22nd Iranian Chemistry Conference, 23-25 August, 2023
University of Kurdistan

Synthesis of MXene/MIL-101 nanocomposite high adsorption capacity for Methylene blue dye removal

Saeideh Eslaminejad,[a] Rahmatollah Rahimi[b]* and Maryam Fayazi[c]

[a] *Department of inorganic chemistry, Faculty of Chemistry, Iran University of Science and Technology, Tehran, Iran*

[b] *Department of Inorganic Chemistry, Faculty of Chemistry, Iran University of Science and Technology, Tehran, Iran*

[c] *Department of Environment, Institute of Science and High Technology and Environmental Sciences, Graduate University of Advanced Technology, Kerman, Iran*

[*] *E-mail: rahimi_rah@iust.ac.ir*

Water is an essential resource for life, but the increase in population and industrialization has led to contamination of natural water resources [1]. Therefore, water purification is an essential need for society, and researchers are constantly looking for new and efficient methods of water purification [2]. One of the common and useful techniques employed for removal of synthetic dyes from industrial effluents is an adsorption process [3].

In this study, novel MXene/MIL-101 nanocomposite synthesized through the solvothermal method and characterized by x-ray diffraction (XRD), infrared spectroscopy (IR), and field-emission scanning electron microscopy (FESEM) analyses. Pollutant adsorption tests were conducted over Methylene blue (MB) dye as an organic pollutant. The maximum equilibrium adsorption capacity was 23.18 mg g^{-1} with MB dye having an initial concentration of 50 mg L^{-1}. Langmuir isotherm model was the best fit for adsorption data based on linear regression analysis. The best kinetic model for the adsorption was pseudo-second-order kinetics (R^2 = 0.999). The effect of dye concentration, contact time and MOF dose on the adsorption of dye was also investigated. The study showed that MXene/MIL-101 is an efficient adsorbent for the removal of MB dye from aqueous solution. Therefore, MXene/MIL-101 nanocomposite could be regarded as a promising adsorbent for the removal of dye pollutants due to its high adsorbent activity, good reusability, and easy preparation. MXene/MIL-101 nanocomposite can be reused at least four times.

Keywords: MIL-101, MXene, solvothermal, nanocomposite, Methylene blue.

References

[1] X. Ma, Z. Deng, Z. Li, D. Chen, X. Wan, X. Wang, and X. Peng, *Journal of Materials Chemistry A*, **2020**, 8(43), 22728-22735.
[2] J. Li, H. Wang, X. Yuan, J. Zhang, and J. W. Chew, *Coordination Chemistry Reviews*, **2020**, 404, 213116.
[3] M.Yang, and Q. Bai, *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, **2019**, 582, 123795.