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Design of novel 3D flower-like neodymium molybdate: An efficient and challenging catalyst for sensing and destroying pulmonary toxicity antibiotic drug nitrofurantoin(Article)

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Abstract

The extensive use of antibiotic drug (Nitrofurantoin; NFT) in pharmaceuticals and food producing animals may cause severe threats to both human health and animals. Besides, the residues of NFT can found or discharged into soil, rivers, lakes and local ground water can also cause serious health risks to living things. Therefore, rapid and highly selective detection as well as the removal of NFT from the foodstuff and water samples is very important concern. In the present study, we designed a novel 3D flower-like neodymium molybdate ($Nd_2Mo_3O_9$; NdM) catalyst by simple sol–gel route and evaluated for its bifunctional catalytic activity for the electrochemical detection and photodegradation of NFT for the first time. Moreover, the physicochemical properties of NdM were scrutinized by various analytical and spectroscopic techniques. The NdM modified screen printed carbon electrode (SPCE) showed an excellent electrocatalytic activity towards NFT with wide linear ranges (0.1–21 μM; 28–481 μM), lower detection limit (16 nM) and excellent selectivity in the existence of potentially co-interfering compounds (nitro group containing drugs; other nitro aromatic and biological compounds). Besides, the NdM modified SPCE was successfully applied to the real sample analysis in NFT oral suspension, water and urine samples, and the obtained recovery are well-satisfactory. Interestingly, the UV–visible spectroscopy results envisage that NdM could act as a superior photocatalyst which degrades above 99% of NFT solution under visible light irradiation. The trapping experiments revealed that hydroxyl radicals ([rad]OH) played the major role in the photodegradation process. These results suggested that the NdM is a more auspicious material for the degradation and determination of NFT, which creates it a novel and suitable candidate for the applications in electrocatalysis and photocatalysis. © 2018 Elsevier B.V.

Author keywords

Antibiotic drug | Electrocatalysis | Neodymium molybdate | Nitrofurantoin | Photocatalysis

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