

ABSTRACT

Environmental contamination by heavy metals, especially Ag(I) ions, is a serious concern due to their toxicity. One effective and eco-friendly approach to mitigate this problem is adsorption using porous and ion-exchange materials. In this study, GO/Zeolite composites with varying SiO₂/Al₂O₃ ratios (2, 5, and 10) were synthesized and evaluated as adsorbents for Ag(I) ion removal and as antifungal agents. The zeolites were prepared via a hydrothermal method, while GO was synthesized using the modified Hummers method. The GO/Zeolite composites (2:1) were optimized for Ag(I) adsorption using Response Surface Methodology (RSM) with a Box–Behnken Design, focusing on three kind of variable which are concentrations (25, 75, 125 ppm), pH (2, 4, 6), and contact time (10, 35, 60 min). FTIR, XRD, AAS, and SEM–EDX analyses confirmed the characteristics of the zeolite types (NaA, NaY, and NaP) and the presence of GO ($2\theta = 11.17^\circ$). The results demonstrated an Ag(I) adsorption efficiency of approximately 98% for all GO/Zeolite variants (GO/Z2, GO/Z5, GO/Z10) under optimal conditions (125 ppm, pH 6, 35 min). Antifungal activity against *Aspergillus niger* using the agar well diffusion method revealed inhibition zone diameters of 11.84, 12.55, and 11.54 mm for GO/Z2, GO/Z5, and GO/Z10, respectively. In conclusion, the GO/Zeolite composites have significant potential as both heavy metal adsorbents and antifungal agents, offering a promising material for managing Ag(I) contamination and controlling fungal growth.

Keywords: GO/Zeolite, Ag(I) adsorption, Response Surface Methodology, antifungal activity, *Aspergillus niger*