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Design of novel solar-light driven sponge-like $Fe_2V_4O_{13}$ photocatalyst: A unique platform for the photoreduction of carcinogenic hexavalent chromium(Article)

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Abstract

In past days, the occurrence of toxic heavy metal ions into the water and soil environment causes a major health risk to the living organisms. In this work, we mainly focused on the photoreduction of hexavalent chromium (Cr^{6+}) using novel sponge-like $Fe_2V_4O_{13}$ photocatalyst under visible light irradiation. The sponge-like $Fe_2V_4O_{13}$ was tailored through hydrothermal process using ferric chloride and sodium metavanadate precursors without the addition of any templates. The surface morphology, elemental analysis and various physical properties are characterized by numerous spectroscopic techniques. Interestingly, the sponge-like $Fe_2V_4O_{13}$ demonstrated proficient photocatalytic performances towards the reduction of Cr^{6+} into Cr^{3+}. The obtained UV–visible spectroscopy results portrayed that sponge-like $Fe_2V_4O_{13}$ could reduce above of Cr^{6+} solution within 40 min. The effect of operational reaction parameters such as catalyst dosage, initial Cr^{6+} concentration and pH of the solution was optimized. Moreover, the sponge-like $Fe_2V_4O_{13}$ holds very good stability even after five consecutive cycles. This study could open new insights for the design novel nanostructured binary metal oxides for environmental applications.

Author keywords

Binary metal oxide | Hexavalent chromium | Photocatalyst | Solar light

Indexed keywords

Engineering controlled terms: Biology | Chlorination | Chlorine compounds | Chromium compounds | Health risks | Heavy metals | Iron compounds | Light | Metal ions | Morphology | Photocatalysts | Spectroscopic analysis | Surface morphology

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