A novel electrochemiluminescence sensor based on an $\text{Ru}(\text{bpy})_3^{2+}$ - Eu_2O_3 - nafion nanocomposite and its application in the detection of diphenhydramine

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doi: 10.20964/2017.06.56

Received: 26 December 2016 / Accepted: 8 April 2017 / Published: 12 May 2017

An ultrasensitive solid-state electrochemiluminescence (ECL) sensor based on the efficient and stable enhancement of tris-(bipyridine)ruthenium(II) ($\text{Ru}(\text{bpy})_3^{2+}$) by diphenhydramine (DPH) in a carbon paste electrode has been developed. The ECL intensity was found to be correlated to the concentration of DPH. Incorporation of europium oxide (Eu_2O_3) nanoparticles in the carbon paste electrode (CPE) led to the development of the novel ECL sensor. Eu_2O_3 showed attractive sensitizing effects for the $\text{Ru}(\text{bpy})_3^{2+}$ -DPH electrochemiluminescence system. Under optimized conditions, the linear response of the ECL intensity to DPH concentration was in the range of 1.0×10^{-9} to 1.25×10^{-7} mol/L ($R^2 = 0.998$) with a detection limit (S/N=3) of 3.0×10^{-10} mol/L and a relative standard deviation (RSD) of 4.1%. The evaluations proved the method as being very sensitive, selective and simple. The sensor was also used in the analysis of DPH concentration in serum and urine specimens.

Keywords: Diphenhydramine, Carbon paste, Soli-state, Electrochemiluminescence, Europium oxide

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