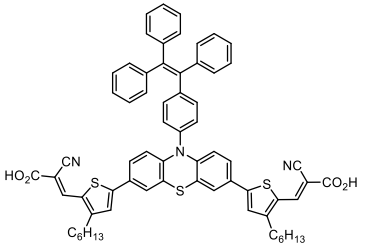
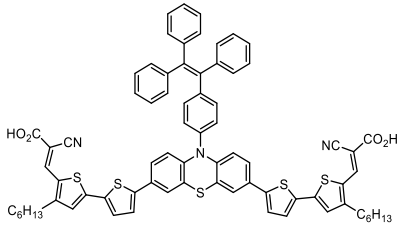
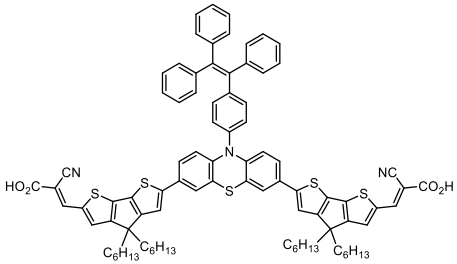
		Photophysical parameters					Electrochemistry			Photovoltaic parameters							
Dye	**Dye name**	**λ_{sol}**	**ε (10^3 M^{-1} cm^{-1})**	**Solvent**	**λ_{film}**	**λ_{PL}**	**E_{OX}**	**E_g**	**vs**	**J_{SC}**	**V_{OC}**	**FF**	**PCE**	**IPCE max**	**IPCE onset**	**Structure**	**Ref**
275	**AC-9**	471	18.9	THF	458	616	0.39			17.27	650	0.42	4.85	7	600		[4]*
276	**PTZ1**	459	42.6				1.13			3.00	558	0.56	1.10				[57]
277	**TD**	468	33.0	THF			0.96	2.19	NHE	11.30	643	0.67	4.90	60	670		[122]
278	**P6H2T2A**	482	36.1	DMF	460		0.73	2.12	NHE	11.60	635	0.70	5.20	65	690		[61]
278	**Dye 1**									8.80	570	0.65	3.20	50	700		[123]
279	**HL5**									13.24	710	0.67	6.33	74	690		[124]
279	**HL5**	516	39.0	THF	444		1.04	2.10	NHE	16.08	730	0.66	7.80	82	725		[125]
279	**HL5**	512	39.0	THF						16.60	732	0.70	8.50	95	690		[126]
280	**PRSCN2**	445	26.2	DMF	450		0.69	2.38	NHE	15.86	606	0.63	6.04	72	725		[127]
280	**PRSCN2**	450	26.2	DMF	445		0.69	2.38	NHE	17.23	645	0.64	7.16	76	720		[128]
281	**PR6C2**	469	22.5	DCM						14.96	675	0.68	6.8				[25]
282	**HL3**	475	47.9	THF	460	648	1.10	2.19	NHE	13.23	700	0.70	6.48	64	725		[129]
282	**HL3**	475	47.9	THF	456		1.10	2.19	NHE	14.95	680	0.68	6.91	78	725		[125]

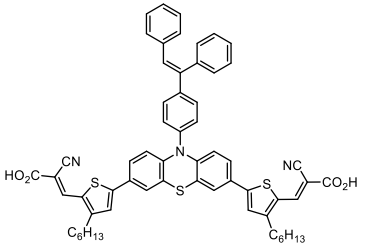
283	**TPAPC**	405	29.8	DMF	428			2.51		5.76	675	0.69	2.66	60	560		[130]
284	**DP-1**	458	27.4	DCM/THF (1:1)	436		1.12	2.25	NHE	11.73	726	0.67	5.70	80	670		[131]
285	**DP-2**	450	38.6	DCM/THF (1:1)	415		1.14	2.21	NHE	9.69	740	0.59	4.21	65	670		[131]
286	**MA-2**	471	27.8	DMF	482	592	0.62	2.18	NHE	13.10	728	0.72	6.87	74	650		[132]
287	**TP2**	471	31.6	$CHCl_3$	437		0.97	2.22	NHE	12.13	810	0.65	6.60	83	630		[50]
288	**T2P2**	470	34.0	$CHCl_3$	434		0.92	2.20	NHE	12.72	830	0.67	7.06	73	650		[50]
289	**TP3**	467	44.8	$CHCl_3$	447		0.99	2.22	NHE	10.42	770	0.60	4.78	65	650		[50]

290	**14A-25D**	382	35.0			549	0.80	2.60		4.80	529	0.59	1.50	44	600		[133]
291	**12A-45D**	395	37.0			550	0.80	2.60		10.80	648	0.64	4.50	75	640		[133]
292	**PTDA**	453	23.4	THF/DCM (1:1)	489	568	1.29	2.22	NHE	14.37	715	0.66	6.82	88	690		[73]
293	**HL2**	469	50.2	THF	437	655	1.11	2.21	NHE	13.52	670	0.69	6.29	67	725		[129]
294	**HL4**	484	71.6	THF	422	743	1.01	2.15	NHE	14.91	680	0.66	6.67	74	750		[129]
295	**PRTCN2**	436	32.7	DMF	433		0.62	2.34	NHE	18.69	636	0.61	7.30	76	720		[127]
296	**HL6**	520	37.8	THF	508		1.17	2.07	NHE	15.21	720	0.68	7.43	80	725		[125]

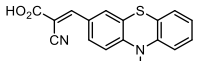
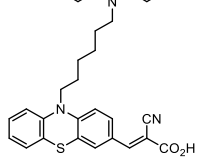
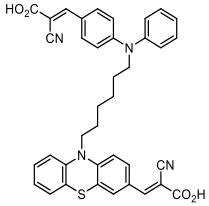
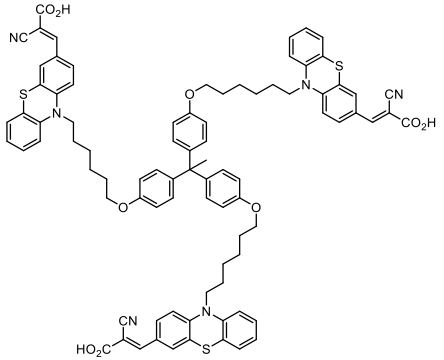
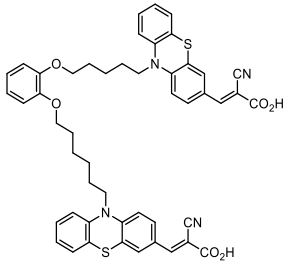
297	**HL7**	518	46.8	THF	450		1.05	2.11	NHE	16.23	750	0.68	8.32	86	725		[125]
298	**UY10**	534	90.0	DCM	528		0.98	2.12	NHE	10.02	522	0.67	3.52	57	720		[80]
299	**UY11**	555	99.0	DCM	548		0.95	2.04	NHE	11.82	548	0.70	4.52	63	725		[80]
300	**7a**	370	33.3	THF	412	491	1.12	2.85	NHE	3.76	670	0.74	1.89	88	510		[134]
301	**8a**	427	23.9	THF	431	513	1.11	2.55	NHE	6.89	650	0.73	3.28	90	570		[134]
302	**9a**	444	12.4	THF	515	534	1.09	2.33	NHE	6.71	700	0.66	3.13	66	620		[134]

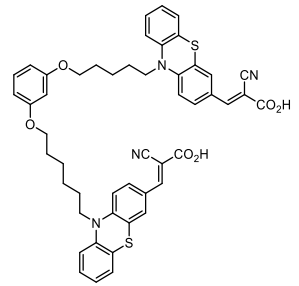
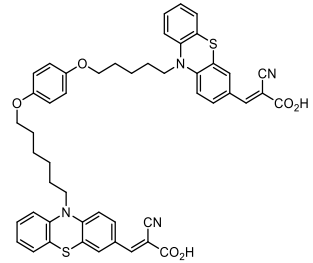
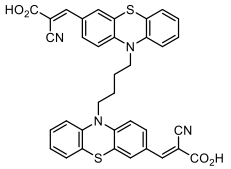
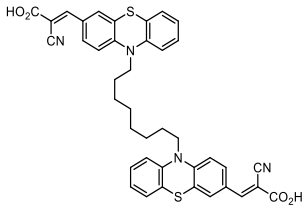
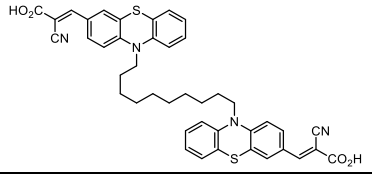
303	**DCE2**	487	11.4	THF		1.06	2.15	NHE	18.19	706	0.69	8.82	80	700		[51]
304	**DCE3**	488	10.1	THF		1.09	2.09	NHE	18.16	680	0.65	7.99	77	700		[51]
305	**DCE4**	477	8.2	THF		1.07	2.16	NHE	15.64	667	0.67	7.02	68	675		[51]
305	**DCE4**	477	8.1	THF					14.10	712	0.67	6.70	75	700		[126]
306	**PRED CN2**	471	34.3	DMF	459	0.63	2.33	NHE	19.75	676	0.62	8.32	75	750		[128]
307	**D1**	448	46.0	THF		0.71	1.97		12.49	796	0.75	7.44	64	650		[135]
308	**D2**					0.72	1.99		11.78	797	0.71	6.64	61	650		[135]
309	**D3**	449	44.3	THF		0.70	1.95		11.38	814	0.73	6.72	58	650		[135]

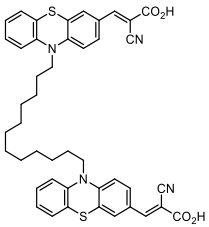
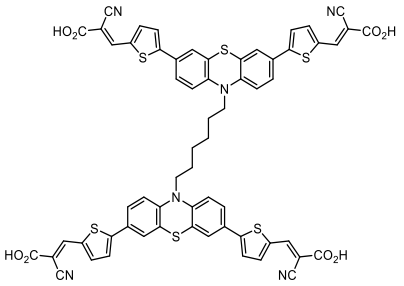
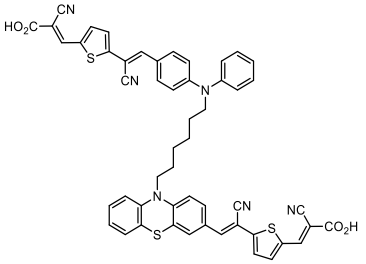
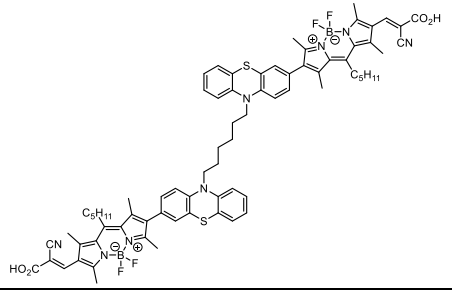
310	**D4**	449	40.9	THF		0.69	1.95		10.90	764	0.73	6.06	61	650		[135]
311	**6**	455		DCB	638	1.18	2.33	NHE	13.4	660	0.66	5.8	65	620		[23]
312	**YL1**	484	32.5	THF	567	1.07	2.29	NHE	16.2	708	0.65	7.5	95	700		[126]
313	**YL2**	496	39.3	THF	603	1.06	2.23	NHE	17.6	735	0.68	8.8	95	700		[126]
314	**YL3**	495	51.8	THF	654	0.99	2.12	NHE	17.8	743	0.7	9.3	93	725		[126]
315	**YL4**	527	76.6	THF	660	0.97	2.11	NHE	18.3	778	0.69	9.8	96	725		[126]

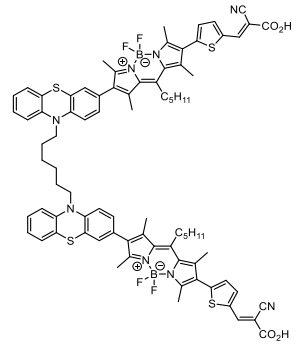
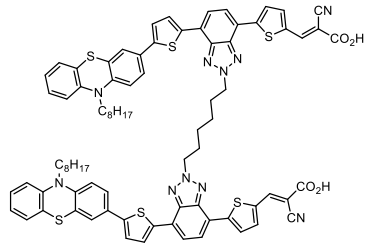
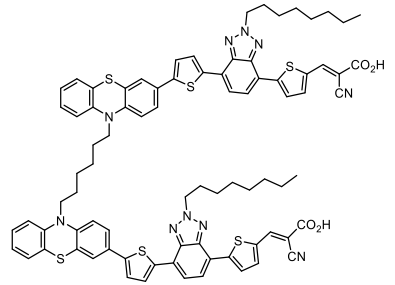
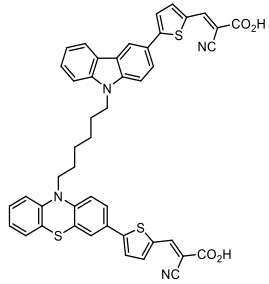
316	**YL5**	495	31.1	THF	648	1.07	2.14	NHE	15.9	732	0.66	7.6	85	700		[126]

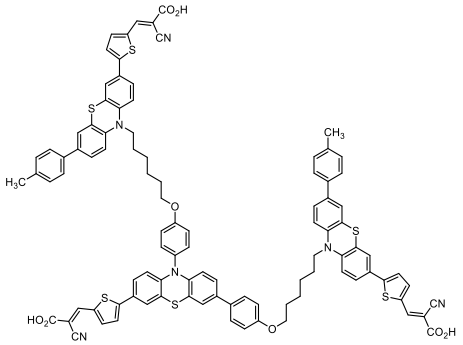
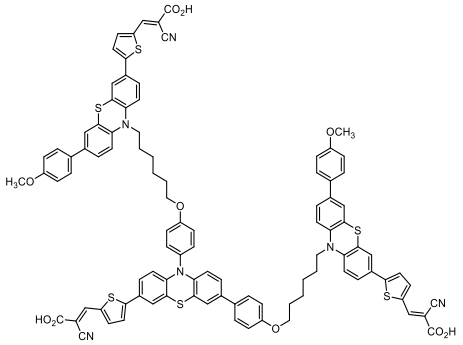
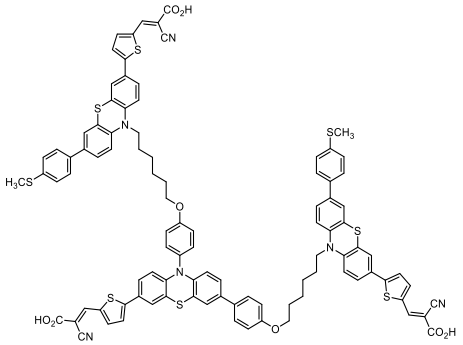
Tethered dyes

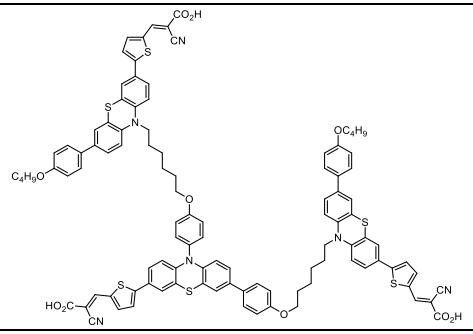
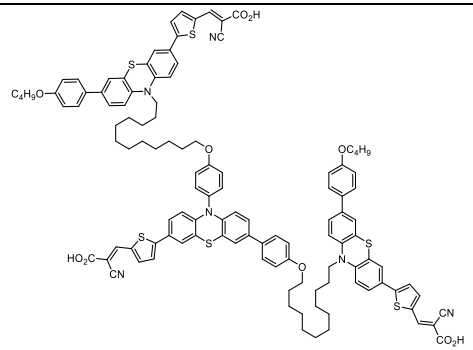
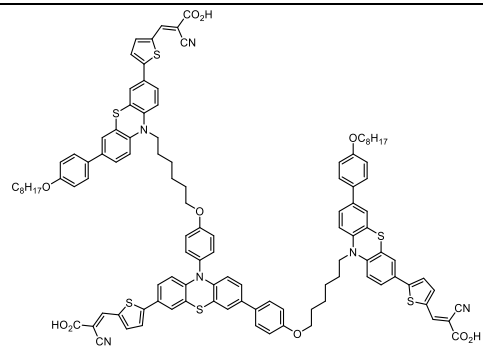
		Photophysical parameters					Electrochemistry			Photovoltaic parameters							
Dye	**Dye name**	**λ_{sol}**	**ε (10^3 M^{-1} cm^{-1})**	**Solvent**	**λ_{film}**	**λ_{PL}**	**E_{OX}**	**E_g**	**vs**	**J_{SC}**	**V_{OC}**	**FF**	**PCE**	**IPCE max**	**IPCE onset**	**Structure**	**Ref**
317	**2(PTZCA)**	417	21.0	DMF	423		0.84	2.54		10.32	628	0.60	3.91	64	640		[14]
317	**C6**	399	14.1		423					7.80	670	0.71	3.60	49	610		[20]
318	**DC2**	422	39.8	DCM/MeOH		610	0.99	2.44	NHE	8.98	756	0.69	4.66	68	620		[136]
319	**3(PTZCA)**	413	30.0	DMF	427		0.82	2.57		11.96	681	0.60	4.90	71	640		[14]
320	**oDB**	420	8.5	DCM/MeOH (1:1)	422		1.00	2.62	NHE	10.92	705	0.68	5.25				[137]

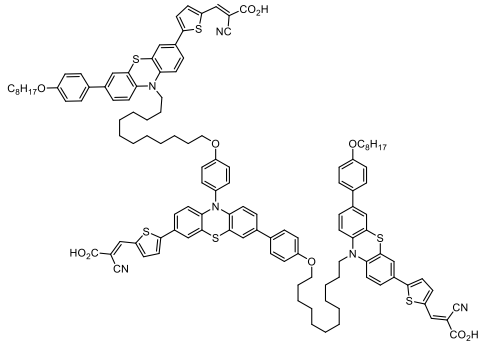
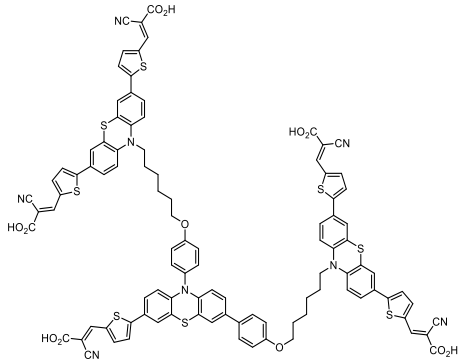
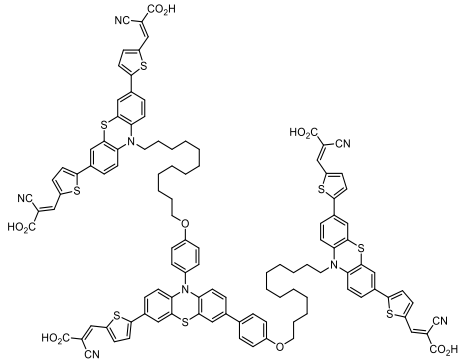
321	**mDB**	414	14.4	DCM/MeOH (1:1)	412	1.10	2.62	NHE	11.92	740	0.66	5.85				[137]
322	**pDB**	424	18.1	DCM/MeOH (1:1)	422	1.16	2.64	NHE	12.26	756	0.66	6.14				[137]
323	**C4**	396	14.4		417				6.13	670	0.72	2.84	42	600		[20]
324	**C8**	402	16.3		425				8.71	695	0.68	4.00	53	625		[20]
325	**C10**	402	15.3		434				8.82	695	0.68	4.03	50	625		[20]

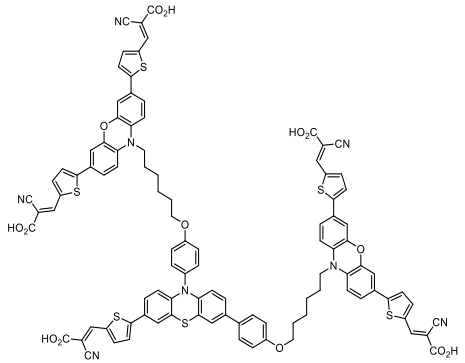
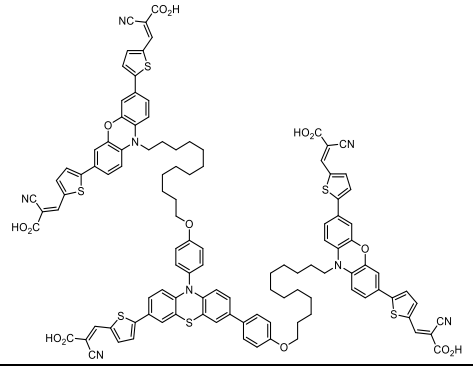
326	**C12**	400	15.3		427				8.75	705	0.68	4.02	57	625		[20]
327	**Dye 4**								9.80	570	0.61	3.40	47	700		[123]
328	**DC3**	439	44.4	DCM/MeOH	579	0.93	2.34	NHE	10.79	687	0.70	5.19	68	700		[123]
329	**UY3**	532	130.0	$CHCl_3$	527	0.91	1.99	NHE	9.44	550	0.63	3.24	54	700		[79]

330	**UY4**	535	135.0	$CHCl_3$	528		0.87	1.97	NHE	12.16	590	0.68	4.89	66	700		[79]
331	**DB-D**	492	88.8	DCM/THF (1:1)	467	564	0.90	2.20	NHE	14.39	718	0.59	6.13	65	725		[86]
332	**DB-B**	492	79.2	DCM/THF (1:1)	453	561	0.90	2.21	NHE	9.40	657	0.59	3.65	58	700		[86]
333	**CVTC-H-CVTP**	397	44.9	DMF	443		0.63	2.55		6.51	660	0.75	3.20				[62]

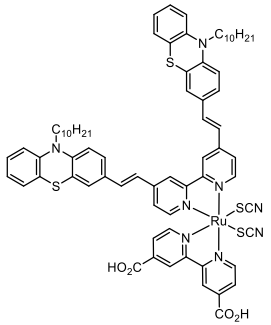
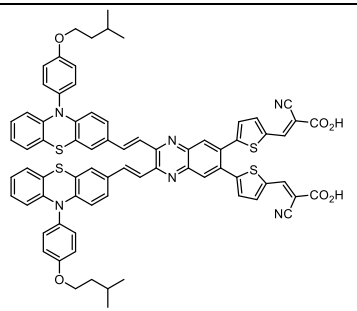
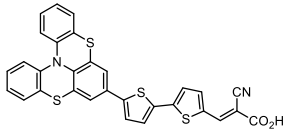
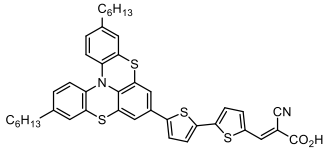
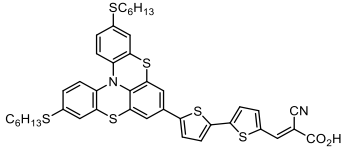
334	**PTZTC 1**	435	55.3	DCM/EtOH (9:1)	410	0.89	2.27	NHE	12.37	641	0.66	5.21	70	700		[111]
335	**PTZTC 2**	470	50.9	DCM/EtOH (9:1)	435	0.90	2.07	NHE	12.46	659	0.69	5.65	78	700		[111]
336	**PTZTC 3**	472	58.4	DCM/EtOH (9:1)	438	0.92	2.04	NHE	12.84	667	0.71	6.09	84	700		[111]

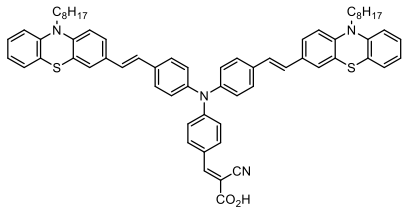
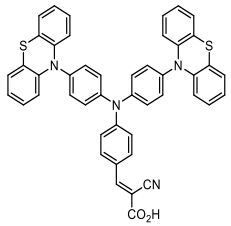
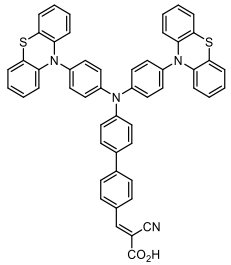
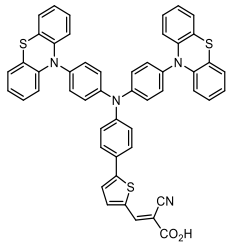
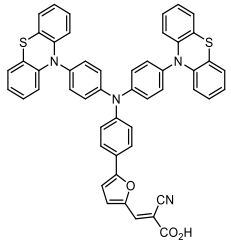
337	**PTZTB 1**	469	54.5	DCM/EtOH (9:1)	0.90	1.92	NHE	12.26	638	0.73	5.68	79	675		[112]
338	**PTZTB 2**	473	54.2	DCM/EtOH (9:1)	0.90	1.91	NHE	14.01	680	0.63	6.02	79	700		[112]
339	**PTZTB 3**	472	59.4	DCM/EtOH (9:1)	0.92	1.89	NHE	14.20	655	0.72	6.66	85	690		[112]

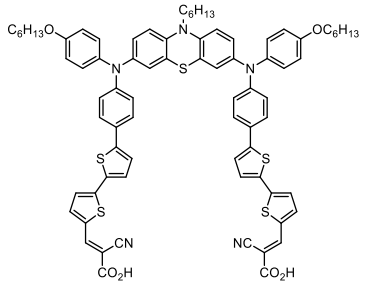
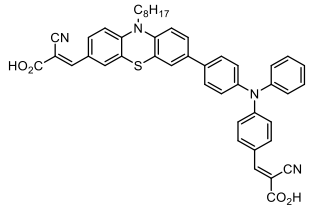
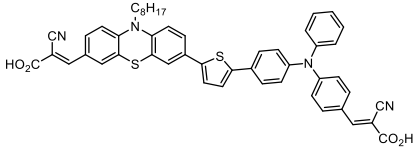
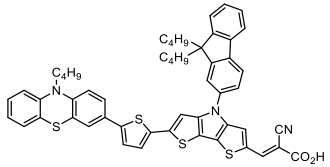
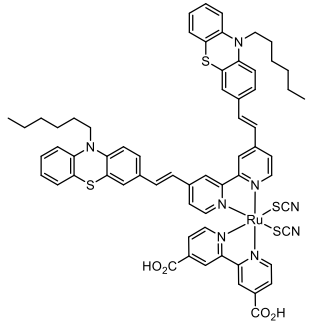
340	**PTZTB 4**	474	63.1	DCM/Et OH (9:1)	0.92	1.89	NHE	13.55	689	0.65	6.04	82	700		[112]
341	**TQ1**	467	100.0	THF	0.95	2.07	NHE	13.30	659	0.71	6.18	73	670		[122]
342	**TQ2**	467	125.0	THF	0.96	2.05	NHE	13.57	691	0.71	6.65	78	670		[122]

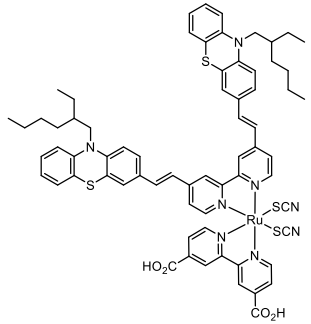
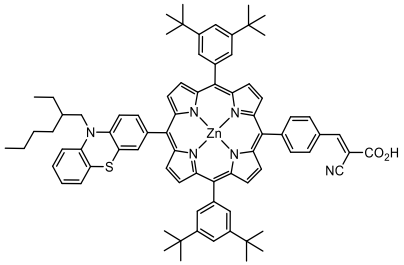
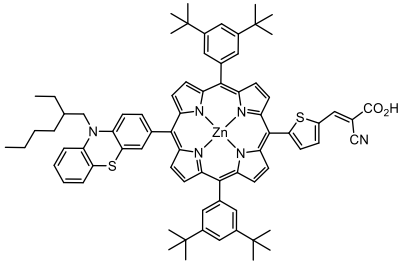
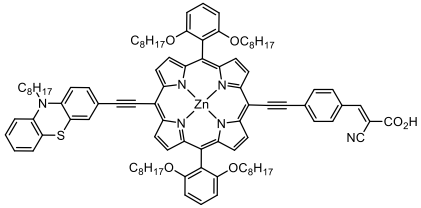
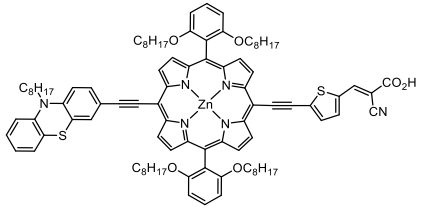
343	**OQ1**	512	89.0	THF	0.97	1.86	NHE	13.81	626	0.67	5.77	76	670		[122]
344	**OQ2**	513	125.0	THF	0.97	1.95	NHE	14.59	662	0.67	6.45	84	670		[122]

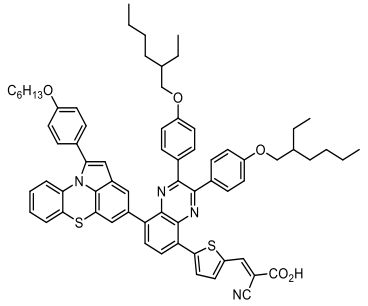
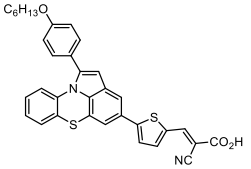
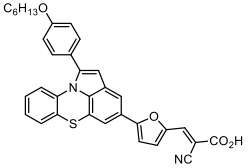
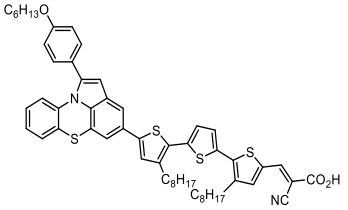
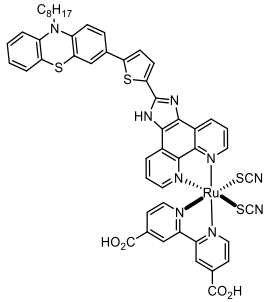
Other dyes

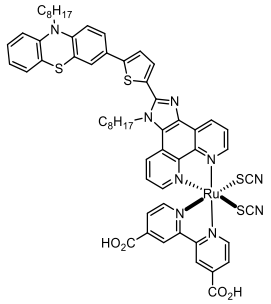
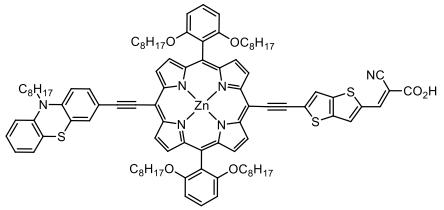
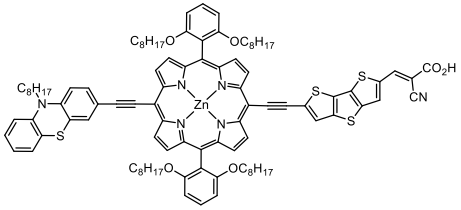
		Photophysical parameters					Electrochemistry			Photovoltaic parameters							
Dye	**Dye name**	**λ_{sol}**	**ε (10^3 M^{-1} cm^{-1})**	**Solvent**	**λ_{film}**	**λ_{PL}**	**E_{OX}**	**E_g**	**vs**	**J_{SC}**	**V_{OC}**	**FF**	**PCE**	**IPCE max**	**IPCE onset**	**Structure**	**Ref**
345	**PTZ1**		20.0	DMF		760	0.84	1.86	SCE	7.79	640	0.75	3.77	54	770		[138]
346	**NQX12**	488	39.8	THF			1.22	2.12	NHE	7.58	560	0.77	3.30	48	680		[139]
347	**JK-205**	422	17.4	THF			1.15	2.47	NHE	12.19	670	0.73	5.96	79	650		[140]
348	**JK-206**	432	13.1	THF			1.25	2.40	NHE	13.44	710	0.74	7.08	76	660		[140]
349	**JK-207**	427	12.9	THF			1.41	2.43	NHE	10.88	630	0.75	5.24	74	640		[140]

350	**TP**	409	54.0	THF	440		0.57	2.34	NHE	11.11	740	0.59	4.84	56	575		[141]*
351	**PTZ-1**	433	51.5	DCM		530	0.64	2.63	NHE	8.50	660	0.79	4.40	66	600		[142]
351	**WD-1**	422	29.4	ACN	416		0.64	2.63	NHE	9.20	625	0.79	4.54	56	570		[143]
352	**WD-6**	385	21.1	ACN	385		1.28	2.34	NHE	10.86	635	0.71	4.90	68	590		[144]
353	**WD-7**	406	23.6	ACN	418		1.21	2.25	NHE	12.64	680	0.70	6.02	79	625		[144]
354	**WD-8**	421	22.9	ACN	423		1.14	2.19	NHE	14.43	682	0.69	6.79	79	635		[144]

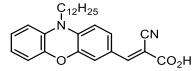
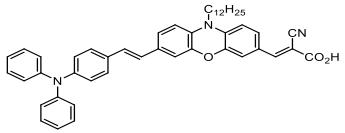
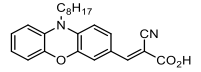
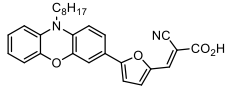
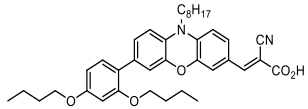
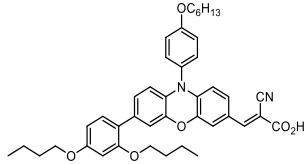
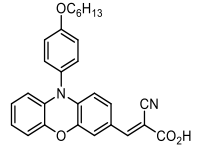
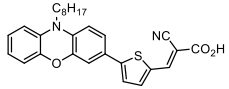
355	**DC-2**	490	46.5	THF		656	0.99	2.07	NHE	5.72	660	0.65	2.44	70	700		[145]
356	**DP-3**	442	29.7	DCM/THF (1:1)	438		1.39	2.28	NHE	11.24	796	0.66	5.92	74	660		[26]
357	**DP-4**	445	32.3	DCM/THF (1:1)	433		1.25	2.34	NHE	11.69	710	0.65	5.40	74	670		[26]
358	**5d**	493	58.3	THF	524		1.28	2.27	NHE	10.88	694	0.65	4.87	66	720		[146]
359	**SCZ-1**	539	17.7	DMF			0.99	1.75	NHE	19.85	761	0.69	10.40	88	740		[147]

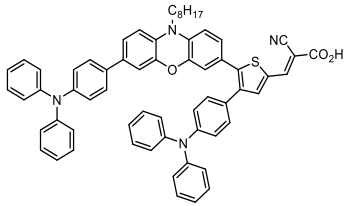
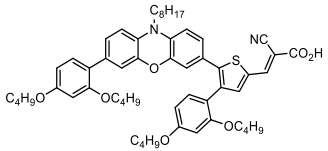
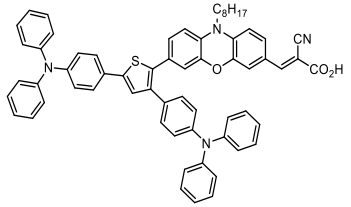
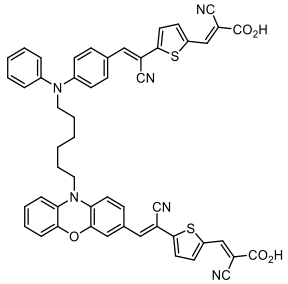
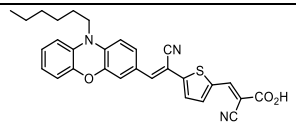
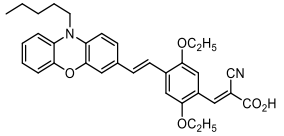
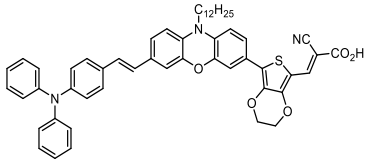
360	**SCZ-2**	539	16.6	DMF		1.04	1.75	NHE	19.88	761	0.68	10.10	88	740		[147]
361	**JY25**	593	13.0	DCM	602	0.93	2.06	NHE	12.40	704	0.60	5.21	64	675		[148]
362	**JY26**	602	13.0	DCM	612	0.94	2.03	NHE	14.10	661	0.62	5.80	77	700		[148]
363	**LG4**	676	52.5	THF	685	0.79	1.80	SCE	15.02	710	0.68	7.30	68	790		[149]
364	**LG5**	687	70.8	THF	688	0.82	1.80	SCE	21.01	680	0.71	10.20	85	840		[149]
364	**LG5**	687	31.1	THF		1.06	1.80	NHE	18.38	778	0.68	9.65				[150]

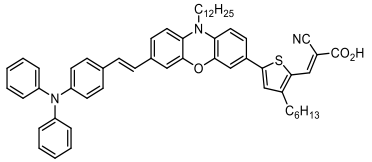
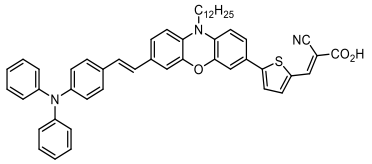
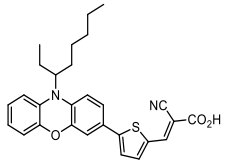
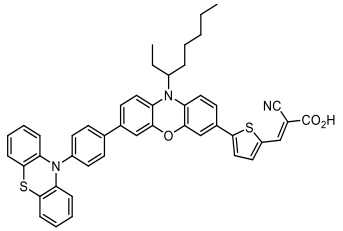
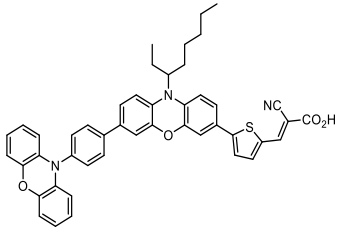
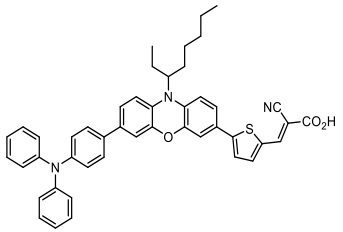
365	**JY59**	424	40.4	DCM				12.01	837	0.69	6.92				[151]
366	**JY40**	400	26.9	DCM	1.13	2.17	NHE	13.38	736	0.65	6.42	84	610		[152]*
367	**JY41**	418	24.6	DCM	1.13	2.25	NHE	12.60	705	0.63	5.60	80	590		[152]*
368	**JY42**	461	35.7	DCM	1.06	2.01	NHE	17.76	726	0.58	7.54	88	710		[152]*
369	**JR1**	520	23.9	DMF	0.97	1.84	NHE	16.4	817	0.65	8.68	76	730		[153]

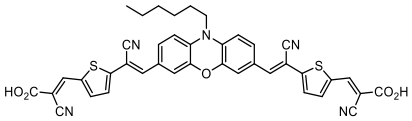
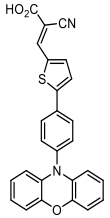
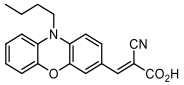
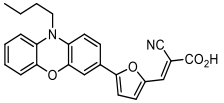
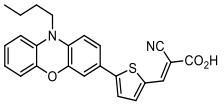
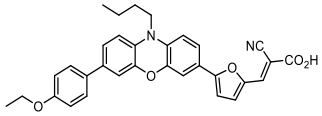
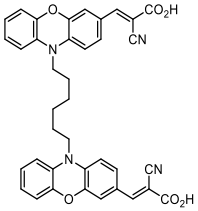
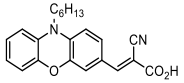
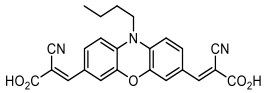
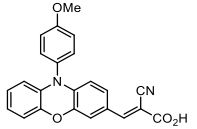
370	**JR2**	523	28.9	DMF	1.01	1.82	NHE	17.18	841	0.63	9.12	79	750		[153]
371	**LG-tT**	675	8.1	THF	1.05	1.72	NHE	15.1	793	0.69	8.25				[150]
372	**LG-DtT**	681	39.0	THF	1.08	1.75	NHE	12.99	778	0.69	7.01				[150]

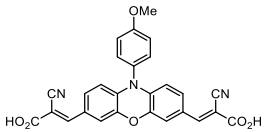
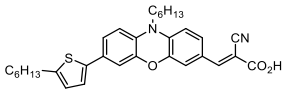
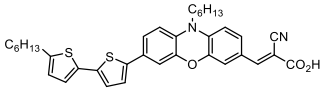
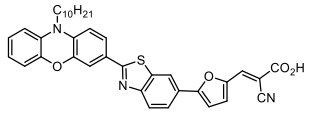
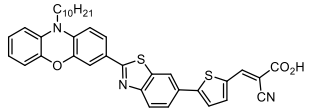
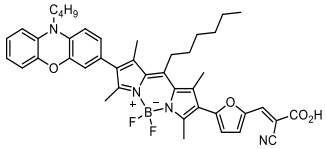
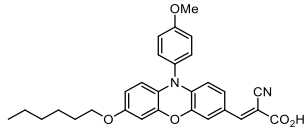
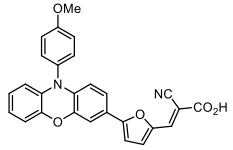
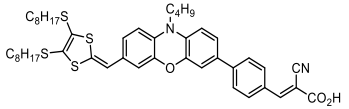
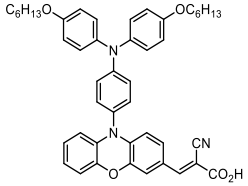
Phenoxazine dyes

		Photophysical parameters					Electrochemistry			Photovoltaic parameters							
Dye	**Dye name**	**λ_{sol}**	**ε (10^3 M^{-1} cm^{-1})**	**Solvent**	**λ_{film}**	**λ_{PL}**	**E_{OX}**	**E_g**	**vs**	**J_{SC}**	**V_{OC}**	**FF**	**PCE**	**IPCE max**	**IPCE onset**	**Structure**	**Ref**
373	**TH301**	491	22.0	DCM	446	610	1.07	2.24	NHE	11.50	722	0.75	6.20	93	625		[154]
374	**TH305**	517	28.0	DCM	468	640	0.87	2.15	NHE	14.70	733	0.71	7.70	94	670		[154]
374	**TH305**	517	28.0	DCM	468	647	0.68	2.06	NHE	14.90	738	0.69	7.50	96	690		[155]
375	**MP13**	506	22.2	DCM	456	627	0.96	2.17	NHE	14.38	780	0.64	7.17	89	670		[156]
376	**MP08**	500	20.3	DCM	455	625	0.97	2.19	NHE	13.09	800	0.7	7.40	90	630		[156]
377	**MP03**	518	19.2	DCM	448	626	0.92	2.16	NHE	14.22	700	0.6	6.03	84	680		[156]
378	**MP05**	486	19.8	DCM	451	601	1.13	2.27	NHE	10.67	770	0.74	6.07	92	610		[156]
379	**MP12**	491	18.8	DCM	448	607	1.09	2.25	NHE	12.25	760	0.72	6.70	90	625		[156]
380	**IB1**	486	21.0	EtOH/DCM (4 : 1)	466	638	0.91	2.19	NHE	13.20	700	0.68	6.20	87	700		[157]

381	**IB2**	483	15.0	EtOH/DCM (4 : 1)	483	650	0.81	2.17	NHE	12.80	760	0.65	6.30	80	700		[157]
382	**IB3**	482	17.0	EtOH/DCM (4:1)	480	650	0.79	2.17	NHE	13.70	800	0.63	7.00	84	700		[157]
383	**IB4**	492	19.0	EtOH/DCM (4:1)	475	605	0.93	2.28	NHE	13.40	740	0.66	6.50	91	670		[157]
384	**DC**	511	26.1			568	0.66	2.29	NHE	12.75	691	0.69	6.06	72	730		[158]
385	**SC2**	513	12.7			676	0.62	2.09	NHE	9.13	679	0.71	4.40	49	720		[158]
386	**S3O**	509	33.2	DCM	455		0.73	2.35		8.96	691	0.64	3.94	53	670		[159]
387	**LJ101**	550	31.0	DCM	513	700	0.68	1.81	NHE	14.01	704	0.65	6.40	84	725		[155]

388	**LJ102**	538	31.0	DCM	487	677	0.60	1.84	NHE	13.37	714	0.66	6.30	77	725		[155]
389	**LJ103**	542	38.0	DCM	485	706	0.57	1.85	NHE	13.25	696	0.66	6.10	78	710		[155]
390	**POZ-2**	465	16.1	THF		593				12.58	744	0.71	6.60	85	690		[160]
390	**POZ-2**	461	16.1	THF		593				12.82	730	0.69	6.50	85	690		[161]
390	**POZ-2**	465	16.1	THF		593				12.58	727	0.71	6.40	85	680		[162]
391	**POZ-3**	475	15.0	THF		600				13.98	769	0.73	7.80	87	700		[160]
392	**POZ-4**	476	20.6	THF		601				13.54	762	0.69	7.10	87	700		[160]
393	**POZ-5**	483	21.2	THF		610				14.55	720	0.62	6.40	85	730		[160]

394	**POX-th-CN**	518	26.2	DMF		682				7.40	631	0.32	1.78	57	650		[163]
395	**POZ-1**	371	23.5	THF		418				4.83	660	0.74	2.40	55	600		[161]
396	**POX**									9.88	664	0.73	4.80	78	630		[164]
396	**POX**	464	39.0	THF	444	558	1.01	2.38	NHE	11.19	680	0.65	4.97	80	650		[165]
397	**WS1**	452	19.1	EtOH/ $CHCl_3$	449		0.88	2.36	NHE	11.72	653	0.69	5.26	74	710		[164]
398	**WS2**	455	19.2	EtOH/ $CHCl_3$	452		0.89	2.33	NHE	11.11	628	0.70	4.91	70	710		[164]
399	**WS3**	475	26.3	EtOH/ $CHCl_3$	466		0.81	2.13	NHE	11.35	640	0.67	4.87	73	710		[164]
400	**SDD4**	476	39.1	THF		576	0.84	2.3	NHE	6.81	743	0.62	3.92				[166]
401	**RD**	474	19.6	THF		571	0.82	2.32	NHE	5.94	759	0.64	3.61				[166]
402	**WB**	498	34.2	THF	482	565	1.14	2.29	NHE	11.79	650	0.65	5.02	80	650		[165]
403	**WH1**	458	37.2	THF	426	555	1.06	2.42	NHE	10.11	690	0.72	5.09	85	610		[165]
403	**WH1**	484	18.9	DCM	459	592	0.98	2.26	NHE	7.90	760	0.75	4.49	79	610		[167]

404	**WH2**	498	47.9	THF	494	554	1.16	2.33	NHE	10.75	660	0.68	4.86	82	625		[165]
405	**CSOR G7**	465	25.4	THF	459	610	1.40	2.31	NHE	11.56	726	0.72	6	84	680		[43]
406	**CSOR G9**	467	27.3	THF	460	602	1.41	2.3	NHE	12.07	720	0.69	6	83	680		[43]
407	**MCG1**	439	45.1	DMF		556				11.04	604	0.68	4.52	66	730		[168]
408	**MCG2**	437	28.1	DMF		541				13.62	617	0.68	5.73	79	730		[168]
409	**POZ-B**	556	69.0	$CHCl_3$	544		0.88	1.97	NHE	10.91	546	0.61	3.61	58	740		[169]
410	**WS4**	500	16.6	DCM	463	614	0.84	2.23		9.03	800	0.73	5.25	77	650		[167]
411	**WS5**	508	19.3	DCM	473	652	0.90	2.2		11.16	770	0.74	6.34	76	680		[167]
412	**DTF-C6**	431	31.0	THF			0.93	2.42		15.76	790	0.72	9.04	95	680		[170]
413	**PHX-TPA**	466	22.0	THF		572				8.02	675	0.66	3.597	75	600		[28]

References

1. A. S. Hart, C. B. K. C, N. K. Subbaiyan, P. A. Karr, F. D'Souza, *ACS Appl. Mater. Interfaces* 2012, **4**, 5813-5820.
2. T.-Y. Wu, M.-H. Tsao, F.-L. Chen, S.-G. Su, C.-W. Chang, H.-P. Wang, Y.-C. Lin, W.-C. Ou-Yang, I.-W. Sun, *Int. J. Mol. Sci.* 2010, **11**, 329-353.
3. D. Cao, J. Peng, Y. Hong, X. Fang, L. Wang, H. Meier, *Org. Lett.* 2011, **13**, 1610-1613.
4. A. Fabianczyk, P. Gnida, P. Chulkin, S. Kula, M. Filapek, A. Szlapa-Kula, H. Janeczek, E. Schab-Balcerzak, *Sol. Energy* 2020, **220**, 1109-1119.
5. H. Tian, X. Yang, R. Chen, Y. Pan, L. Li, A. Hagfeldt, L. Sun, *Chem. Commun.* 2007, 3741-3743.
6. S. H. Kim, H. W. Kim, C. Sakong, J. Namgoong, S. W. Park, M. J. Ko, C. H. Lee, W. I. Lee, J. P. Kim, *Org. Lett.* 2011, **13**, 5784-5787.
7. M. Cheng, X. Yang, S. Li, X. Wang, L. Sun, *Energy Environ. Sci.* 2012, **5**, 6290-6293.
8. S. H. Kim, C. Sakong, J. B. Chang, B. Kim, M. J. Ko, D. H. Kim, K. S. Hong, J. P. Kim, *Dyes Pigm.* 2013, **97**, 262-271.
9. X. Zhang, F. Gou, J. Shi, H. Gao, C. Xu, Z. Zhu, H. Jing, *RSC Adv.* 2016, **6**, 106380-106386.
10. Y. J. Chang, P.-T. Chou, Y.-Z. Lin, M. Watanabe, C.-J. Yang, T.-M. Chin, T. J. Chow, *J. Mater. Chem.* 2012, **22**, 21704-21712.
11. K.-H. Kim, S.-M. Lee, M.-H. Seo, S.-E. Cho, W.-P. Hwang, S.-H. Park, Y.-K. Kim, J.-K. Lee, M.-R. Kim, *Macromol. Res.* 2012, **20**, 128-137.
12. C.-J. Yang, Y. J. Chang, M. Watanabe, Y.-S. Hon, T. J. Chow, *J. Mater. Chem.* 2012, **22**, 4040-4049.
13. Y. Hua, S. Chang, H. Wang, D. Huang, J. Zhao, T. Chen, W.-Y. Wong, W.-K. Wong, X. Zhu, *J. Power Sources* 2013, **243**, 253-259.
14. M. S. Kim, M. J. Cho, Y. C. Choi, K.-S. Ahn, D. H. Choi, K. Kim, J. H. Kim, *Dyes Pigm.* 2013, **99**, 986-994.
15. G. Marotta, M. A. Reddy, S. P. Singh, A. Islam, L. Han, F. De Angelis, M. Pastore, M. Chandrasekharam, *ACS Appl. Mater. Interfaces* 2013, **5**, 9635-9647.
16. S. Wang, H. Wang, J. Guo, H. Tang, J. Zhao, *Dyes Pigm.* 2014, **109**, 96-104.
17. Y.-D. Lin, B.-Y. Ke, Y. J. Chang, P.-T. Chou, K.-L. Liau, C.-Y. Liu, T. J. Chow, *J. Mater. Chem. A* 2015, **3**, 16831-16842.
18. Z. Wan, C. Jia, Y. Wang, J. Luo, X. Yao, *Org. Electron.* 2015, **27**, 107-113.
19. F. Han, Y. Wang, Z. Wan, C. Jia, J. Luo, X. Yao, *Synth. Met.* 2016, **221**, 95-102.
20. Y. H. Lee, R. K. Chitumalla, B. Y. Jang, J. Jang, S. Thogiti, J. H. Kim, *Dyes Pigm.* 2016, **133**, 161-172.
21. J. Luo, Z. Wan, C. Jia, Y. Wang, X. Wu, X. Yao, *Electrochim. Acta* 2016, **211**, 364-374.
22. S. Erten-Ela, Y. Ueno, T. Asaba, Y. Kubo, *New J. Chem.* 2017, **41**, 10367-10375.
23. S. Yellappa, W. A. Webre, H. B. Gobeze, A. Middleton, C. B. KC, F. D'Souza, *ChemPlusChem* 2017, **82**, 896-903.
24. Y.-C. Chen, Y.-T. Kuo, C.-J. Liang, *RSC Adv.* 2018, **8**, 9783-9789.
25. S. S. Park, Y. S. Won, Y. C. Choi, J. H. Kim, *Energy Fuels* 2009, **23**, 3732-3736.
26. X.-X. Dai, H.-L. Feng, W.-J. Chen, Y. Yang, L.-B. Nie, L. Wang, D.-B. Kuang, H. Meier, D. Cao, *Dyes Pigm.* 2015, **122**, 13-21.
27. Z. Iqbal, W.-Q. Wu, D.-B. Kuang, L. Wang, H. Meier, D. Cao, *Dyes Pigm.* 2013, **96**, 722-731.
28. M.-D. Damaceanu, C.-P. Constantin, A.-E. Bejan, M. Mihaila, M. Kusko, C. Diaconu, I. Mihalache, R. Pascu, *Dyes Pigm.* 2019, **166**, 15-31.
29. Y. Hua, L. T. Lin Lee, C. Zhang, J. Zhao, T. Chen, W.-Y. Wong, W.-K. Wong, X. Zhu, *J. Mater. Chem. A* 2015, **3**, 13848-13855.
30. X. Zhang, F. Gou, D. Zhao, J. Shi, H. Gao, Z. Zhu, H. Jing, *J. Power Sources* 2016, **324**, 484-491.
31. A. F. Buene, E. E. Ose, A. G. Zakariassen, A. Hagfeldt, B. H. Hoff, *J. Mater. Chem. A* 2019, **7**, 7581-7590.
32. B. Nagarajan, S. Kushwaha, R. Elumalai, S. Mandal, K. Ramanujam, D. Raghavachari, *J. Mater. Chem. A* 2017, **5**, 10289-10300.
33. R. Y.-Y. Lin, F.-L. Wu, C.-T. Li, P.-Y. Chen, K.-C. Ho, J. T. Lin, *ChemSusChem* 2015, **8**, 2503-2513.
34. A. F. Buene, N. Boholm, A. Hagfeldt, B. H. Hoff, *New J. Chem.* 2019, **43**, 9403-9410.
35. C. Chen, J.-Y. Liao, Z. Chi, B. Xu, X. Zhang, D.-B. Kuang, Y. Zhang, S. Liu, J. Xu, *J. Mater. Chem.* 2012, **22**, 8994-9005.
36. C. Chen, J.-Y. Liao, Z. Chi, B. Xu, X. Zhang, D.-B. Kuang, Y. Zhang, S. Liu, J. Xu, *RSC Adv.* 2012, **2**, 7788-7797.

37. M.-J. Kim, Y.-J. Yu, J.-H. Kim, Y.-S. Jung, K.-Y. Kay, S.-B. Ko, C.-R. Lee, I.-H. Jang, Y.-U. Kwon, N.-G. Park, *Dyes Pigm.* 2012, **95**, 134-141.
38. M. Marszalek, S. Nagane, A. Ichake, R. Humphry-Baker, V. Paul, S. M. Zakeeruddin, M. Grätzel, *J. Mater. Chem.* 2012, **22**, 889-894.
39. M. Cheng, X. Yang, C. Chen, J. Zhao, Q. Tan, L. Sun, *Phys. Chem. Chem. Phys.* 2013, **15**, 17452-17459.
40. Y. Hua, S. Chang, D. D. Huang, X. Zhou, X. J. Zhu, J. Z. Zhao, T. Chen, W. Y. Wong, W. K. Wong, *Chem. Mater.* 2013, **25**, 2146-2153.
41. Z. Iqbal, W.-Q. Wu, H. Zhang, P.-L. Hua, X. Fang, D.-B. Kuang, L. Wang, H. Meier, D. Cao, *Dyes Pigm.* 2013, **99**, 299-307.
42. Y. Hua, S. Chang, J. He, C. Zhang, J. Zhao, T. Chen, W.-Y. Wong, W.-K. Wong, X. Zhu, *Chem. Eur. J.* 2014, **20**, 6300-6308.
43. M. Anil Reddy, B. Vinayak, T. Suresh, S. Niveditha, K. Bhanuprakash, S. Prakash Singh, A. Islam, L. Han, M. Chandrasekharam, *Synth. Met.* 2014, **195**, 208-216.
44. M. P. Antony, T. Moehl, M. Wielopolski, J.-E. Moser, S. Nair, Y.-J. Yu, J.-H. Kim, K.-Y. Kay, Y.-S. Jung, K. B. Yoon, C. Graetzel, S. M. Zakeeruddin, M. Graetzel, *ChemSusChem* 2015, **8**, 3859-3868.
45. C. V. Kumar, D. Raptis, E. N. Koukaras, L. Sygellou, P. Lianos, *Org. Electron.* 2015, **25**, 66-73.
46. R. Y.-Y. Lin, T.-M. Chuang, F.-L. Wu, P.-Y. Chen, T.-C. Chu, J.-S. Ni, M.-S. Fan, Y.-H. Lo, K.-C. Ho, J. T. Lin, *ChemSusChem* 2015, **8**, 105-113.
47. S. Nagane, A. Ichake, I. Agrawal, A. Sadhanala, R. H. Friend, S. Ogale, P. P. Wadgaonkar, *ChemPlusChem* 2017, **82**, 280-286.
48. C. Zhang, S. Wang, Y. Li, *Sol. Energy* 2017, **157**, 94-102.
49. A. F. Buene, N. Uggerud, S. P. Economopoulos, O. R. Gautun, B. H. Hoff, *Dyes Pigm.* 2018, **151**, 263-271.
50. U. Eiamprasert, J. Sudchanham, P. Surawatanawong, P. Pakawatpanurut, S. Kiatisevi, *J. Photochem. Photobiol. A: Chem.* 2018, **352**, 86-97.
51. C.-T. Li, F.-L. Wu, C.-J. Liang, K.-C. Ho, J. T. Lin, *J. Mater. Chem. A* 2017, **5**, 7586-7594.
52. E. A. Yemene, V. Venkatraman, D. Moe Almenningen, H. B. Hoff, R. O. Gautun, *Molecules* 2020, **25**, 2349.
53. A. Slodek, D. Zych, G. Szafraniec-Gorol, P. Gnida, M. Vasylieva, E. Schab-Balcerzak, *Materials* 2020, **13**, 2292.
54. T. Hua, Z.-S. Huang, K. Cai, L. Wang, H. Tang, H. Meier, D. Cao, *Electrochim. Acta* 2019, **302**, 225-233.
55. N. Duvva, Y. K. Eom, G. Reddy, K. S. Schanze, L. Giribabu, *ACS Appl. Energy Mater.* 2020, **3**.
56. D. M. Almenningen, H. E. Hansen, M. F. Vold, A. F. Buene, V. Venkatraman, S. Sunde, B. H. Hoff, O. R. Gautun, *Dyes Pigm.* 2021, **185**, 108951.
57. K. E, M. S, P. S, R. R, S. Y. Chin, M. M. R. Khan, *Optik* 2020, **208**, 164046.
58. A. Slodek, D. Zych, S. Golba, S. Zimosz, P. Gnida, E. Schab-Balcerzak, *J. Mater. Chem. C* 2019, **7**, 5830-5840.
59. B. Nagarajan, A. C D, R. Elumalai, S. Chandran, D. Raghavachari, *J. Photochem. Photobiol. A: Chem.* 2021, **404**, 112820.
60. T. Khamrang, A. Seetharaman, M. D. Kumar, M. Velusamy, M. Jaccob, M. Ramesh, M. Kathiresan, A. Kathiravan, *J. Phys. Chem. C* 2018, **122**, 22241-22251.
61. Y. S. Yang, H. D. Kim, J.-H. Ryu, K. K. Kim, S. S. Park, K.-S. Ahn, J. H. Kim, *Synth. Met.* 2011, **161**, 850-855.
62. H. Wei, J. Shen, Y. Liu, T. Huang, Q. Zhang, J. Zhao, X. Zhao, *Dyes Pigm.* 2018, **149**, 789-795.
63. A. F. Buene, A. Hagfeldt, B. H. Hoff, *Dyes Pigm.* 2019, **169**, 66-72.
64. W. Wang, X. Li, J. Lan, D. Wu, R. Wang, J. You, *J. Org. Chem.* 2018, **83**, 8114-8126.
65. H. Wu, Z. Huang, T. Hua, C. Liao, H. Meier, H. Tang, L. Wang, D. Cao, *Dyes Pigm.* 2019, **165**, 103-111.
66. X. Qian, X. Wang, L. Shao, H. Li, R. Yan, L. Hou, *J. Power Sources* 2016, **326**, 129-136.
67. C. Teng, X. Yang, C. Yang, H. Tian, S. Li, X. Wang, A. Hagfeldt, L. Sun, *J. Phys. Chem. C* 2010, **114**, 11305-11313.
68. H. Tian, X. Yang, J. Cong, R. Chen, C. Teng, J. Liu, Y. Hao, L. Wang, L. Sun, *Dyes Pigm.* 2010, **84**, 62-68.
69. M.-H. Tsao, T.-Y. Wu, H.-P. Wang, I. W. Sun, S.-G. Su, Y.-C. Lin, C.-W. Chang, *Mater. Lett.* 2010, **65**, 583-586.
70. Z. Xie, A. Midya, K. P. Loh, S. Adams, D. J. Blackwood, J. Wang, X. Zhang, Z. Chen, *Prog. Photovolt: Res. Appl.* 2010, **18**, 573-581.
71. Y. J. Chang, P.-T. Chou, S.-Y. Lin, M. Watanabe, Z.-Q. Liu, J.-L. Lin, K.-Y. Chen, S.-S. Sun, C.-Y. Liu, T. J. Chow, *Chem.: Asian J.* 2012, **7**, 572-581.
72. M. Cheng, X. Yang, J. Zhao, C. Chen, Q. Tan, F. Zhang, L. Sun, *ChemSusChem* 2013, **6**, 2322-2329.

73. Z. Iqbal, W.-Q. Wu, H. Zhang, L. Han, X. Fang, L. Wang, D.-B. Kuang, H. Meier, D. Cao, *Org. Electron.* 2013, **14**, 2662-2672.
74. M. Marszalek, S. Nagane, A. Ichake, R. Humphry-Baker, V. Paul, S. M. Zakeeruddin, M. Grätzel, *RSC Adv.* 2013, **3**, 7921-7927.
75. J. Zhao, X. Yang, M. Cheng, S. Li, L. Sun, *J. Phys. Chem. C* 2013, **117**, 12936-12941.
76. G. B. Bodedla, K. R. J. Thomas, C.-T. Li, K.-C. Ho, *RSC Adv.* 2014, **4**, 53588-53601.
77. T. Duan, K. Fan, C. Zhong, W. Gao, X. Chen, T. Peng, J. Qin, *J. Photochem. Photobiol., A* 2014, **278**, 39-45.
78. Z.-S. Huang, H.-L. Feng, X.-F. Zang, Z. Iqbal, H. Zeng, D.-B. Kuang, L. Wang, H. Meier, D. Cao, *J. Mater. Chem. A* 2014, **2**, 15365-15376.
79. M. Mao, X.-L. Zhang, X.-Q. Fang, G.-H. Wu, S.-Y. Dai, Q.-H. Song, X.-X. Zhang, *J. Power Sources* 2014, **268**, 965-976.
80. M. Mao, X. Zhang, L. Cao, Y. Tong, G. Wu, *Dyes Pigm.* 2015, **117**, 28-36.
81. M. Mao, X.-L. Zhang, X.-Q. Fang, G.-H. Wu, Y. Ding, X.-L. Liu, S.-Y. Dai, Q.-H. Song, *Org. Electron.* 2014, **15**, 2079-2090.
82. J.-S. Ni, J.-H. You, W.-I. Hung, W.-S. Kao, H.-H. Chou, J. T. Lin, *ACS Appl. Mater. Interfaces* 2014, **6**, 22612-22621.
83. X.-F. Zang, Z.-S. Huang, H.-L. Wu, Z. Iqbal, L. Wang, H. Meier, D. Cao, *J. Power Sources* 2014, **271**, 455-464.
84. A. Baheti, K. R. Justin Thomas, C.-T. Li, C.-P. Lee, K.-C. Ho, *ACS Appl. Mater. Interfaces* 2015, **7**, 2249-2262.
85. A. Dessi, M. Calamante, A. Mordini, M. Peruzzini, A. Sinicropi, R. Basosi, F. Fabrizi de Biani, M. Taddei, D. Colonna, A. di Carlo, G. Reginato, L. Zani, *RSC Adv.* 2015, **5**, 32657-32668.
86. Z.-S. Huang, C. Cai, X.-F. Zang, Z. Iqbal, H. Zeng, D.-B. Kuang, L. Wang, H. Meier, D. Cao, *J. Mater. Chem. A* 2015, **3**, 1333-1344.
87. X. Liu, J. Long, G. Wang, Y. Pei, B. Zhao, S. Tan, *Dyes Pigm.* 2015, **121**, 118-127.
88. J.-S. Ni, W.-S. Kao, H.-J. Chou, J. T. Lin, *ChemSusChem* 2015, **8**, 2932-2939.
89. T. Bhim Raju, J. V. Vaghasiya, M. A. Afroz, S. S. Soni, P. K. Iyer, *Phys. Chem. Chem. Phys.* 2016, **18**, 28485-28491.
90. H.-H. Gao, X. Qian, W.-Y. Chang, S.-S. Wang, Y.-Z. Zhu, J.-Y. Zheng, *J. Power Sources* 2016, **307**, 866-874.
91. G. Koyyada, S. P. Singh, K. Bhanuprakash, L. Han, I. M. Bedja, R. K. Gupta, A. Islam, M. Chandrasekharam, *Energy Technol. (Weinheim, Ger.)* 2016, **4**, 458-468.
92. T. B. Raju, J. V. Vaghasiya, M. A. Afroz, S. S. Soni, P. K. Iyer, *Org. Electron.* 2016, **39**, 371-379.
93. Y. Wang, Z. Wan, C. Jia, X. Yao, *Synth. Met.* 2016, **211**, 40-48.
94. J. He, H. Pei, H. Li, S. Zhang, S. Zhang, H. Tan, Z. Hu, *Synth. Metals* 2019, **247**, 228-232.
95. Z.-S. Wu, X.-C. Song, Y.-D. Liu, J. Zhang, H.-S. Wang, Z.-J. Chen, S. Liu, Q. Weng, Z.-W. An, W.-J. Guo, *J. Power Sources* 2020, **451**, 227776.
96. R. Su, L. Lyu, M. R. Elmorsy, A. El-Shafei, *New J. Chem.* 2020, **44**, 2797-2812.
97. W. Wu, J. Yang, J. Hua, J. Tang, L. Zhang, Y. Long, H. Tian, *J. Mater. Chem.* 2010, **20**, 1772-1779.
98. J. Li, W. Wu, J. Yang, J. Tang, Y. Long, J. Hua, *Sci. China Chem.* 2011, **54**, 699-706.
99. R. Y. Y. Lin, T. C. Chu, P. W. Chen, J. S. Ni, P. C. Shih, Y. C. Chen, K. C. Ho, J. T. Lin, *ChemSusChem* 2014, **7**, 2221-2229.
100. X. Sun, Y. Wang, X. Li, H. Agren, W. Zhu, H. Tian, Y. Xie, *Chem. Commun.* 2014, **50**, 15609-15612.
101. T. Wei, X. Sun, X. Li, H. Agren, Y. Xie, *ACS Appl. Mater. Interfaces* 2015, **7**, 21956-21965.
102. X. Yang, J. Zhao, L. Wang, J. Tian, L. Sun, *RSC Adv.* 2014, **4**, 24377-24383.
103. S. H. Bae, K. D. Seo, W. S. Choi, J. Y. Hong, H. K. Kim, *Dyes Pigm.* 2015, **113**, 18-26.
104. Z. Iqbal, W.-Q. Wu, Z.-S. Huang, L. Wang, D.-B. Kuang, H. Meier, D. Cao, *Dyes Pigm.* 2016, **124**, 63-71.
105. D. Muenmart, N. Prachumrak, R. Tarsang, S. Namungruk, S. Jungsuttiwong, T. Sudyoadsuk, P. Pattanasattayavong, V. Promarak, *RSC Adv.* 2016, **6**, 38481-38493.
106. S.-G. Chen, H.-L. Jia, X.-H. Ju, H.-G. Zheng, *Dyes Pigm.* 2017, **146**, 127-135.
107. A. F. Buene, M. Christensen, B. H. Hoff, *Molecules* 2019, **24**, 4485.

108. R. M. El-Shishtawy, J.-D. Decoppet, F. A. M. Al-Zahrani, Y. Cao, S. B. Khan, M. S. Al-Ghamdi, B. G. Alhogbi, A. M. Asiri, S. M. Zakeeruddin, M. Grätzel, *New J. Chem.* 2018, **42**, 9045-9050.
109. M.-L. Han, Y.-Z. Zhu, S. Liu, Q.-L. Liu, D. Ye, B. Wang, J.-Y. Zheng, *J. Power Sources* 2018, **387**, 117-125.
110. H.-L. Jia, Z.-J. Peng, Y.-C. Chen, C.-Y. Huang, M.-Y. Guan, *New J. Chem.* 2018, **42**, 18702-18707.
111. X. Liao, H. Zhang, J. Huang, G. Wu, X. Yin, Y. Hong, *Dyes Pigm.* 2018, **158**, 240-248.
112. W. Yang, D. Cao, H. Zhang, X. Yin, X. Liao, J. Huang, G. Wu, L. Li, Y. Hong, *Electrochim. Acta* 2018, **283**, 1732-1741.
113. D. Unny, J. Sivanadanam, S. Mandal, I. S. Aidhen, K. Ramanujam, *J. Electrochem. Soc.* 2018, **165**, H845-H860.
114. S. Liu, Y. Jiao, Y. Ding, X. Fan, J. Song, B. Mi, Z. Gao, *Dyes Pigm.* 2020, **180**, 108470.
115. Z. Wan, C. Jia, L. Zhou, W. Huo, X. Yao, Y. Shi, *Dyes Pigm.* 2012, **95**, 41-46.
116. V. A. Chiykowski, B. Lam, C. Du, C. P. Berlinguette, *Chem. Commun.* 2017, **53**, 2547-2550.
117. V. A. Chiykowski, B. Lam, C. Du, C. P. Berlinguette, *Chem. Commun.* 2017, **53**, 2367-2370.
118. L. May, S. Daniel, T. J. J. Mueller, *Org. Chem. Front.* 2020, **7**, 329-339.
119. A. L. Capodilupo, E. Fabiano, L. De Marco, G. Ciccarella, G. Gigli, C. Martinelli, A. Cardone, *J. Org. Chem.* 2016, **81**, 3235-3245.
120. A. Saini, K. R. J. Thomas, C.-T. Li, K.-C. Ho, *J. Mater. Sci.: Mater. Electron.* 2016, **27**, 12392-12404.
121. G. Zhou, N. Pschirer, J. C. Schöneboom, F. Eickemeyer, M. Baumgarten, K. Müllen, *Chem. Mater.* 2008, **20**, 1808-1815.
122. W. Zhang, X. Dai, X. Liao, X. Zang, H. Zhang, X. Yin, C. Yu, C. Ke, Y. Hong, *Sol. Energy* 2020, **212**, 220-230.
123. H. S. Yang, Y. S. Yang, Y. S. Han, Y. C. Choi, D. K. Lee, K.-S. Ahn, J. H. Kim, *Mol. Cryst. Liq. Cryst.* 2011, **538**, 149-156.
124. G.-W. Huang, C.-T. Li, Y.-C. Chen, R.-J. Jeng, S. A. Dai, *Polymer* 2019, **179**, 121673.
125. W.-I. Hung, Y.-Y. Liao, T.-H. Lee, Y.-C. Ting, J.-S. Ni, W.-S. Kao, J. T. Lin, T.-C. Wei, Y.-S. Yen, *Chem. Commun.* 2015, **51**, 2152-2155.
126. C.-T. Li, Y.-L. Kuo, C. H. P. Kumar, P.-T. Huang, J. T. Lin, *J. Mater. Chem. A* 2019, **7**, 23225-23233.
127. H. J. Jo, J. E. Nam, D.-H. Kim, H. Kim, J.-K. Kang, *Dyes Pigm.* 2014, **102**, 285-292.
128. H. J. Jo, J. E. Nam, H. Heo, D. H. Kim, J. H. Kim, J. K. Kang, *J. Phys. Chem. C* 2018, **122**, 995-1002.
129. W.-I. Hung, Y.-Y. Liao, C.-Y. Hsu, H.-H. Chou, T.-H. Lee, W.-S. Kao, J. T. Lin, *Chem.: Asian J.* 2014, **9**, 357-366.
130. T. H. Nguyen, L. Q. Bao, S. Thogiti, R. Cheruku, K.-S. Ahn, J. H. Kim, *J. Nanosci. Nanotechnol.* 2017, **17**, 3181-3187.
131. X.-X. Dai, H.-L. Feng, Z.-S. Huang, M.-J. Wang, L. Wang, D.-B. Kuang, H. Meier, D. Cao, *Dyes Pigm.* 2015, **114**, 47-54.
132. M. G. Murali, X. Wang, Q. Wang, S. Valiyaveettil, *Dyes Pigm.* 2016, **134**, 375-381.
133. M. J. Cho, S. S. Park, Y. S. Yang, J. H. Kim, D. H. Choi, *Synth. Met.* 2010, **160**, 1754-1760.
134. G. B. Bodedla, K. R. J. Thomas, M.-S. Fan, K.-C. Ho, *Chem.: Asian J.* 2016, **11**, 2564-2577.
135. C.-H. Siu, L. T. L. Lee, P.-Y. Ho, C.-L. Ho, T. Chen, S. Suramitr, S. Hannongbua, Z. Xie, M. Wei, W.-Y. Wong, *Chem.: Asian J.* 2017, **12**, 332-340.
136. Y. Hong, J.-Y. Liao, J. Fu, D.-B. Kuang, H. Meier, C.-Y. Su, D. Cao, *Dyes Pigm.* 2012, **94**, 481-489.
137. X.-F. Zang, T.-L. Zhang, Z.-S. Huang, Z. Iqbal, D.-B. Kuang, L. Wang, H. Meier, D. Cao, *Dyes Pigm.* 2014, **104**, 89-96.
138. M. Chandrasekharam, G. Rajkumar, C. S. Rao, T. Suresh, P. Y. Reddy, *Synth. Met.* 2011, **161**, 1469-1476.
139. J. M. Park, C. Y. Jung, Y. Wang, H. D. Choi, S. J. Park, P. Ou, W.-D. Jang, J. Y. Jaung, *Dyes Pigm.* 2019, **170**, 107568.
140. C. Kim, H. Choi, S. Paek, J.-J. Kim, K. Song, M.-S. Kang, J. Ko, *J. Photochem. Photobiol., A* 2011, **225**, 17-25.
141. J. Jia, K. Cao, P. Xue, Y. Zhang, H. Zhou, R. Lu, *Tetrahedron* 2012, **68**, 3626-3632.
142. Z. Wan, C. Jia, Y. Duan, J. Zhang, Y. Lin, Y. Shi, *Dyes Pigm.* 2012, **94**, 150-155.
143. Z. Wan, C. Jia, Y. Duan, L. Zhou, J. Zhang, Y. Lin, Y. Shi, *RSC Adv.* 2012, **2**, 4507-4514.
144. Z. Wan, C. Jia, Y. Duan, L. Zhou, Y. Lin, Y. Shi, *J. Mater. Chem.* 2012, **22**, 25140-25147.
145. K. D. Seo, B. S. You, I. T. Choi, M. J. Ju, M. You, H. S. Kang, H. K. Kim, *ChemSusChem* 2013, **6**, 2069-2073.

146. S. Kumar, K. R. Justin Thomas, C.-T. Li, K.-C. Ho, *Org. Electron.* 2015, **26**, 109-116.
147. Z. She, Y. Cheng, L. Zhang, X. Li, D. Wu, Q. Guo, J. Lan, R. Wang, J. You, *ACS Appl. Mater. Interfaces* 2015, **7**, 27831-27837.
148. X. Qian, L. Lu, Y.-Z. Zhu, H.-H. Gao, J.-Y. Zheng, *RSC Adv.* 2016, **6**, 9057-9065.
149. N. V. Krishna, J. V. S. Krishna, S. P. Singh, L. Giribabu, L. Han, I. Bedja, R. K. Gupta, A. Islam, *J. Phys. Chem. C* 2017, **121**, 6464-6477.
150. P. S. Gangadhar, S. Gonuguntla, S. Madanaboina, N. Islavath, U. Pal, L. Giribabu, *J. Photochem. Photobiol. A: Chem.* 2020, **392**, 112408.
151. P.-P. Dai, Y.-Z. Zhu, Q.-L. Liu, Y.-Q. Yan, J.-Y. Zheng, *Dyes Pigm.* 2020, **175**, 108099.
152. F. Li, Y.-Z. Zhu, S.-C. Zhang, H.-H. Gao, B. Pan, J.-Y. Zheng, *Dyes Pigm.* 2017, **139**, 292-299.
153. H.-L. Jia, S.-S. Li, Z.-J. Peng, J. Zhao, B.-Q. Gong, M.-Y. Guan, H.-G. Zheng, F.-F. Xia, *Dyes Pigm.* 2020, **180**, 108454.
154. H. Tian, X. Yang, J. Cong, R. Chen, J. Liu, Y. Hao, A. Hagfeldt, L. Sun, *Chem. Commun.* 2009, 6288-6290.
155. J. Liu, X. Yang, J. Zhao, L. Sun, *RSC Adv.* 2013, **3**, 15734-15743.
156. K. M. Karlsson, X. Jiang, S. K. Eriksson, E. Gabrielsson, H. Rensmo, A. Hagfeldt, L. Sun, *Chem.: Eur. J.* 2011, **17**, 6415-6424.
157. H. Tian, I. Bora, X. Jiang, E. Gabrielsson, K. M. Karlsson, A. Hagfeldt, L. Sun, *J. Mater. Chem.* 2011, **21**, 12462-12472.
158. Y.-P. Hong, J.-Y. Liao, D.-R. Cao, X.-F. Zang, D.-B. Kuang, L.-Y. Wang, H. Meier, C.-Y. Su, *J. Org. Chem.* 2011, **76**, 8015-8021.
159. Y. Shan, J. Tang, H. Lai, H. Tan, X. Liu, F. Yang, Q. Fang, *Chin. J. Chem.* 2012, **30**, 1497-1503.
160. H. Tan, C. Pan, G. Wang, Y. Wu, Y. Zhang, Y. Zou, G. Yu, M. Zhang, *Org. Electron.* 2013, **14**, 2795-2801.
161. H. Tan, C. Pan, G. Wang, Y. Wu, Y. Zhang, G. Yu, M. Zhang, *Dyes Pigm.* 2014, **101**, 67-73.
162. J. He, H. Pei, H. Li, S. Zhang, S. Zhang, H. Tan, Z. Hu, *Synth. Met.* 2019, **247**, 228-232.
163. S. Ramkumar, S. Anandan, *RSC Adv.* 2013, **3**, 21535-21543.
164. W. Lee, J. Choi, J. W. Namgoong, S. H. Kim, K. C. Sun, S. H. Jeong, K. Yoo, M. J. Ko, J. P. Kim, *Dyes Pigm.* 2014, **104**, 185-193.
165. W. Lee, S. B. Yuk, J. Choi, H. J. Kim, H. W. Kim, S. H. Kim, B. Kim, M. J. Ko, J. P. Kim, *Dyes Pigm.* 2014, **102**, 13-21.
166. Y. Hong, Z. Iqbal, X. Yin, D. Cao, *Tetrahedron* 2014, **70**, 6296-6302.
167. J. H. Bae, S. J. Lim, J. Choi, S. B. Yuk, J. W. Namgoong, J. H. Ko, W. Lee, J. P. Kim, *Dyes Pigm.* 2019, **162**, 905-915.
168. G. Koyyada, S. P. Singh, K. Bhanuprakash, L. Han, I. M. Bedja, R. K. Gupta, A. Islam, M. Chandrasekharam, *Energy Technol.* 2016, **4**, 458-468.
169. M. Mao, Q.-S. Li, X.-L. Zhang, G.-H. Wu, C.-G. Dai, Y. Ding, S.-Y. Dai, Q.-H. Song, *Dyes Pigm.* 2017, **141**, 148-160.
170. Y. Wu, Q. Zhang, J. Li, X. Tian, D. Li, X. Lu, B. Xu, Y. Wu, K. Guo, *J. Mater. Chem. C* 2019, **7**, 1974-1981.