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Adsorptive Membrane for Hemodialysis: Potential, Future Prospection and Limitation of MOF as Nanofillers

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Abstract : The field of membrane materials is the most dynamic due to the constantly evolving requirements advancement of materials, to address challenges such as biocompatibility, protein-bound uremic toxins, blood coagulation, auto-immune responses, oxidative stress, and poor clearance of uremic toxins. Hemodialysis is a membrane filtration processes that is currently necessary for daily living of the patients with ESRD. Tens of millions of people with ESRD have benefited from hemodialysis over the past 60–70 years, both in terms of safeguarding life and a longer lifespan. Beyond challenges associated with the efficiency and separative properties of the membranes, ensuring hemocompatibility, or the safe circulation of blood outside the body for four hours every two days, remains a persistent challenge. This review explores the ongoing field of metal–Organic Frameworks (MOFs) and their applications in hemodialysis, offering a comprehensive examination of various MOFs employed to address challenges inherent in traditional hemodialysis methodologies. this This review included includes the experimental work done with various MOFs as a filler such as UiO-66, HKUST-1, MIL-101, and ZIF-8, which together lead to improved adsorption capacities for a range of uremic toxins and proteins. Furthermore, this review highlights how effectively MOF-based hemodialysis membranes remove a variety of uremic toxins, including p-cresol, urea, creatinine, and indoxyl sulfate and potential filler choices for the future. Future research efforts should focus on refining synthesis techniques, enhancing toxin selectivity, and investigating the long-term durability of MOF-based membranes. With these considerations, MOFs emerge as transformative materials in the quest to develop advanced and efficient hemodialysis technologies, holding the promise to significantly enhance patient outcomes and redefine the landscape of renal therapy.

Keywords : membrane, hemodailysis, metal organic frameworks, seperation, protein adsorbtion
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