OPTIMIZATION OF CO_2 SEQUESTRATION BY MICROALGAE *CHLORELLA SP.*
GROWING IN PALM OIL MILL EFFLUENT (POME) FROM POLISHING POND

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ABSTRACT

Palm oil mill effluent (POME) is one of the high constituted waste in a palm oil processing plant, this waste has high biological oxygen demand (BOD) which disables it to be released directly to natural water source. Recent technology allows POME to be manipulated into bioenergy that is digestion to produce methane through anaerobic digestion. Unfortunately, this conversion produces high amount of carbon dioxide (CO_2). A novel attempt has been idealized to lower the BOD of POME and at the same time sequestered the CO_2 produced from the conversion of bioenergy. In this study, a microalgae species of *Chlorella sorokiniana* was used to treat the POME and simultaneously sequestered CO_2 gas. An optimization study was done to find the optimum condition that gives maximum growth of the microalgae with two variables controlling the process which were CO_2 concentration and sparging rate. Optimization of the microalgae growth was done by response surface methodology where data was obtained from factorial experiments and composite experiments. The data was fitted in logistic equation by using MATLAB R2013a software. The data obtained from the regressions are evaluated to see the validity of the points and are then extrapolated into quadratic equation to obtain a maximum point. Form the quadratic equation plot, it was found that at sparging rate of 0.800 vvm and at CO_2 concentration of 16%, the maximum biomass concentration is 1.7882 g/L. However, these conditions is of a contradiction towards the growth rate.

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CHAPTER 1

1   INTRODUCTION

1.1   BACKGROUND STUDY

Palm oil industry has been one of the longest industries to be domineered and one of the earliest industries to be exploited. The high and increasing demand of palm oil has given success in terms of economics and technological development, specifically in food, pharmaceutical and biodiesel industry. Palm oil industry has been significant in the foresaid areas due to its low cost and high efficiency processing. Despite that, this industry is high in demand due to the unique feature of the oil palm which produces two types of oil, one from the flesh of the fruit and one from the palm kernel. The wide range of products obtained from the production increases its growth year by year. However, the high demand has led to an uncontrollable amount of waste being produced per production.

Palm oil production is saturated in Indonesia and Malaysia. Being the lead palm oil producer, the companies in these countries has expanded its production capacity to a larger scale to meet the global palm oil demand. This gives the rising of number of waste production, namely, liquid waste like palm oil mill effluent (POME), solid wastes like oil palm trunks (OPT), oil palm fronds (OPF), empty fruit bunch (EFB), and palm pressed fibres (PPF) and greenhouse gases like methane and carbon dioxide. Most of these solid wastes can be manipulated into other products, but not the liquid and gas waste.

Environmental issues regarding the palm oil production has poked the interest of many scientists in the sense of finding the solution to the matter. Palm oil mill effluent (POME) is the major waste product produced by the palm oil mill, it has and still is the main concern in every palm oil mill. The waste management of POME is one of the crucial points in making the industry viable, given the current environmental condition of the earth. There are many methods proposed to curb these waste management issues, and one of them