SCHOOL OF CHEMICAL ENGINEERING

COLLEGE OF ENGINEERING

TITLE: INVESTIGATION OF CHEMICAL PROPERTIES BETWEEN SINGLE AND DOUBLE LAYER POLYSULFONE SUBSTRATE MEMBRANE FOR DESALINATION PROCESS

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AUTHOR'S DECLARATION

I hereby declare that the work in this report is my own except for quotations and summaries which have been duly acknowledged. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

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ABSTRACT

Nowadays, earth population continues to grow and having limited freshwater resources. As the population continues to grow, the demand for freshwater will increase significantly. Research shows renewable sources such as oceans can offer an alternative source of potable water through desalination process using reverse osmosis. Based on previous studies, membrane technology is a preferred method used for water treatment due to its efficiency, low energy consumption, resistance to high pH and harsh chemicals, their ability to remove water pollutants and simple operation. For this study, polysulfone was used for desalination due to its salt rejection properties and chemical stability. Polysulfone membranes were fabricated with a mixture of 15% polysulfone (PSf), 5% polyvinylpyrrolidone (PVP), and 84.5% N-methyl-2-pyrrolidone (NMP). In this study, acid, base and oxidation agent are used to evaluate the performance and stability of the polysulfone substrate. The acid, base and oxidation agents used in this study was 1M Sulfuric acid (H_2SO_4), 1M Sodium hydroxide (NaOH), and 0.5M Potassium permanganate ($KMnO_4$). Based on the experiment, it was observed that the substrate has no change for both single layer and double layer in acid and base condition. It is because polysulfone membrane has strong properties against acid and base, good chemical stability and can tolerate a wide pH range. But for oxidation agents, it damages both single layer and double layer substrates and make it less durable. It is because $KMnO_4$ is more reactive than acid and alkali. Enhancing its ability to damage polysulfone substrates. In conclusion, this study shows polysulfone substrates are more durable in acidic and basic conditions rather than oxidizing agents.

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CHAPTER ONE: BACKGROUND OF STUDY

1.1 INTRODUCTION

Research shows that 71% of earth is covered with water [1]. The ocean holds almost all of Earth's water in about 96.5% of it and covering most of the planet's surface [1]. 96.5% of water on earth is saline water from the oceans while the remaining 3.5% is fresh water [1]. Nowadays, other countries, especially Middle East face critical water crisis. It is because the population has increased over the past 50 years, leading to growing demand for fresh water sources [4]. This water crisis will impact on daily life by limiting access to clean water for drinking and sanitation [5]. In a research from Lund Schlamovitz and Becker, they predict global water demand will increase up to 55% from previous levels in next 50 years [7]

Nowadays, Malaysia can somehow relate with water crisis issues too especially in Selangor. According to the Ministry of Water, Land and Natural Resources' (KATS), Selangor experienced the highest number of unscheduled water supply interruptions from 2014 to 2017 [10]. Limited fresh water supply especially during droughts will significantly impact on households and many businesses. According to Fakruhayat Ab Rashid, lack of fresh clean water supply in Malaysia can contribute to major environmental issues that will affect entire communities [9]. Studies have found that the main causes of fresh water crisis were drought, population growth, and climate change [9]. These issues can lead to various impacts, including changes in economic growth, human activities, health, and water quality [9].

Research shows renewable sources such as oceans can offer an alternative source of potable water [24]. But for humans, consuming saline water is not safe because it can cause dehydration. The salt content in seawater is much higher than what can be processed by the human body [10]. According to the National Oceanic and Atmospheric Administration, saline water contains more than three times the amount of salt that is normally present in human blood [10]. By drinking it can give kidney damage, skin can get dry and dry mouth or tongue. Without treatment, it can lead to permanent brain damage or death [12].