UNIVERSITI TEKNOLOGI MARA

NANO FLAT SHEET MEMBRANE FILTRATION USING SILICA SUGARCANE BAGASSE AS ADDITIVE FOR LEACHATE TREATMENT

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Thesis submitted in fulfillment
of the requirements for the degree of
Doctor of Philosophy

Faculty of Civil Engineering

October 2018

AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results 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 degree or qualification.

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ABSTRACT

Membrane technology using ultrafiltration and nanofiltration membrane process had proven to be successful in treating physical and organic impurities from water and wastewater. However, this technology has it challenge due to its higher selectivity. The selectivity of membrane influenced by the materials used to fabricate a membrane. Recently, additive was added into membrane formulation to improve hydrophilicity, membrane charge and surface roughness. Silica is one of the additives in membrane formulation that has capability to resist chemical attack and high thermal stability. Silica can be extracted from various sources such as alkoxysilane, quartz, sand, silicon tetrachloride and tetraethyl orthosilicate. However, different types of silica produce different effects of membrane characteristics and performance. Therefore, this thesis is focused on the exploration of new membrane materials to develop a new flat sheet nanofiltration membrane using silica extracted from sugarcane bagasse as additives. The process involved in this study includes extraction of silica from sugarcane bagasse, characterization of silica sugarcane bagasse, dope formulation and fabrication using silica sugarcane bagasse, and characterization and performance of the newly developed nano flat sheet silica sugarcane silica bagasse additive membrane (SSAM). Morphology via Scanning Electron Microscopy (SEM) for SSAM showed that the addition of silica enhanced the macrovoid formation in sub layer of membrane and improve interconnectivity of the pore, hence, increase flux. High silica concentration increases solution viscosity and strong interaction with polymer able to delay dope precipitation and cause decreasing in size of pores, thus, increase salt rejection. Silica sugarcane bagasse is hydrophilic which can attract large amount of water which is 46 L/m^2hr to pass through membrane and increased salt rejection from 65.80% to 77.50%. This SSAM with weight percent 21 wt.%:71 wt.%:5 wt.%:3 wt.% of PSF:DMAc:PVP:Silica showed excellent performance in combination of aeration and membrane system for leachate treatment with the result of approximately 100% rejection of Copper (Cu), Chromium (Cr), Zinc (Zn), Nickel (Ni), Cadmium (Cd) and Iron (Fe). In conclusion, silica sugarcane bagasse is comparable to be as an alternative and sustainable source of membrane material which is additive. New membrane formulation determined from this research work tailored for leachate treatment, 21 wt.%:71 wt.%:5 wt.%:3 wt.% of PSF:DMAc:PVP:Silica is able to discharged treated leachate effluent that satisfy the Standards A requirement of Environment Quality Act (EQA) 2009.

TABLE OF CONTENTS