ABSTRACT

Wastewater containing dye pollutants is a major environmental challenge in the industrial era. Membrane filtration is considered a promising solution due to its high selectivity and eco-friendly properties. Graphene oxide (GO), rich in oxygen-containing groups, is often blended with polyvinyl alcohol (PVA) to improve permeability. However, fouling still reduces efficiency and shortens membrane lifespan. To address this, self-cleaning additives such as Isoreticular Metal-Organic Framework-3 (IRMOF-3), known for photocatalytic activity, were incorporated into PVA/GO membranes. In this study, GO was synthesized by a modified Hummer's method, while IRMOF-3 was prepared via precipitation. Composite membranes were fabricated by vacuum filtration on nylon supports and characterized using UV-Vis, FTIR, XRD, SEM-EDX, and UV-Vis DRS. Porosity and pore size were evaluated by the gravimetric method and Guerout–Elford–Ferry equation. The results confirmed the successful incorporation of IRMOF-3 with GO and PVA, yielding multifunctional surfaces with diverse active sites. IRMOF-3 showed a band gap of 2.83 eV with indirect transitions. Compared with GO and PVA/GO, PVA/GO/IRMOF-3 membranes exhibited higher porosity, smaller pore radii, and superior rejection stability. Notably, membranes containing 10 mg and 30 mg IRMOF-3 achieved rejection rates of 87.75% and 83.72% after five cycles, outperforming GO (67.55%) and PVA/GO (74.88%). These findings demonstrate the potential of IRMOF-3 to enhance self-cleaning and sustain dye removal efficiency in wastewater treatment.

Keywords: *membrane filtration, graphene oxide (GO), polyvinyl alcohol (PVA), IRMOF-3, self-cleaning*