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Determination of hydrazine hydrate in water using electrochemiluminescence of $Ru(bpy)_3^{2+}$

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Hydrazine is a man-made chemical and is not found in natural and well waters. However, it should be noted that hydrazine hydrate is a very common industrial chemicals employed, and hydrazine exhibits intense water absorbability. Being an efficient chemical treatment, hydrazine is employed to scavenge small amounts of dissolved oxygen that are not removed by mechanical aeration for high-pressure boilers, due to its advantage over sulfite in not producing any dissolved solids in the boiler water. Hydrazine is highly toxic and dangerously unstable, especially in the anhydrous form. Hydrazine can damage the liver, kidneys, and central nervous system. It may also cause steatosis, nausea, pulmonary edema and seizures. In addition, hydrazine is a probable human carcinogen with a 10^{-6} risk level of 10 ng/L in drinking water. Limit tests for hydrazine in pharmaceuticals suggest that it should be in the low ppm range. It will be a great challenge to develop a simple but reliable detection method for a rapid and sensitive determination of hydrazine at trace levels in drinking water. Considering of the basic properties and also the two nitrogen atoms in the structure, hydrazine hydrate was employed to be an amine additive candidate, to build a $Ru(bpy)_3^{2+}$/hydrazine electrochemiluminescence (ECL) system, and ECL of Ru(bpy)32+ has been employed for the determination of hydrazine hydrate. The result demonstrated that the logarithmic ECL increasing ($\Delta ECL = ECL_{\text{after addition of hydrazine}} - ECL_{\text{before addition of hydrazine}}$) versus the logarithmic concentration of hydrazine hydrate is linear over a concentration range 1.0×10^{-9}–1.0×10^{-5} mol/L, on both GC and Pt electrodes in a pH 9 phosphate buffer. The hydrazine hydrate detection limit was down to 1.0×10^{-9} mol/L, comparatively lower than other detection methods. To check its applicability, the proposed method was applied to the determination of hydrazine hydrate added into a tap water sample with good reproducibility and stability. All these provide a possibility to develop a novel ECL detection method for hydrazine in water.

Biography

Fengyu Liu is a teacher of School of Chemistry, Dalian University of technology. She has published more than 20 papers in reputed journals.

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