

Removal of Cr(VI) from Wastewater by Hexagonal Boron Nitride-Magnetite Nanocomposites: Kinetics, Mechanism and LCA Analysis

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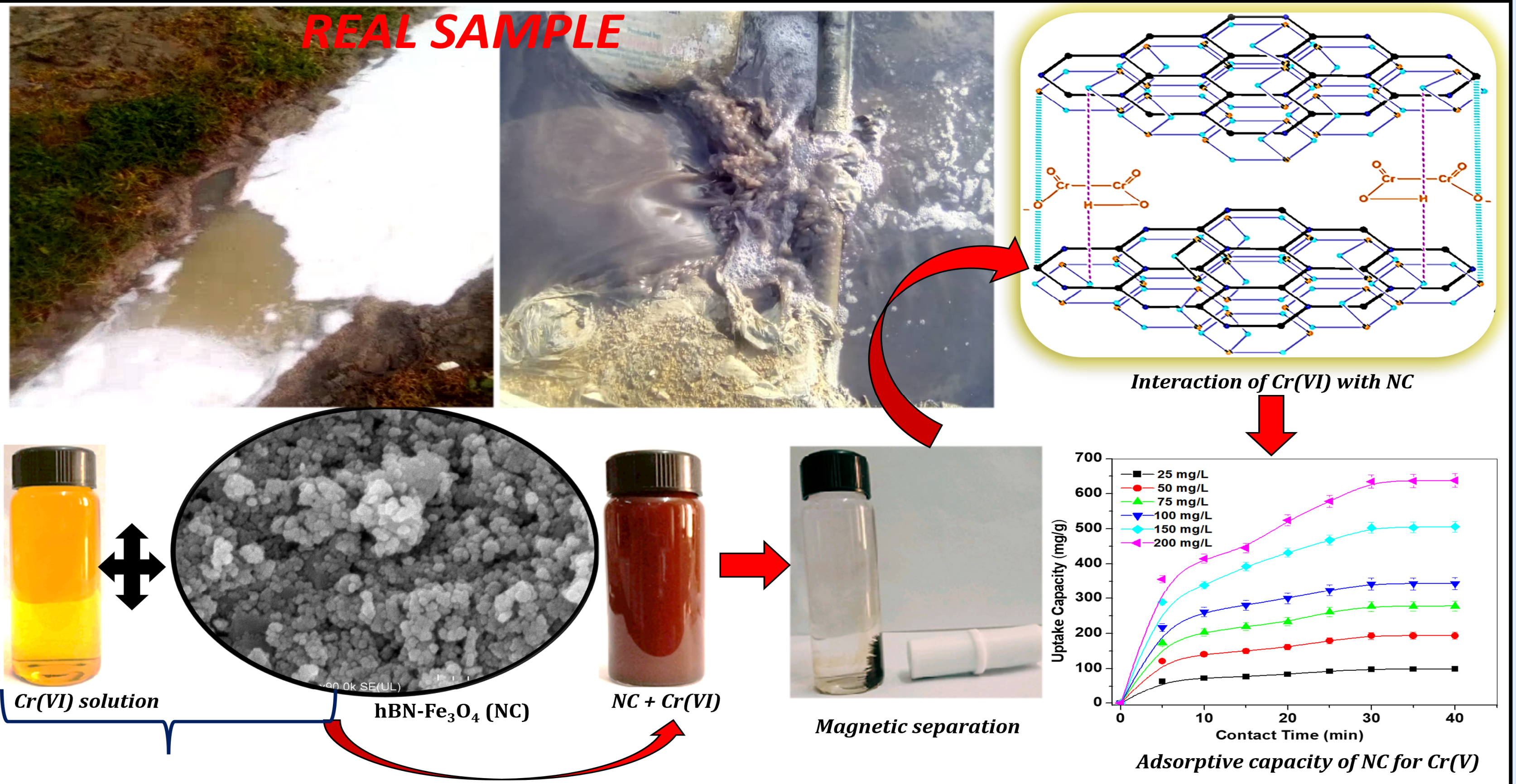
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Abstract:
Hexagonal boron nitride (hBN)-magnetite (Fe₃O₄) nanocomposites (hBN-Fe₃O₄ NCs) were prepared through *in situ* coprecipitation *via* the green route using Callistemon citrinus (CC) and used as adsorbents for the removal of Cr(VI) ions from aqueous solution. The synthesized hBN-Fe₃O₄ NC was characterized by X-ray diffraction, energy-dispersive X-ray (EDX) spectroscopy and field emission scanning electron microscopy (FE-SEM). When hBN-Fe₃O₄ NC was used as an adsorbent for removing Cr(VI) ions from K₂Cr₂O₇ solution, the results showed a very high removal efficiency, almost 100% at low pH. The maximum adsorption capacity was estimated as 208.6 mg/g at 50 °C. A life cycle analysis of the NC production process was also conducted.

Objective:



The present study reports the Callistemon citrinus (Bottlebrush) leaf extract-assisted synthesis of a magnetite (Fe₃O₄)-boron nitride composite for hexavalent chromium removal in an aqueous solution. The fabricated nanocomposite was used to investigate the effect of various experimental factors on Cr(IV) adsorption.

Results:

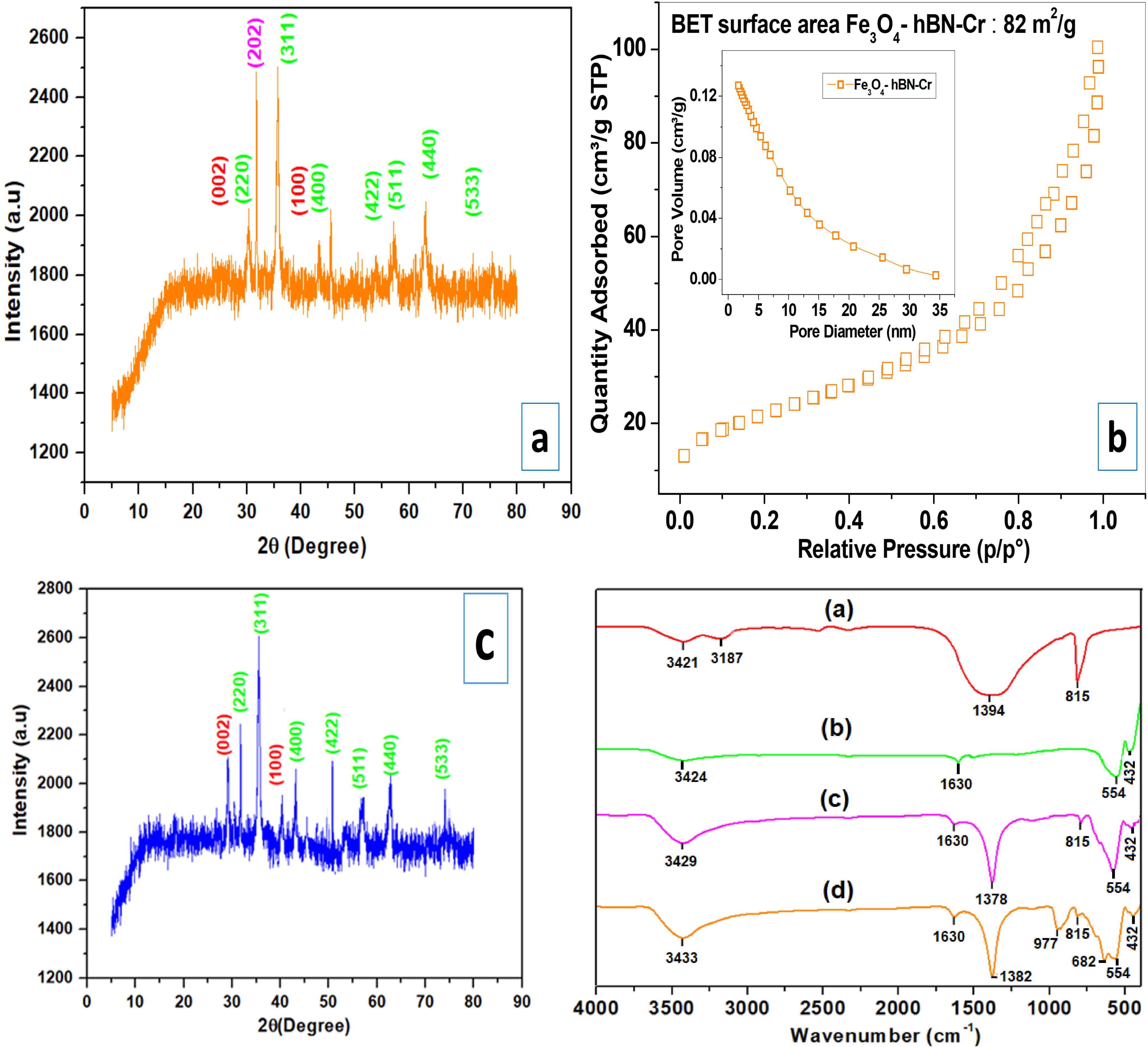


Figure 1. XRD patterns of the synthesized nanomaterial Cr(VI) loaded NC; b) BET surface area and pore size distribution (inset) for Cr(VI) loaded NC; c) (c) hBN-Fe₃O₄; FTIR spectra of the synthesized nanomaterials.

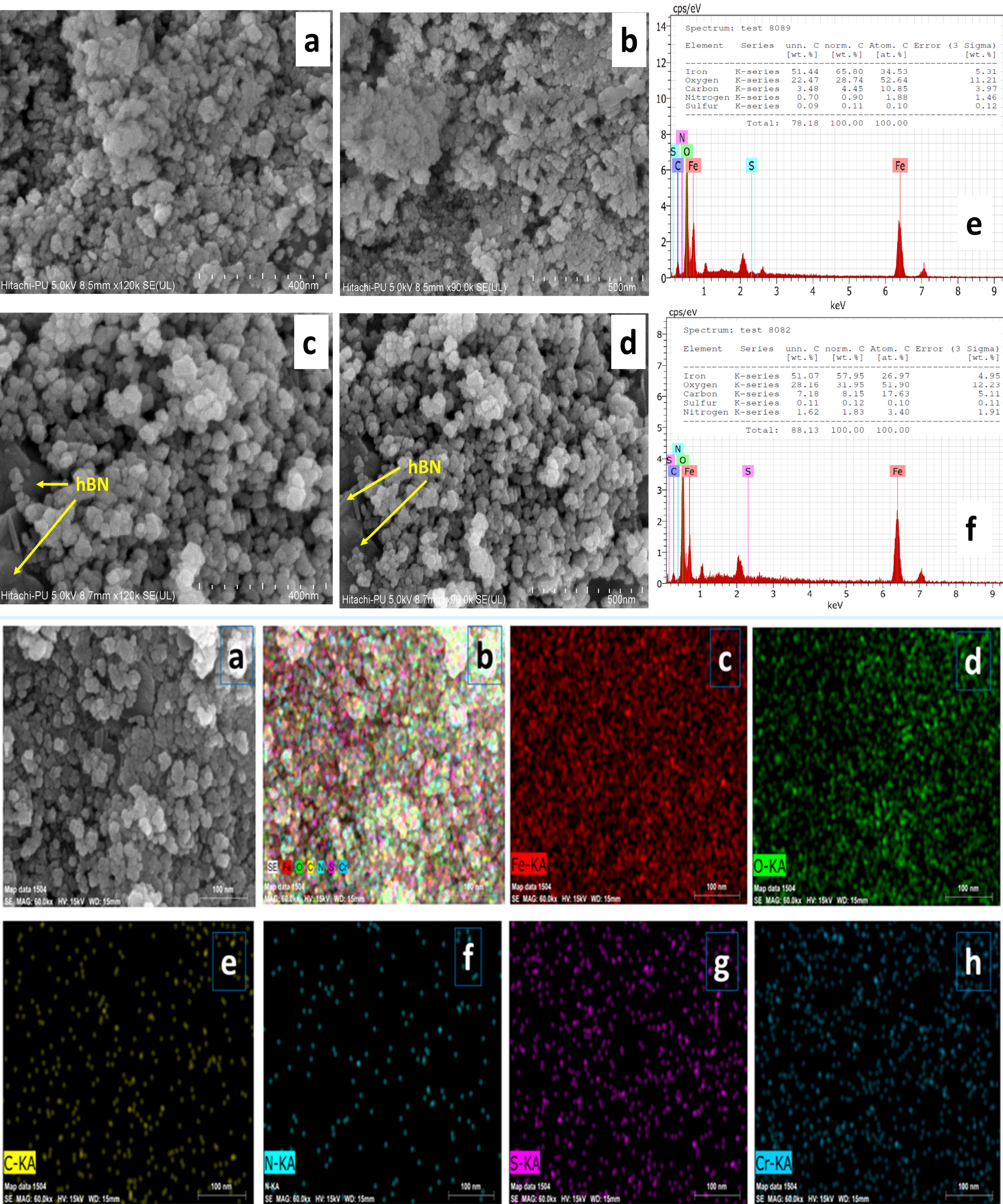


Figure 2. FE-SEM images of 1) micrographs of synthesized material 2) elemental mapping of Cr(VI) loaded NC.

Conclusions:

The hBN-Fe₃O₄ NC is an effective material for the removal of Cr(VI) from waste water.