Poster

Efficient Nickel and Cobalt Recovery by Metal–Organic Framework based Mixed Matrix Membranes (MMM-MOFs)

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The electric vehicle rechargeable battery market has seen a substantial boost due to the green energy transition. This surge has sparked a high demand for raw materials such as cobalt and nickel, both vital constituents in lithium-ion batteries (LIBs) [1]. However, the current mining protocols and the concentrated localization of these ores have transformed cobalt and nickel into mineral puzzles [2]. Shortages in their supply threaten to hinder the progress of the renewable energy transition. In this study, our aim is to advance sustainable recycling practices for valuable metals found in lithium-ion batteries (LIBs) and wastewater [3]. We investigate the efficiency of four mixed matrix membranes (MMMs) incorporating different organic frameworks (Fig. 1), **MIL-53(Al)**, **MIL-53(Fe)**, **MIL-101(Fe)** and {$Ca^{II}Cu^{II}$ [(S,S)-serimox] (OH) (H O)}.39H O **(SrCu Ser)** embedded in polyether sulfone (PES). Our focus is on recovering cobalt (II) and nickel (II) metal cation from mixed cobalt-nickel aqueous solutions containing common interfering ions. While the neat PES membrane slightly contributes to the adsorption of metal ions, the inclusion of MOFs in the polymeric matrix substantially improves the adsorption performances. The four **MOF@PES MMMs** efficiently remove these metals from water, with the **MIL-53(Al)@PES** being the one that presents higher removal efficiencies. Remarkably, the MOF@PES MMMs containing **SrCu$_6$Ser** exhibit outstanding selectivity towards cobalt (II) cations in front of nickel (II) ones. Overall, the remarkable efficiencies, versatility, high environmental robustness, and cost-effective synthesis, shown by this family of MOF@PES MMMs situate them among the best adsorbents for the extraction of this kind of contaminant.

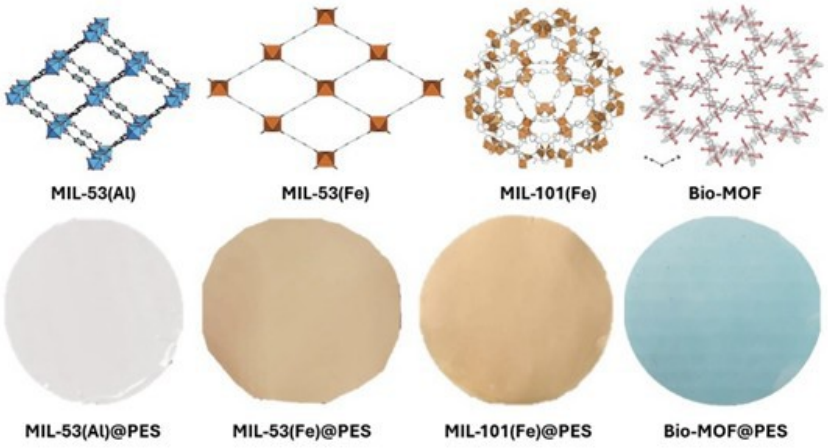

Figure 1. The top row views of the three-dimensional structures of different MOFs. The bottom row shows photographs of MOF mixed matrix membranes.

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