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In Situ Synthesis, Characterization, and Catalytic Performance of Polypyrrole Polymer-Incorporated Ag_2MoO_4 Nanocomposite for Detection and Degradation of Environmental Pollutants and Pharmaceutical Drugs(Article)

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Abstract

Material combinations of semiconductor with conducting polymer are gaining growing interest due to their enhanced activities in photocatalysis as well as electrochemical sensing. In this present work, we report a facile in situ synthesis of polypyrrole (PPy) polymer-incorporated silver molybdate (Ag_2MoO_4) nanocomposite that is utilized as a photocatalyst and electrocatalyst for the degradation of pollutant heavy metals, namely, methylene blue (MB) and heavy metal (Cr(VI)), and ciprofloxacin (CIP) and for detection of the drug, azomycin. The synthesized nanocomposite was characterized by various theoretical, spectral, and microscopic studies. Matching of the powder X-ray diffraction pattern with JCPDS no. 76-1747 confirmed the formation of α-Ag_2MoO_4/PPy. The surface topography and spherical morphology of the nanocomposite were studied using field emission-scanning electron microscopy and transmission electron microscopy. Fourier transform infrared spectral detail expounds the smooth incorporation of PPy to Ag_2MoO_4. The as-synthesized nanocomposite performs as an efficient photocatalyst in the degradation of MB (99.9%), Cr(VI) (99%), and CIP drug (99.8%) within 10 min. In addition to this, the Ag_2MoO_4/PPy-modified glassy carbon electrode (GCE) demonstrated excellent electrocatalytic activity in terms of a higher cathodic peak current and lower peak potential when compared with other modified and unmodified GCEs for the detection of azomycin. The Ag_2MoO_4/PPy/GCE displayed a broader linear response range and lower detection limit of 0.5-499 μM and 65 nM, respectively. Moreover, other potentially co-interfering compounds, such as a similar functional group-containing biological substances and inorganic species, have no interference effect toward azomycin sensing.

Author keywords

Ag_2MoO_4/PPy azomycin CIP Cr(VI) electrochemical sensing in situ synthesis MB short-term degradation

Indexed keywords

Engineering controlled terms: Aromatic compounds Conducting polymers Electrocatalysts Electrochemical sensors Field emission microscopes Glass membrane electrodes Heavy metals High resolution transmission electron microscopy Nanocomposites Pollution detection Polypyrroles Scanning electron microscopy Silver compounds Topography

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EMTREE medical terms: catalysis; chemistry; pollutant

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2 nitroimidazole, 527-73-1; ciprofloxacin, 85721-33-1; methylene blue, 61-73-4; molybdenum, 7439-98-7; molybdic acid, 11116-47-5, 14259-85-9, 7782-91-4; polypyrrole, 30604-81-0; silver, 7440-22-4;

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