UNIVERSITI TEKNOLOGI MARA

STRUCTURAL ANALYSIS OF PALM OIL MILL FLY ASH (POFA) AS A LOW COST ALTERNATIVE IN WATER TREATMENT

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ABSTRACT

Palm oil mill fly ash (POFA) is known to exhibit pozzolanic property. The abundance and easily available of POFA in Malaysia make it an attractive alternative to be fabricated as a ceramic membrane in water treatment. As POFA membrane has high permeability and low selectivity, it is usually coated with graphene. Graphene oxide (GO) and reduction of graphene oxide (rGO) using an environmentally friendly agent was synthesized and the characteristic was studied alongside with POFA membrane. In depth study is done to determine the most suitable composition and casting method to successfully fabricate POFA membrane. The characteristics of the synthesized membranes were performed by using X-Ray Diffraction (XRD), X-Ray Fluorescence (XRF) Spectroscopy, Thermal Gravimetric Analysis (TGA), Fourier Transform Infrared Spectroscopy (FTIR) and Hg Porosimetry Micromeritics. The result revealed that POFA contained high amount of silica which made it pozzolanic with 67.65% porosity. The high porosity of POFA membrane render it as a good choice in wastewater treatment.

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TABLE OF CONTENT

CHAPTER ONE
INTRODUCTION

1.1 Research Background

Ceramic membrane is preferred over polymeric membrane in wastewater treatment because of its strength since it can be used in aggressive media such as acidic and caustic solution (Lee, Wu and Li, 2015). Therefore, it is durable to degradation and aggressive chemical with pH range 1-14 can be used during cleaning (Jiang, Nordheden and Stagg-williams, 2011). Ceramic membrane has a higher life span due to its unique properties of high thermal, pressure and chemical tolerance. Although ceramic membrane has greater advantages in wastewater treatment than polymeric membrane, capital cost of ceramic membrane is higher that polymeric membrane.

Palm oil mill fly ash (POFA) is used as a substrate in water treatment by fabricating it as a silica source due to its high silica composition (Saharudin *et al.*, 2018). POFA is a by-product of palm oil industries which is obtained after the burning of palm oil fiber, empty fruit bunches and shells which are used as a fuel for palm oil mill boiler in temperature range of 900°C -1000°C (Bamaga, Hussin and Ismail, 2013). It is easily available and environmentally friendly as the improper disposition of POFA leads to health hazard. Therefore, the utilization of POFA minimizes the waste from industrial industry and reduce the probability of pollution and hazard. Besides, POFA is inexpensive as it is an unwanted by-product that is usually discarded after the process.

Graphene oxide which is also known as GO is a film that is produced by oxidation of graphite. It can fabricate from graphite through various methods and modified Hummer method was chosen. GO is widely used due to its high surface area and easiness in manufacturing rather than a graphene. It is also cheap and fluorescent which make it suitable for wastewater treatment application. However, GO is not a good conductor, hence reduced graphene oxide (rGO) is preferred over GO due to its conductivity property. rGO is fabricated by furthering the reduction of GO via thermally or chemically and rGO is fabricated once the oxygenated functional groups from GO are eliminated (Park *et al.*, 2018). Beside from its conductive property, rGO can be stored longer than GO without any agglomeration and it is more stable in organic