UNIVERSITI TEKNOLOGI MARA
Cawangan Terengganu
Kampus Bukit Besi

TITLE:

PRELIMINARY CHEMICAL PROPERTIES STUDY ON ADDITION OF TITANIUM DIOXIDE NANOPARTICLES INTO POLYSULFONE SUBSTRATE FOR DESALINATION APPLICATION

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2024

AUTHOR'S DECLARATION

"I hereby declare that this Final Year Project report is my original work and has been carried out under the supervision of Sir Mohd Haikal Mustafa"

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ABSTRACT

Water is essential for all living things, especially for human consumption. In some organisms, up to 90% of their body weight comes from water, and up to 60% of the human adult body is water. However, only potable water can be consumed by humans to survive. For example, water plays an important role in regulating the body temperature through respiration and sweating to maintain human health. In order to fulfill the need for freshwater, a finding suggested using the new technology of the desalination process and reverse osmosis (RO) to treat contaminants like seawater. Nanoparticles will be added to the thin layer of polysulfone (PSF) membrane properties to enhance attractiveness. The addition of titanium dioxide (TiO_2) significantly shows an improvement in the thin film of membranes toward salt rejection and anti-fouling properties compared to the (PSF) membrane without nanoparticle addition. Furthermore, the single layer of thin film nanocomposite is also important during the fabrication process to test the water permeability and effectiveness of the membrane through oxidation and chemical testing. A previous study from the Malaysian Journal of Industry Technology (MJIT 2021) shows an average of 98.28% salt rejection from the (PSF) membrane with the application of (TiO_2). Moreover, (TiO_2) nanoparticles improved the membrane structure and overall performance of the membrane in desalination and RO process application. In conclusion, the addition of nanoparticles to the membrane indeed increases salt rejection and anti-fouling to overcome the water crisis.

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BACKGROUND

1.1 INTRODUCTION

Water is considered one of the most important nutrients for human consumption, especially for drinking water. By 2050 the world population is expected to reach 9.8 billion [1]. Together with this the demand for freshwater also increases driven by the need for the seawater treatment process which is desalination and reverse osmosis. Seawater is one of the potential water sources to be treated besides other wastewater. About 97.5% of the water on Earth is seawater [2]. This incredible quantity of seawater is widely available and almost a limitless resource. Therefore, applying advanced desalination and reverse osmosis technologies can convert seawater into fresh water to meet the demands.

Humans need to use clean water as a resource for human health. There are several critical importance of clean water to humans and the environment which increases the oxygen level in the body and reduces the risk of waterborne diseases. The use in agriculture sectors and cleaning sectors requires to use of clean water [3]. This also follows the sustainability Development Goal (SDG) number 6 target to ensure access to clean water and sanitation for well-being. The World Health Organization (WHO) establishes a series of water quality guidelines, such as for drinking water and wastewater safe use. Since 2004, the Guidelines for drinking water quality have promoted the framework for safe drinking water, which is based on risk management [4].

Thus, most work technologies the desalination application and reverse osmosis have been introduced to remove the impurities and produce fresh water for dealing with the water crisis. Desalination is also related to membrane technologies by using the nanoparticle which is Titanium Dioxide (TiO_2) due to its lower toxic concentration and effective rejection ability [5]. Over the past 50 years, desalination has become the selected operation to fulfill the clean water supplies with an expected 95 million cubic meters of fresh water produced per day by the 20,000 desalination plants worldwide [6].