Chapter 4
Innovative GO Membranes:
An Insight Into the Fabrication and Wastewater Treatment

Saurav Kumar Maity
Guru Gobind Singh Indraprastha University, India

Uplabdhi Tyagi
Guru Gobind Singh Indraprastha University, India

Krishna Kumar
https://orcid.org/0009-0001-9707-3155
Guru Gobind Singh Indraprastha University, India

Gulshan Kumar
https://orcid.org/0000-0001-8953-7100
Guru Gobind Singh Indraprastha University, India

ABSTRACT

Traditional membrane technologies often suffer from limitations such as fouling, limited selectivity, and insufficient durability under harsh operating conditions. GO-based membranes, in this regard, offer a promising solution to these challenges due to their exceptional properties. This chapter provides a comprehensive exploration of GO membranes, emphasizing their transformative role in industrial wastewater treatment. The discussion extends to advanced fabrication techniques, innovations in scaling production, and the challenges encountered in the process. Strategies to enhance membrane performance and address issues like fouling are also examined, alongside the environmental and economic benefits of GO membranes, including

DOI: 10.4018/979-8-3373-0669-8.ch004

their potential for carbon reduction and cost-effectiveness. Lastly, the chapter concludes with future perspectives, outlining emerging trends, interdisciplinary approaches, and recommendations for advancing GO membrane technology toward widespread industrial adoption, ultimately contributing to sustainable and efficient wastewater management.

1. INTRODUCTION

The growing urbanization, industrialization, and agriculture have created a serious concern about water contamination. The paramount importance of water to all living organisms can never be over-emphasized. The availability of safe and adequate water is critically important for human health, agriculture, industry, and the possibility of sustainable economic development (Fida et al., 2023). Water-containing pollutants are regarded as a serious threat, as they can spread diseases like cholera, dysentery, typhoid, and chronic gastrointestinal diseases, at worst even leading to death, especially among children and the elderly. Other than human health, aquatic contamination is also indeed terrible because it affects the normal operation of the ecosystems, destroying biodiversity and impairing nature (A. Shah et al., 2023). Further, contaminants like heavy metals (Hg, Cd, Pb, Cr) and pesticides can bio-accumulate in live organisms, hence leading to the process of bioaccumulation and biomagnification that increases toxicity in the food chain. Therefore, it calls for efficient management of the contaminated water through integrated waste management that should be beneficial to the health of humans and at the same restore ecological integrity (Sarker et al., 2023).

In this regard, numerous methods have been devised for the reclamation of water from contamination, involving processes such as distillation, membrane filtration, ion exchange, and adsorption. All these technologies are based on factors like energy requirements, resource availability, levels of contamination, and financial issues. Therefore, the development of efficient, economical, versatile, and most importantly energy-efficient technology for treating wastewater is the need of the hour (Solayman et al., 2023). Membrane technology, in this regard, has evolved as one of the most effective solutions to address the problem of contaminated water, this process involves the water passing through a barrier that prevents the transfer of undesirable substances while allowing only the water molecules through it. The contaminants are separated by means of filters, size exclusion, Donnan exclusion, sorption, and diffusion, depending upon a specific application (Q. Wang et al., 2023). This concept of utilizing membranes for separation processes has received much development since the very beginning of the 20th century. The latter half, however, came with a number of essential innovations that have made the technology core of the modern

Successive Spin-Correlated Local Processes Underlying the Magnetism in Diluted Magnetic Semiconductors and Related Magnetic Materials

Antonis N. Andriotisand Madhu Menon (2016). *Computational Approaches to Materials Design: Theoretical and Practical Aspects (pp. 13-27).*
www.irma-international.org/chapter/successive-spin-correlated-local-processes-underlying-the-magnetism-in-diluted-magnetic-semiconductors-and-related-magnetic-materials/156825