

# Spectroscopic Properties of Phthalocyanines with Different Ligands and Metallic Nuclei

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Phthalocyanines (Pcs) are aromatic macromolecules non-natural occurrence, which presents an extensive conjugated  $\pi$  system (18  $\pi$  electron). Pcs exhibit unique properties and may be applied in different scientific areas<sup>1</sup>, such as photodynamic therapy (PDT). Nature of substituents on the Pcs rings and of metallic nuclei cause great influence in spectroscopic properties<sup>2</sup>.

In this work, seven compounds were compared in tetrahydrofuran (THF), changing the peripheral substituents and metallic nuclei, such as: Zinc Phthalocyanine (**ZnPc-1**), metil Pc (**2**), metil Zn Pc (**3**), metil AlCl Pc (**4**), t-butil Pc (**5**), t-butil Zn Pc (**6**) and t-butil AlCl Pc (**7**).

**Table 1.** Spectroscopic parameters for standard (**ZnPc-1**) and studied compounds (**2-7**) in THF.

Compound	$\Phi_F$	<sup>a</sup> $\tau_{F1}$	<sup>a</sup> $\tau_{F2}$	$\tau_{F(average)}$	$X^2$	<sup>b</sup> $K_F$ (s <sup>-1</sup> ) (x10 <sup>8</sup> )	$\Phi_A$
1 (ZnPc)	0.18	3.41 (100)	0.02	3.41	0.970	0.53	0.53 <sup>c</sup>
2	0.23	0.63	5.74 (100)	5.74	1.062	0.40	0.18
3	0.22	0.13	3.30 (100)	3.30	1.016	0.67	0.48
4	0.27	0.22	6.05 (100)	6.05	1.031	0.49	0.18
5	0.27	5.53 (100)	0.62	5.53	1.060	0.49	0.16
6	0.19	0.36	3.25 (100)	3.25	1.006	0.58	0.53
7	0.32	0.74	6.29 (100)	6.29	1.028	0.51	0.26

<sup>a</sup> Abundances shown in brackets. <sup>b</sup>  $K_F$  is the rate constant for fluorescence. Values calculated using  $K_F = \Phi_F / \tau_{F(average)}$ . <sup>c</sup> Data from Ref. <sup>3</sup>

The  $\Phi_F$  values increased when compared substituted Pc complexes with **ZnPc-1**. Complex **4** and **7** presented the highest values. The  $\tau_F$  values change drastically with changing metallic nuclei. These results show the metal effects of Pcs on their  $\tau_F$ . Unsubstituted and substituted zinc Pcs show the highest  $\Phi_A$  values. Compound **7** shows higher  $\Phi_A$  value than **4**, which may indicate the influence of the ligands.

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