

Cellulose-Derived Adsorbent for Effective Chromium and Iron Ion Removal from Water: Preparation, Characterization, and Performance Assessment

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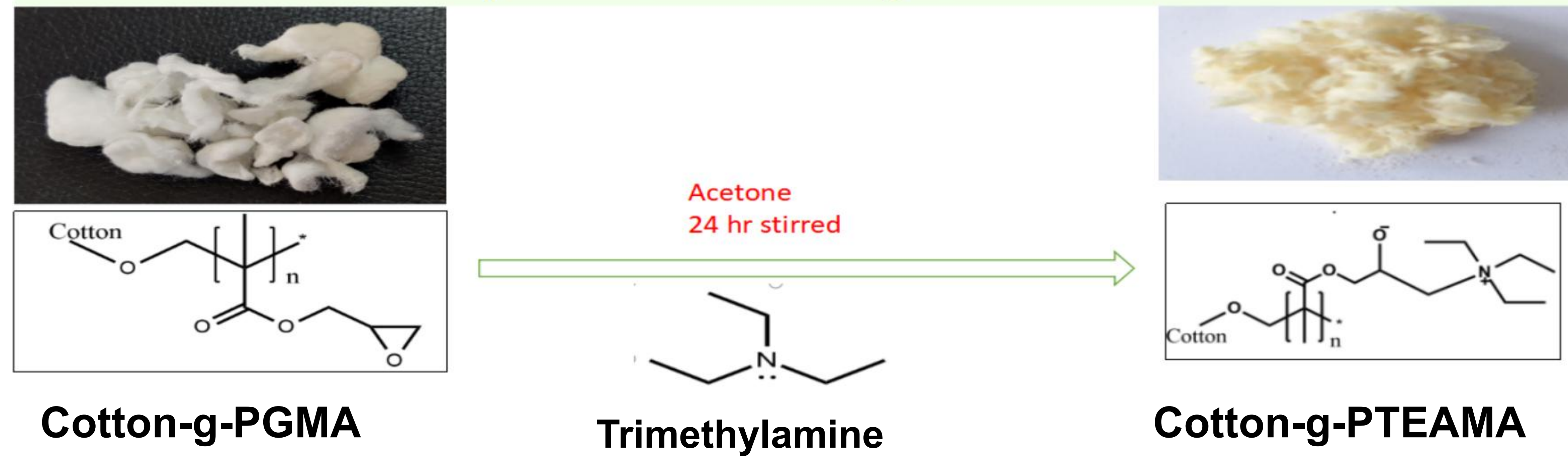
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Abstract

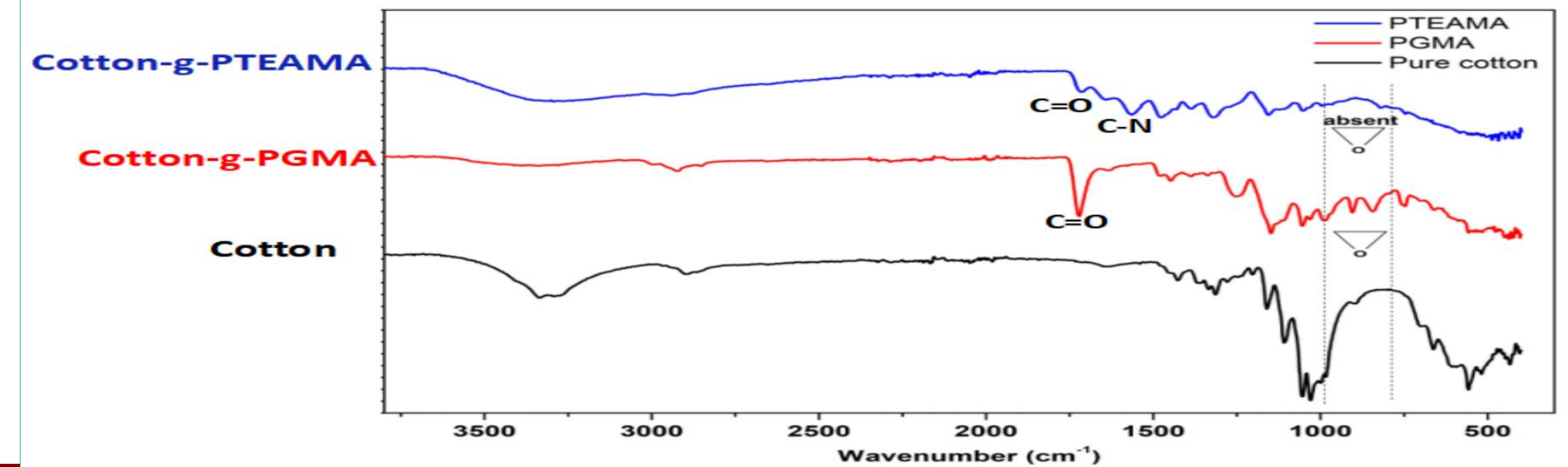
In this study, Cotton-g-PTEAMA was prepared by grafting triethylamine (TEA) onto poly glycidyl methacrylate (PGMA) cotton, to remove heavy metals namely Fe and Cr from wastewater. The successful synthesis of cotton-grafted-Polytriethylaminemethacrylate (Cotton-g-PTEAMA) was confirmed by Fourier-transform infrared spectroscopy (FTIR). The adsorption behaviour of Cotton-g-PTEAMA toward s Fe and Cr from contaminated water were studied at different pH, times, and metal concentrations. The obtained data were fitted to different models of adsorption kinetics and adsorption isotherms. The adsorption rate of metals showed good fitting to the pseudo-first-order kinetic model for both Fe and Cr, and the adsorption reached equilibrium within 60 min. The isotherm studies indicated that the obtained data showed good fitting to the Freundlich model for Fe and Langmuir model for Cr. The maximum adsorption capacities of Fe and Cr were 12.68, and 34.72 mg g⁻¹, respectively. Regeneration experiments indicated that the adsorbent maintained 80% efficiency even after five adsorption/desorption cycles.

Synthesis & Characterization

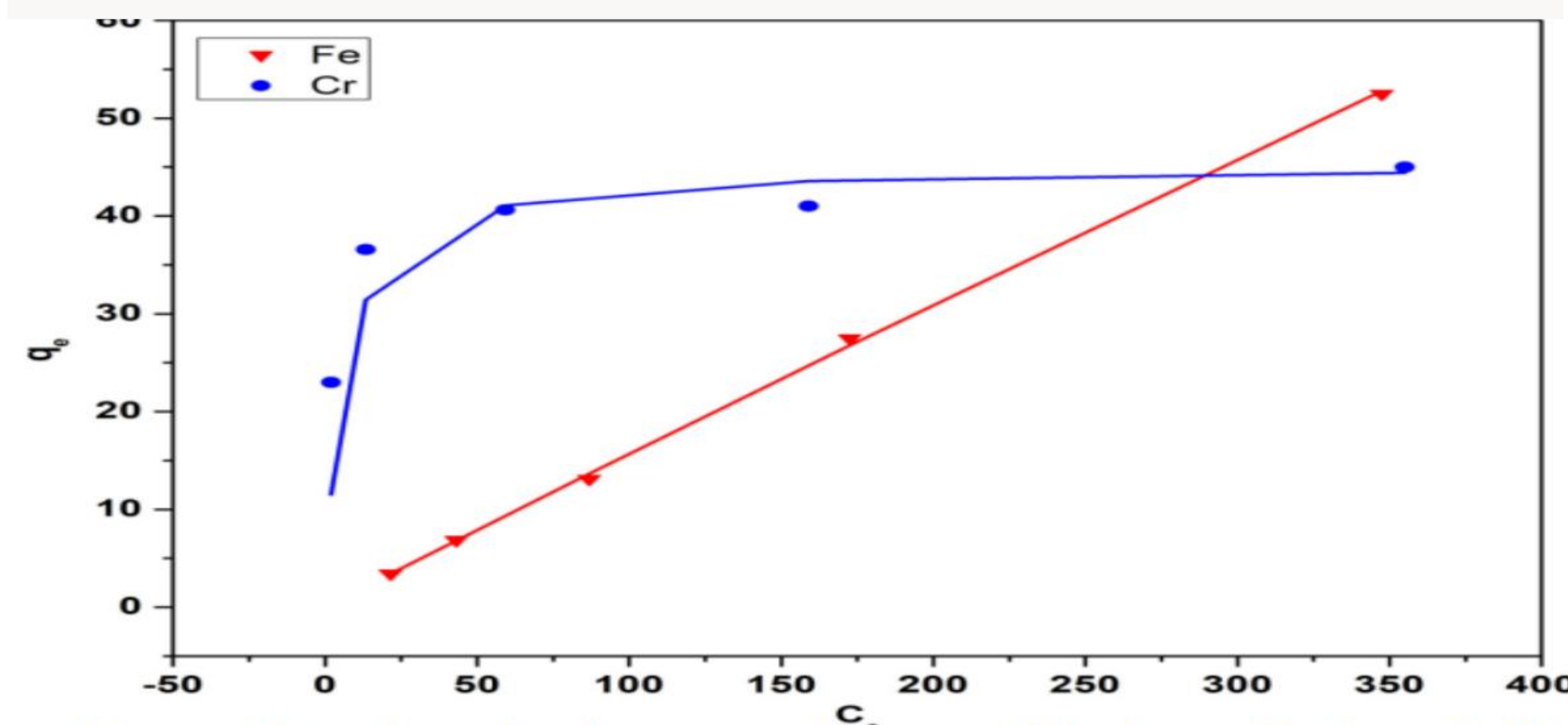
Synthesis of Cotton-g-PTEAMA



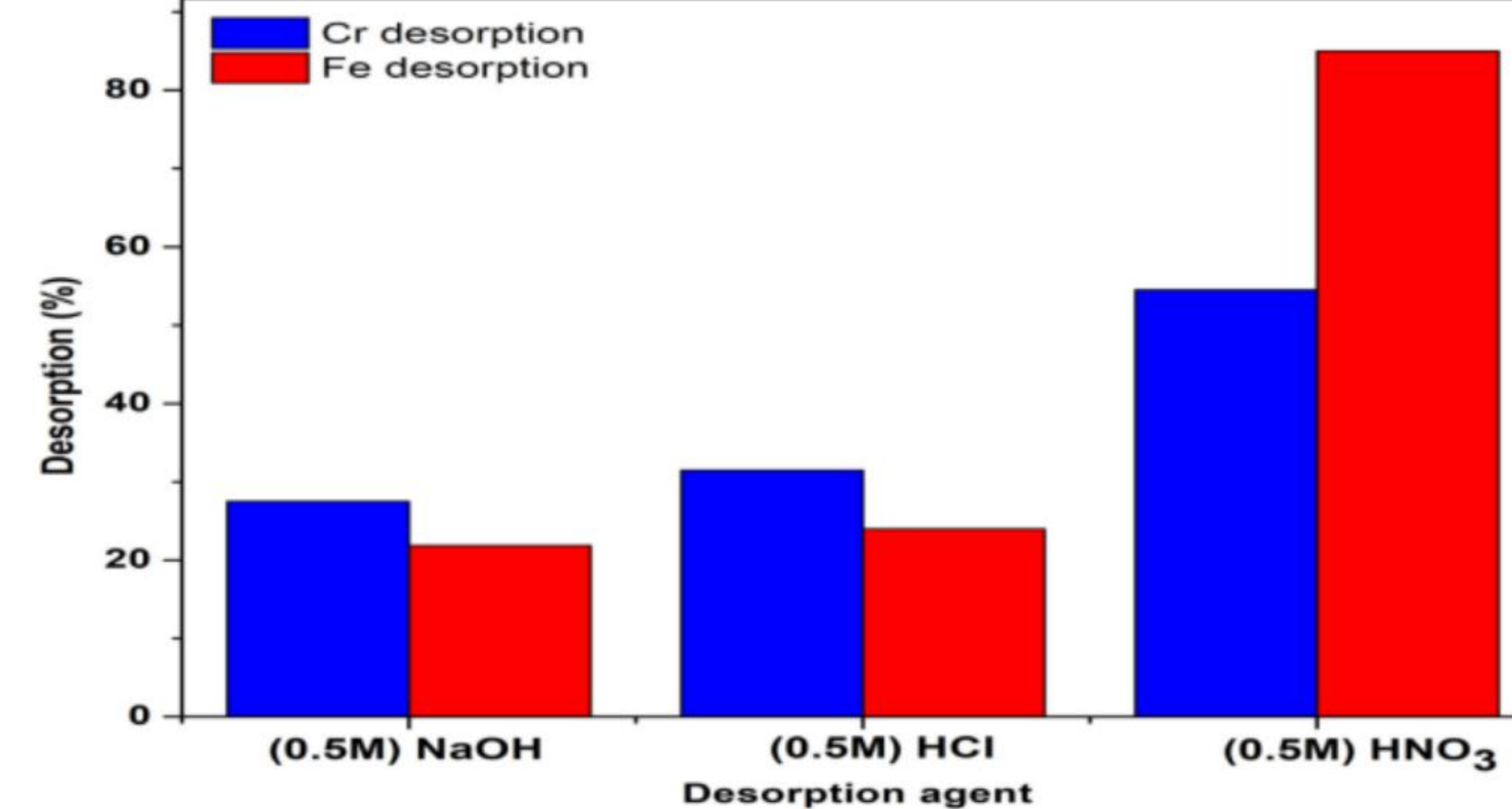
FT-IR data of Cotton-g-PTEAMA



Adsorption of Fe, Cr metals by Cotton-g-PTEAMA



Desorption of Fe, Cr by Cotton-g-PTEAMA



Conclusion

- Biodegradable adsorbent successfully synthesized via polymer grafting.
- Synthesized bio-based adsorbent showed promising efficiency for removal of Cr and Fe metals from aqueous solution through adsorption
- These bio-based adsorbent also showed promising efficiency for the treatment of industrial waste water by adsorbing these metals.
- The adsorbent's improved adsorption capacity, high regeneration potential, and biodegradability make it an appealing alternative for industrial applications.



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