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催化H₂O₂氧化2,3,4,9-四氢-9-羟基-1,10-蒽醌固体基质室温磷光猝灭法测定痕量砷

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摘要 基于2,3,4,9-四氢-9-羟基-1,10-蒽醌(R)在醋酸纤维素膜固体基质上能出发强而稳定的固体基质室温磷光; α,α'-联吡啶可活化As(V)催化H₂O₂氧化R转化为无磷光化合物(R'); 导致固体基质室温磷光急剧猝灭;

据此建立了催化H₂O₂氧化2,3,4,9-四氢-9-羟基-1,10-蒽醌固体基质室温磷光猝灭法测定痕量砷的新方法.

在最佳条件下; As(V)的含量在1.60~160 fg/斑 (浓度范围0.0040~0.40ng/mL, 0.4μL点样量)

范围内与磷光强度ΔI_p值符合比尔定律; 工作曲线的回归方程为ΔI_p = 20.46 + 0.5492C_{As(V)} (fg/斑); n = 6, 相关系数r =

0.9995; 检出限为0.27fg/斑(对应As(V)浓度为6.8 × 10⁻¹³g·mL; n=11). 对0.0040和0.40ng·mL As(V)分别进行11

次的测定; 其RSD为3.0%与2.7%. 同时讨论了催化固体基质室温磷光猝灭机理. 本文还报道了R的合成; 并借助

¹HNMR、IR、MS和元素分析确定了其结构.

关键词 砷 磷光 α,α'-联吡啶, 蒽醌

分类号

Determination of Trace Arsenic by Solid Substrate-Room Temperature Phosphorescence Quenching Method Based on the Catalyzed Reaction of H₂O₂ Oxidizing 9-Hydroxy-2,3,4,9-tetrahydro-1,10-anthraquinone

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Abstract A new solid substrate-room temperature phosphorescence (SS-RTP) quenching method for the determination of trace As(V) has been developed, based on the facts that 9-hydroxy-2,3,4,9-tetrahydro-1,10-anthraquinone (R) can emit intense and stable SS-RTP on solid substrate, and α,α'-dipyridyl can activate As(V) catalysis of the reaction of H₂O₂ oxidizing R to non-phosphorescence compound R', which can cause the sharp quenching of SS-RTP. Under the optimum condition, the relationship between the ΔI_p of the emitting intensity and 1.60—160 fg·spot⁻¹ As(V) (corresponding concentration: 0.0040—0.40 ng·mL⁻¹, sample volume: 0.4 μL·spot⁻¹) conformed to Beer' law. The regression equation of working curve can be expressed as ΔI_p = 20.46 + 0.5492c_{As(V)} (fg·spot⁻¹) (r = 0.9995, n = 6). The limit detection (LD) is 0.27 fg·spot⁻¹ [As(V) corresponding concentration: 6.8 × 10⁻¹³ g·mL⁻¹, n = 11]. The samples containing 0.0040 and 0.40 ng·mL⁻¹ As(V) were repeatedly determined for 11 times. RSD are 3.0% and 2.7% respectively. The SS-RTP mechanism was also discussed. R was synthesized in this paper. Meanwhile, the structure was determined by NMR, IR, mass spectra and elemental analysis.

Key words arsenic phosphorescence α,α'-dipyridyl anthraquinone

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