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PRODUCTIVITY OF *Spirulina fusiformis*, (VORINICHIN) IN PLASTIC PHOTOBIOREACTOR WITH SUN LIGHT FILTERING

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Abstract — **Recently climate change has become a complex issues which have relation with many problems in the world, one of them is food security. Based on these problems, we need alternative food resources which have high productivity characteristic. Besides that, such resource should be able to be grown in critical and limited land. Microalgae as an alternative food resource give us a hope to have sustainable food resource in the future. Microalgae can grow up fast and do not need wide and fertile land. In other hand, Microalgae culture that can be performed in outdoor, especially Spirulina fusiformis, faced issues like expensive cost culture and the high intensity of sun light in field. Based on these problems, the research was conducted for develop cheap flat Photobioreactor (plastic) which is equipped by sun light filter system. The objective of this research is to find out the percentage of sun light filtering that can give high productivity and high protein content. The method used was experimental method, using a Completely Randomized Design (CRD) with six treatments (percentage of the filtering by sunlight 0%, 50%, 60%, 70%, 80%, and 90%.) and four replications.. Parameters measured were growth, levels of protein, pH, temperature, and light intensity. Research results showed filter sun light treatment influential real against productivity S. fusiformis. The highest productivity is obtained at 50% filter sun light tretament (F5), in the amount of 0.063 g/L/day. The highest protein content obtained at 70% sun light filtering treatment, which is equal to 49.83 %.**

Keywords — ***Flat Photobioreactor, Plastic Photobioreactor, Productivity, Photo inhibition, Spirulina fusiformis, Sunlight Filtering.***

I. INTRODUCTION

Recently climate change has become a complex issue which has relation with many problems in the world; one of them is food security. FAO data show that the number of people under starving threat in the world is estimated to reach 925 million people by 2010 and in Indonesia amounted to 29.9 million people in the period 2005-2007 (FAO, 2011). Every year, starving in the world is increasing 5.4 million people and died reached 36 million people (Rosario, 2007).

The problem of hunger is not only caused by economic factors, but by many factors such as discharge of field, land use change, critical land and climate change (FAO, 2011). Therefore, the handling is not enough through economic approach. It is also required the development of alternative food sources which have characteristic such as high nutrition, high productivity, high efficiency use of land and high endurance from climate change. One of the sources of food that has these characteristics is spirulina.

Spirulina fusiformis is a microalgae that has protein content up to 50-60% of the dry weight, so it is potential to be developed as a source of protein (Chrismadha, 2006). Microalgae have high productivity and can be developed on critical lands (Ahsan, 2008). In one hectare, *S. fusiform* is able to produce as much biomass as 18-29 tons/ha/year (Chrismadha, 2009). Assuming a 60% protein content, spirulina is able to produce proteins up to 20 times higher than soybeans and 200 times higher than beef in the same area (Ahsan et al, 2008 & Belay, 2005).

Development of microalgae is still constrained by low mastery of culture techniques to produce high productivity with low cost. Various efforts are done to improve the productivity and lower the cost of culture, through optimization of growth parameters and development of simple photobioreactor made from economical material (Chrismadha, 2009).

Photobioreactor is a closed system of microalgae culture techniques that can improve the productivity of microalgae 2-5 times higher than normal conditions (Barsanti Setiawan et al, 2006 & 2008). Culture were performed in a closed transparent chamber can expand light absorption area and better controlling of growth parameters, thus increasing productivity (Barsanti et al 2006). Flat type photobioreactor use a flat-shaped container culture (Vonshak, 1997). Lee (2001), stated that the development of photobioreactor one of which is expected to lead to the development of flat-type photobioreactor.

Plastic photobioreactor has been known to have the advantage of producing biomass *S. fusiformis* (Chrismadha, 2009). In addition, plastic is easily to obtain in the market and the price is cheap so it can reduce construction costs in the manufacture of photobioreactor. Plastic photobioreactor is very practical and does not require complicated control system so that the handling easier and simpler.

Light is one of the important parameters in cultures of microalgae and require in adequate intensity. The high exposure of light intensity such as sun light can cause photoinhibition in culture and resulted in a decrease in productivity (Vonshak, 1997). Spirulina requires 10-30 Klux light intensity or about 10-30% of the total intensity of sun light (Vonshak, 1999). Therefore, exposure to direct sun light should be avoided in cultured Spirulina.