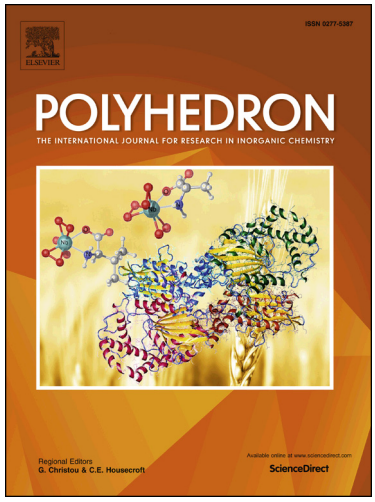

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PII: S0277-5387(18)30177-3
DOI: https://doi.org/10.1016/j.poly.2018.04.010
Reference: POLY 13111

To appear in: *Polyhedron*

Received Date: 6 January 2018
Accepted Date: 3 April 2018

Please cite this article as: M. Tsuchimoto, M. Ookusa, S. Itoh, M. Watanabe, K. Nakajima, Solvent dependence of the emission intensities in photoluminescent mononuclear europium(III) complexes with tetradentate Schiff base ligands, *Polyhedron* (2018), doi: https://doi.org/10.1016/j.poly.2018.04.010

Solvent dependence of the emission intensities in photoluminescent mononuclear europium(III) complexes with tetradentate Schiff base ligands

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Abstract

Mononuclear tetradentate Schiff base–europium(III) complexes with different counter cations, X[Eu(3,5-Clsalen)$_2$] {X = $(C_2H_5)_3NH^+$, $(C_2H_5)_4N^+$, K^+; H_2(3,5-Clsalen): *N*,*N*′-bis-3,5-dichlorosalicylideneethanediamine}, were prepared and photoluminescence properties of the europium(III) complexes in organic solvents (CH_3CN, DMSO, DMF, $(CH_3)_2CO$, CH_3OH, *N*-methylformamide (NMF), CH_2Cl_2) were investigated. All the emission spectra of the complexes displayed similar emission spectral patterns based on the f–f transitions by excitation with 365 nm in the solvents. In contrast, the emission intensities of the complexes varied greatly in the different solvents. All the complexes X[Eu(3,5-Clsalen)$_2$] {X = $(C_2H_5)_3NH^+$, $(C_2H_5)_4N^+$, K^+} displayed strong emission intensities in polar aprotic solvents (ϕ = 0.24–0.42 in CH_3CN, DMF, DMSO, and $(CH_3)_2CO$), and weak emission intensities in polar protic solvents (ϕ = 0.052–0.10 in CH_3OH and NMF) at 298 K. The emission intensities of $(C_2H_5)_3NH$[Eu(3,5-Clsalen)$_2$] and $(C_2H_5)_4N$[Eu(3,5-Clsalen)$_2$] in CH_2Cl_2 at 298 K are significantly different (ϕ = 0.016 for $(C_2H_5)_3NH$[Eu(3,5-Clsalen)$_2$] and ϕ = 0.19 for $(C_2H_5)_4N$[Eu(3,5-Clsalen)$_2$]). Mononuclear yttrium(III) and gadolinium(III) complexes X[Y(3,5-Clsalen)$_2$] and X[Gd(3,5-Clsalen)$_2$] {X = $(C_2H_5)_3NH^+$, $(C_2H_5)_4N^+$} were prepared. X-ray crystal structure analysis of $(C_2H_5)_3NH$[Gd(3,5-Clsalen)$_2$] was performed. Measurements of the ^{1}H and ^{13}C NMR spectra of the