Photoluminescent sensor based on Eu-doped Ca-MOF for detection of Cr (III) and Cr (VI)

Indira Daniela Pineda Hernandez¹, BRAULIO SILVA BARROS², JOANNA ELZBIETA KULESZA², Antonio Marcos Urbano de Araujo³, Arthur Felipe de Farias Monteiro¹, Ana Karina Pereira Leite⁴

¹UNIVERSIDADE FEDERAL DE PERNAMBUCO (Quimica Fundamental) , ²UNIVERSIDADE FEDERAL DE PERNAMBUCO, ³Universidade Federal do Rio Grande do Norte (Instituto de Quimica) , ⁴Universidade Federal do Rio Grande do Norte (Química)

e-mail: indira.pineda@ufpe.br

Lanthanide-based MOFs have been proven successful in the detection of volatile organic compounds, small molecules and ionic species [1]. The present work explores the use of \{Ca(1,4-BDC)(DMF)·3(H₂O)\} doped with Eu³⁺ as a sensor for Cr(III) and Cr(VI) in aqueous solution based on luminescence quenching effect. The Cr (VI) is highly toxic to human health and environment while the Cr(III) in high concentrations causes DNA damage and gene mutation [2]. Thus, it becomes essential to investigate and develop new low-cost and safe sensory mechanisms and devices for these ions. The Eu-doped Ca-MOF was synthesized by a sonochemical route and characterized by X-ray diffraction (XRD), Fourier-Transform infrared (FTIR), thermogravimetry (TG), and photoluminescence spectroscopy (PL). XRD and FTIR results confirmed the crystallization of a single MOF phase. The PL emission spectra confirmed the presence of Eu³⁺ ions in the produced sample. The characteristic \(^{5}D \rightarrow ^{7}F_J\) \((J = 1, 2, 3, 4)\) transitions of Eu³⁺ ions were observed. Luminescent titration spectra of an aqueous MOF emulsion with the addition of various concentrations of Cr(III) or Cr(VI) were acquired. The intensity of the Eu³⁺ transitions decreased as Cr(VI), and Cr(III) concentrations increase, suggesting that this MOF is sensitive to these ions. Furthermore, the excitation spectra revealed the existence of two broadband of low and high energy. The low energy band was suppressed entirely when just a small concentration of Cr(VI) was added, what may be used for the identification of this chromium species.

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References
