

Lipid Production of *Nanochloropsis* under Environmental Stress

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ABSTRACT: The effect of environmental condition on lipid production of marine microalgae *Nanochloropsis* were observed. Basically, the amount of total lipids depend on the NaCl and nitrogen concentration on culture medium. The total lipid highest yield (31.45%) was obtained in cell grown at 20% NaCl and 3.0 mM N. And the lowest yield (7.23%) obtained in cell grown at 10% NaCl and 6.0 mM N. The result showed that *Nanochloropsis* containing high amount of total lipid, and suggested to be used as supplemental ingredient for food to exceed the body performance.

KEYWORDS: *Nanochloropsis*, lipid, environmental stress.

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1 INTRODUCTION

Marine microalgae, e.g. *Chlorella*, *Spirulina*, and *Dunaliella*, may accumulate lipid under environmental stress condition, such as in high temperature, light intensity, and salinity^[1,2]. The algal lipids may containing high value of useful poly-unsaturated fatty acids (PUFAs)^[3,4].

Unicellular microalgae can be considered as an important source of PUFAs. The microalgae nutritional source became potential economically^[5]. In addition, the microalgae grown in normal condition may use only for fisheries purposes. The rapid and higher production of renewable sources and fine chemical compounds should be determined by manipulate environmental conditions.

The main aim of research was to examine the proper environmental conditions to increase lipid production of *Nanochloropsis*. The combined effect of both different concentration of NaCl and nitrogen were observed as the main environmental stress conditions.

2 MATERIAL AND METHODS

The research was conducted on January-March 2011 in Aquaculture Laboratory, University of Lampung. Pure isolate of *Nanochloropsis* were selected as experimental materials in this study. The algal species originated from The Marine-culture Developing Centre Laboratory, Hanura-Lampung. The algae were grown in batch cultures under the laboratory conditions as describe elsewhere^[6]. *Nanochloropsis* was cultured in a 10 L flask with 8 L of culture medium containing NaCl (20% and 10%) and nitrogen during research. NaNO₃ served as nitrogen source at two different con-

centrations; i.e 3 and 6 mM N in media containing 10 and 20 % NaCl, respectively. The batch cultures were illuminated continuously with fluorescent lamp (Philips 40 W) and light intensity level was $\pm 200 \text{ W.m}^{-2}$.

The microalgae cell were harvested by centrifugation (5000 rpm) for 10 min and stored at -20°C . The dry weight method and optical density were used to measure the growth of *Nanochloropsis* during research.

The modified method of lipid extraction was described by Hanaa^[3] and Xu^[7]. The microalgae cells were extracted with mixture of distilled water, chloroform, and methanol (8:10:20 v/v/v), twice. Sonicated for 10 min. The sonicated cells filtered on to 47 μm diameter GF/C Whatman glass microfibre filters. Chloroform (10 ml) and distilled water (10 ml) were added sequentially to the filtrate and sonicated again for 10 min. The resultant solution was filtered under vacuum through a 25 mm diameter Whatman glass filter microfiber. The filtrate was washed by 30 ml of 5 % NaCl solution, then the lower layer of CHCl₃ was separated and dried over anhydrous sodium sulfate. The solvent was removed through evaporation at 40°C under reduced pressure. The total lipids were weighed and stored at -20°C until analysis.

The data were analyzed by one ANOVA and LSD t-test to identified significant differences between treatments. All analysis performed using SPSS ver. 15.

3 RESULT AND DISCUSSION

The effect of NaCl and nitrogen concentration on total lipid content showed in Tabel 1. The result described that the level concentration of both nitrogen and NaCl

in growth medium may have a role to control the total lipids percentage of microalgae. The highest total lipid dry weight was 31.45% occurred in medium with highest NaCl concentration (20%) and under nitrogen limitation (3 mM N). And the lowest (7.23%) was observed in cell grown at 10% NaCl and 6 mM N nitrogen.

TABEL 1: **The effect of salt and nitrogen stress on total lipid of *Nanochloropsis*** (Uncapital words showed differences of mean value horizontally; capital words showed differences of mean value vertically)

	NaCl (%)	
	10	20
Nitrogen (mM N)	3 14.72 (a,A)	31.45 (b,B)
	6 7.23 (c,C)	22.67 (d,D)

The result showed that, both environmental stress condition may take effect on total lipid content on *Nanochloropsis*. The salt concentration effect was different with nitrogen concentration effect. The resultant effect of salt concentration was increased as a result of increasing nitrogen concentration. The resultant effect of nitrogen concentration was increased as a result of increasing salt concentration in batch culture. Generally, the total lipid content were decreased gradually as a result of decreasing NaCl (salt) concentration, in which combined with increasing of nitrogen concentration in batch culture. Accordingly, the increasing of microalgal lipid might increase the stability of microalgae toward oxidative damage^[3]. Therefore, the environmental stress condition as a major effect was an increasing the degree of desaturation of total lipids content. This phenomenon was related to the increase of enzyme activity, which may be extremely sensitive to increased NaCl level. Romano^[8] and Seto^[9] showed that the environmental stress may effect of lipis elongated and the enzyme that carry out the elongation and desaturation may required NaCl. Al-Hasan^[10] indicated a salt related increase in the relative proportion of linolenic acid in the total lipid of *Dunaliella salina*, and the environmental conditions may changed the quantitatively and qualitatively the lipid of microalgae.

4 CONCLUSION

The high salinity and low nitrogen in culture medium can manipulate the lipid content to the maximum values of about 31%. These beneficial combination effect recommended to increase lipid compound in microalgae *Nanochloropsis*.

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