PRODUCTION OF SANTA BARBARA AMORPHOUS 15 (SBA-15) USING EXTRACTED SILICA FROM FLY ASH

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ABSTRACT

The purpose of this work is to synthesize Santa Barbara Amorphous 15 (SBA-15) from silica obtained from fly ash. Fly ash is waste generated through combustion of coal from factories and thermal power plants. It is a type of waste that is available in abundant worldwide and may be reuse for other purposes. In this study, Santa Barbara Amorphous 15 (SBA-15) was synthesized from silica extracted from fly ash (FA). This is one of the method utilization of fly ash waste into a valuable product. Silicon dioxide or also known as silica, SiO_2 was extracted from FA via treatment with organic acid and alkali with addition of triblock copolymer surfactants of Pluronic P-123 (P-123) to produce SBA-15 as the product. SBA-15 formed were characterized using X-ray fluorescence (XRF), X-ray powder diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), Thermogravimetric analysis (TGA), Field Emission Scanning Electron Microscopy (FESEM). The result from X-ray fluorescence (XRF) analysis indicated that fly ash contains 49.85% of silicate after treatment with acid. Fourier transform infrared (FTIR) data indicated the presence of siloxane and silanol groups which represent the silica group. Thermogravimetry (TGA) analysis on the sample SBA-15 calcined at 450°C, 550°C and 650°C shows that the samples started to experience about 50% TGA weight loss at temperature of 863°C. The FESEM image of SBA-15 synthesized at 650°C displays a highly ordered and well-defined pore structure.

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CHAPTER ONE

INTRODUCTION

1.1 RESEARCH BACKGROUND

Fly ash is the major residue formed during the incineration of coal. Fly ash is a type of coal remaining released by factories and thermal power plants. 43.4 million Metric tons of coal combustion fly ash produced by the electric utilities in the United States in 1993. From this value, only about 22% from the amount was utilized by cement manufacturers mainly for cement and concrete products. The low level of ash consumption and application shows that fly ash is not fully utilized and the full potential of its application yet to be discovered. Therefore, there is a constant need for finding new ways and usage of fly ash as such by extracting some of the components and using it as source for production of other new products. For a significant increase in ash exploitation, it is necessary to expand the range of useful products, which can be produce from ash. (Ramezanianpour, 2014)

This coal waste fly ashes contain mostly of alumina and silica mixture with smaller amounts of calcium, potassium, iron, and sodium. It was reported that fly ash can be altered via hydrothermal reaction into zeolites in alkali solutions, which is an effective method to yield new values from fly ash and reduce the environmental pollution problem caused by a stack of fly ash (Shi, Liu, Song, & Wang, 2010). Silica in ash constitutes about 40-65% of the total, thus the likelihood of silica recovering and converting into a wide variety of pure chemical silicate products is higher. In terms of technical and economic features these perspective technologies shows a new discovery of methods of ash utilization (Shcherban, 1996)