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TiO₂/PKSAC functionalized with Fe₃O₄ for efficient concurrent removal of heavy metal ions from water

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ABSTRACT

An effective material to assist in the elimination of heavy metal contaminants in the water system is necessary, as they persist for a long period in the environment. A novel multifarious TiO₂/PKSAC/Fe₃O₄ composite with combined properties namely adsorption, photocatalytic and magnetic was successfully synthesized and applied for the simultaneous removal of mixed heavy metals, Pb(II), Cu(II), and Ni(II) under various conditions. Characterisations confirmed the fabrication of TiO₂/PKSAC/Fe₃O₄ composite. An optimal adsorbent dosage of 0.9 g/L allowed >80% removal efficiency in 10 ppm of mixed metal ions solution. Among all three catalyst ratios, the equivalent mass ratio of 1:1:1 (TiO₂/PKSAC/Fe₃O₄) demonstrated the best performance (>72%) in removing Pb(II), Cu(II), and Ni(II) ions, even after the addition of coexisting ions (Ca²⁺, Na⁺, Cl⁻, Br⁻) during the treatment. A recycling study confirmed the materials' regenerative stability. The fabricated TiO₂/PKSAC/Fe₃O₄ composite can be applied as an effective material for heavy metals removal in wastewater.