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Polymer-based nanocomposite membranes for industrial wastewater treatment: A review

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ABSTRACT

The demand for freshwater consumption has outpaced the rapid population growth, urbanization, and industrialization. Polymer nanocomposite plays an effective role in minimizing various environmental issues, including wastewater pollution. Integrating newly generated novel nanomaterials has sparked revolutionary and advantageous innovative nanotechnologies for industrial wastewater treatment. Nanomaterials have been used to create very effective materials for environmental applications, piquing the interest of academia and business worldwide. Additionally, improvements in polymer nanocomposite materials' characteristics have opened a wide range of industrial applications. Because they enhance membrane transport properties and offer exceptional stability under various operational conditions, polymer nanocomposites play a vital role in membrane materials. As a result, nanocomposite membranes are a new class of membranes made at the nanoscale from organic and inorganic polymeric materials. They are believed to perform better than traditional membranes. The present study reviewed the synthesis of polymer-based nanocomposite membrane technologies and the implementation of the polymer-based nanocomposite membrane in wastewater treatment. Furthermore, the review concentrated on patents related to cutting-edge polymer nanocomposites utilized in environmental applications. The inquiry also examined the thermodynamics of polymer blends, specifically focusing on their material transport and solubility. Besides, the physicochemical properties of the polymer-based nanocomposite membranes and their interaction with wastewater treatment were also reviewed in the present study.

1. Introduction

In recent years, water desalination, ultrapure water production, and industrial wastewater treatment have all been areas where membrane separation technologies have been seen as one of the most effective means of addressing water quality and shortage [1]. The availability of clean water is steadily declining, resulting in a severe and persistent crisis [2]. One of the major issues in sustaining modern society is ensuring adequate water resources of high quality for varied defined applications [3]. Membrane technology has enormous promise for wastewater treatment due to its small size, low energy consumption, and low initial cost [4]. Currently, the use of environmentally friendly methods in membrane research is crucial for commercial use. The development of a nanofiltration (NF) membrane using an

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