EMJ MS
EUROPEAN MULTIDISCIPLINARY JOURNAL OF MODERN SCIENCE
https://emjms.academicjournal.io
Special Issue: Use of Modern Innovation on Integrated Research

The Effect of Salinity and Light on the Density of Spirulina Platensis, by using Walne Media

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Abstract: This study aims to determine the effect of salinity on walne media on the density of spirulina platensis, determine the effect of light intensity on walne media on the density of spirulina platensis, and determine the effect of the combination of salinity and light intensity on the density of spirulina platensis. The research was carried out in December 2021 - January 2022 at the Takalar Brackish Water Cultivation Fisheries Center. The method used is an experiment withThe experimental design was a completely randomized design with a factorial pattern, salinity factor (S) with 3 levels (10 ppt, 20 ppt, and 30 ppt), and light factor (C) with 3 levels (16 watts, 21 watts, and 36 watts). . The results of the analysis of variance (ANOVA) showed salinity has no significant effect on walne media on the density of Spirulina platensis. light intensity has a significant effect on walne media on the density of Spirulina platensis no effect the combination of salinity and light intensity on the density of Spirulina platensis on Walne media. Good growth yield of spirulina platensis was 272,505 cells/ml (30 ppt salinity and 36 watts of light).

Keywords: Spirulinaplatensis, Salinity, Light, Density, Walne Media

INTRODUCTION

Microalgae are a very diverse group of plant organisms, the most primitive of which are cellular in size which are generally known as phytoplankton that can carry out photosynthesis, besides that they have very complex cell structures such as at high levels, between 1-50 cm in diameter.μm. These microalgae can be found in various environments, namely fresh water, sea water and in brackish water(Merry, 2018).

In addition, microalgae has the potential to be developed by obtaining the requirements and fulfillment of natural feed for zooplankton, fish larvae and shrimp larvae in aquaculture, because one of the supporting factors in the success of aquaculture is the availability of feed(Saniyatul et al. 2018). Provision of quality feed in sufficient quantities will reduce the percentage of dead larvae. Microalgae is one of the aquatic biota that is useful as natural food, these various forms of excellence make microalgae cultivation very important to continue to be researched further and developed into one of the aquaculture industries. Microalgae has the potential to be developed as natural food(Rahayu Kusdarwati, 2011). One of the microalgae that meet the availability of natural food is spirulina*platensis.*

*Spirulinaplatensis*is a bluish-green autotroph organism consisting of cylindrical cells that form colonies where the cells are columned to form twisted filaments resembling a spiral (helix) so it is also called blue-green filamentous algae.(Buwono et al. 2018). Spirulina has bacterial oxygenic photosynthesis which includes several groups of cyanobacteria and Prochlrales which are generally filamentous and can be found in tropical and subtropical areas with high carbonate/bicarbonate content, high pH and salinity.(Ali & Saleh, 2012).

*Spirulina platensis*can be cultivated in agricultural or industrial wastewater. Spirulina biomass contains high quality and good protein, essential fatty acids, antioxidant pigments such as carotenoids and bioactive compounds with antimicrobial activity.(Grassi et al., 2020). According to(Ahammad, 2008)effect of bioactive properties *Spirulina*platensis on fish health found increased immunity and relief on the oxidative status of fish. Apart from that, Spirulina*platensis* can also improve feed utilization, physiological activity, hunger tolerance, disease resistance and carcass quality. To meet this growing demand, it is necessary to provide appropriate nutrients and additives to keep fish/shrimp healthy, promote profitable growth and improve meat quality. Most aquatic feeds consist of protein and energy sources, the real challenge facing the aquaculture industry is to identify economically viable and environmentally friendly alternatives to replace these ingredients as feed.

Spirulina platensis biomass production must be increased to meet industrial needs, with efforts that have been made to achieve an increase in biomass production, including optimization of culture techniques and optimization of cultivation media. Spirulina platensis biomass production is influenced by several factors including nutrients, temperature, light, salinity and pH in the growth of spirulina.(Notonegoro et al., 2018).

Another use is as an alternative treatment for algae cultivation that can provide added value from the use of wastewater and create new entrepreneurs. In addition, it is easy to cultivate and harvest, and can be digested by humans and animals, both used as fish/shrimp feed ingredients(Cells, 2009). Spirulina*platensis* Commercially, it is widely used to produce food supplements because it has a fairly high protein content which is used as a natural food source for the hatchery of fish larvae or shrimp larvae. Spirulina*platensis* used as immunostimulants, medicines, cosmetics and natural and artificial dyes(Mutia & Nedi, 2021).

Walne is the best medium for the abundance of cells at the peak of the population and the nutritional value of microalgae, because it contains higher protein and fat. The main nutrient elements that must be present in phytoplankton culture are elements of N and P. In pure Walne culture media, the content of N in NaNO3, P content in NaH2PO4.2H2O, and there is a mineral composition consisting of vitamins B1, B12, protein 50.05% , carbohydrate content 15.48%, and fat content 0.506% (Suminto, 2011).

Based on the formulation of the problem above, the objectives of this research are as follows:

1. To determine the effect of salinity on Walne media on the density of Spirulina platensis.
2. To determine the effect of light intensity on Walne media on the density of Spirulina platensis
3. To determine the effect of the combination of salinity and light intensity on the density of Spirulina platensis on Walne media. The learning process in analyzing and solving problems is in accordance with the requirements of the scientific method. Decrease in salt nutrients, a little carbon dioxide, to limited lighting. When biomass increases in the logarithmic phase, aeration is only balanced by growth at that one point. When the cell density decreases, it will cause the pH to decrease thereby suppressing growth.

E. Relevant Research Studies

Similar studies on the effect of salinity and light on the population density of Spirulina platensis using Walne media were carried out by several previous researchers, some of the results of previous studies that were used as references in this study are presented in Table 1.

Table 1. Previous studies.

Research and Year	Title	Method	Research result
Chrysalina Indrastuti (2014)	Study of Different Light Intensity Against Chlorophyll-a Concentration on Growth of Spirulina platensis Microalgae in Laboratory Scale	Laboratory experimental methods. The experimental design used was a completely randomized design (CRD), with three treatments (16 watts, 23 watts, 45 watts), three replications.The media fertilizer used is Walne fertilizer	The results of this study indicate that the highest population is in treatment C (45 watts) which is 330,362 cells/ml and the lowest population is in treatment A (16 watts) 173,674 cells/ml. The results of the calculation of the content for chlorophyll-a spirulina platensis the highest achievement in treatment B (23 watts) of 2.39 mg/ml, treatment A (16 watts) 2.26 mg/ml, and treatment C (45 watts) 2.13 mg /ml. The experimental results supported by statistical analysis showed that the different light intensities obtained an F count of 0.368 while the F table was 3.354, based on these results, the calculated F was smaller than the F table, i.e. different light intensities did not have a significant effect on the growth of spirulina platensis.
Rahayu (2011)	The Effect of Light Color Differences on the Growth of Spirulina sp.	The method used in this research is the treatment of light color and duration of irradiation 12 hours of light: 12 hours of darkness + white light, 12 hours of light: 12 hours of darkness + red light, 12 hours of light: 12 hours of darkness + green light, 12 hours of light: 12 hours dark + yellow light and 12 hours light: 12 hours dark + blue light. The distance between the	Based on the results in the intensity of light into the culture media gave an effect on the growth of the population of spirulina platensis.Addition of light color for 6 days using white color resulted in a population of Spirulina sp. highest of 98,300 units/ml on day 4. Population growth of Spirulina sp. cultured on media with the addition of

		light source and the culture medium was the same for all treatments, which was 30 cm. *Spirulina*desired pure 10000 cells/ml.	light color can be enhanced by using white light color
Jp Pandey, Neeraj Pathak, Amit Tiwari (2010)	Standardization of pH and Light Intensity for Biomass Production of Spirulina Platensis	The method was a completely randomized design with 5 treatments and 3 replications. The different light intensities were 3 Lux, 3.5 Lux, 4 Lux, 4.5 Lux and 5 Lux. While the different pH, namely 7, 8, 9, 10, 11, 12. was carried out with the help of 8 M NaOH and HCl1N solutions. the media used is zarrouk agar media. Data analysis is to calculate dry weight biomass	Based on the results of the effect of different medium pH on the amount of biomass production of spirulina platensis, the higher pH was in the treatment, the dry weight was 0.91±0.061, and the lowest was at pH 11, which was 0.22±0.025. The effect of different light intensity on the biomass production of spirulina platensis, the highest dry weight was 5 lux 0.85 ± 0.030. and the lowest was 3 lux with a dry weight of 0.60 ± 0.020. pH and light intensity affect the maximum production of biomass and protein so that Spirulina platensis can be cultivated under variable natural, artificial and laboratory conditions.
Riche Hariyati (2008)	Growth and Biomass of Spirulina sp in Laboratory Scale	Fertilizer used from Walne and EDTA media. As well as media with the desired salinity. Spirulina sp inoculants with a density of 100 units/ml. Population growth observations were carried out every day under a microscope for 9 days using a Sedgwick-rafter 10x magnification. Calculation of the density of spirulina sp in units/ml. one unit is measured as a sinusoidal angle on the filament	The growth of spirulina sp, seen from the growth graph, showed optimal results, with the maximum density reached on the seventh day, which was 11,698 . 10^3 units/ml. the optimal salinity for the growth of spirulina sp is in the range of 15-20 . In this culture the media used is 15 . Salinity affects the water orgasm in maintaining its osmotic pressure. Most algae show inhibition of photosynthesis after being

			transferred to a medium with higher salinity or higher osmotic pressure. With the medium water salinity in accordance with the optimal temperature, the growth of spirulina sp can progress well, this can be seen from the growth graph.
Khairunnisa (2020)	Effect of Different Salinity on Density and Carotenoid Content of Dunaliella Salina.	This study used the experimental method using a completely randomized design (CRD) consisting of one factor with four levels of treatment, to reduce the error rate, three replications were carried out. P1: Use seawater with a salinity of 20 ppt., P2: Use seawater with a salinity of 30 ppt., P3: Use seawater with a salinity of 40 ppt., and P4: Use seawater with a salinity of 50 ppt.	It is known that the highest content of carotenoids in treatment P4 (1.4769/ml) and the lowest content of carotenoids in treatment P1 (0.2592/ml). based on the results of analysis of variation (ANAVA) showed that different salinity had an effect on the carotenoid content of Dunaliella Salina. ($P<0.05$).
Merry (2018)	The Effect of Differences in Salinity on Biomass Growth of Spirulina platensis Microalgae Cultivation on a Semi Outdoor Scale	The method used is an experimental method using a completely randomized design, with different salinities, namely 15 ppt, 20 ppt, 25 ppt, and 30 ppt with 3 replications.	The results showed that in the growth of biomass with different salinity on the cultivation of Spirulina platensis microalgae was found to have a significant effect, where the P value < 0.005 (H1 was accepted). The highest biomass growth was in the salinity treatment of 25 ppt and lowest at 30 ppt, then based on the day of growth sampling biomass decreased on day 12 to day 14

Microalgae is now known as a natural feed for fish/shrimp hatchery whose role is as a primary producer in waters, the more nutrients microalgae cultured, the higher the quality of the seeds, so the need for microalgae seeds with high quality is also very necessary. spirulina platensis. Spirulina platensis has a chlorophyll content twice as high as other plants, because chlorophyll or the main plant pigment is widely used as a food supplement that is useful to help optimize metabolic functions, the immune system and balance the hormonal

system.(Fithriani et al., 2015).

The main factor for the growth of chlorophyll is light which includes intensity, quality of the spectrum and photoperiod. Cultures carried out under lighting conditions resulted in low biomass content in addition to causing inhibition of decreasing the growth rate of Spirulina platensis cells, the use of high light intensity resulted in high biomass content.(Pandey et al., 2010).

Spirulina protein content*platensis*is 60-70% while the fat content is quite low at 1.5-12%(Buwono & Nurhasanah, 2018). Spirulina contains various vitamins such as vitamin B1, B3, B6, B12, pro vitamin A and vitamin E(Utomo et al., 2005). As explained by(Buwono & Nurhasanah, 2018)Microalgae is an important component in aquaculture, because microalgae as primary producers serve as the beginning of energy flow in the food chain in waters.

In addition to the high protein content, spirulina*platensis*has several advantages over other types of microalgae, namely relatively fast production and the biomass produced is easy to harvest. This is because the size of the spirulina biomass is larger so that it can be separated from the media by filtration using a 20 m filter.

In this study, it was planned to use Walne's medium for the growth medium of spirulina sp. The reason for using Walne's medium is the availability of the media. When compared with Chu 13 media, Walne media also contains similar elements, only the difference is in the sulfate ion content. Because spirulina platensis with its ability to grow in waters with medium salinity can be grown on Walne media. The concentration of each composition in Walne media can be seen in table 1.

Table 2. Walne fertilizer composition (technical) for laboratory-scale Spirulina culture.

No	Chemical material	Dose
1.	FeCl3.6H2O	1.30 gr
2.	MnCl2.4H2O	0.36 gr
3.	H3BO3	33.60 gr
4.	Na2EDTA	45.00 gr
5.	NaH2PO4.2H2O	20.00 gr
6.	NaNO3	100.00 gr
7.	Aquadest	1000 ml
8.	Zn C32	2.10 gr
9.	CoC32.6H2O	2.00 gr
10.	(NH4)6.Mo6O24.4H2O	0.9 gr
11.	Cu5O4.5H2O	2.00 gr
12.	Vitamin B12	10 mg
13.	Vitamin B5	200 mg

Source: (BPBAP Takalar, 2021)

RESEARCH METHODS

A. Place and time of research

This research will be carried out for one month, namely in December 2021 – January 2022, and takes place at the Natural Feed Laboratory of the Takalar Brackish Water Aquaculture Center, Mappakalompo Village, Galesong District, Takalar Regency.

RESULTS AND DISCUSSION

A. Density of Spirulina sp.

The results showed that the growth of Spirulina platensis underwent different stages or phases, it can be seen in the graph presented in Figure 8.

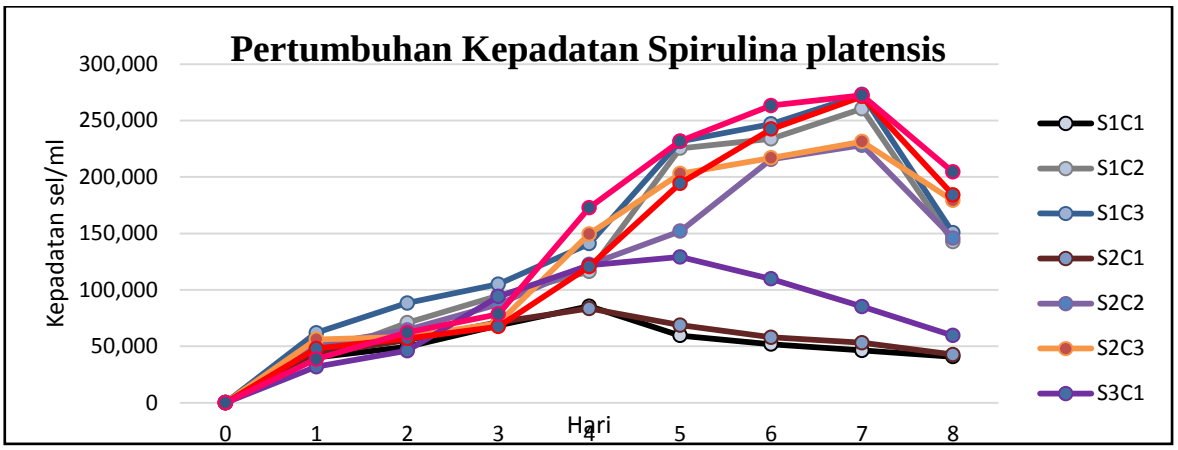

Figure 1. Density Growth Chart of Spirulina sp.

Information:

S1 C1: 10 ppt salinity and 16 watts of light

S1 C2: 10 ppt salinity and 21 watts of light

S1 C3 : 10 ppt salinity and 36 watts of light

S2 C1 : 20 ppt salinity and 16 watts of light

S2 C2 : 20 ppt salinity and 21 watts of light

S2 C3 : 20 ppt salinity and 36 watts of light

S3 C1 : Salinity content of 30 ppt and 16 watts of light

S3 C2 : Salinity level 30 ppt and light 21 watt

S3 C3 : Salinity content of 30 ppt and 36 watts of light

Density growth of spirulina platensis was observed every 8 days. The initial cell density used during the study was 10,000 cells/ml. To find out the growth development of spirulina platensis density in more detail, it can be presented in Appendix 1. Data on the average density growth of spirulina platensis. The growth phase of spirulina platensis during culture can be presented in Figure 1.

The results of measurements of cell density growth of spirulina platensis can be seen in the graph (Figure 8), which is carried out every day at 17.00 WITA for 8 days of maintenance. The data obtained from the measurement of cell density showed that the density growth of S1C1 treatment with salinity of 10 and light intensity of 16 watts increased from day four to day five and decreased on day six, but the highest density growth rate was on day five. The growth of S1C2 treatment density with salinity of 10 and light intensity of 21 watts increased starting from the fourth day and peaked on the seventh day, but the growth rate decreased on the eighth day.

The growth of S2C1 treatment density with salinity of 20 light intensity of 16 watts showed the highest growth increase on the fourth day, decreasing on the fifth day. The growth of S2C2 treatment density with 20 salinity and 21 watt light intensity increased starting from the

fourth day and the highest peak on the seventh day, but the growth rate decreased on the eighth day. The density growth of S2C3 treatment with salinity 20 and light intensity 36 watts increased from day four to day seven and decreased on day eight, but the highest density growth rate was on day seven.

The density growth of S3C1 treatment with salinity 30, light intensity 16 watts increased on the fifth day and decreased on the sixth day. The growth of S3C2 treatment density with salinity of 30 and light intensity of 21 watts increased starting from the fourth day and the highest peak on the seventh day, but the growth rate decreased on the eighth day. Meanwhile, the density growth of S3C3 treatment with salinity 30 and light intensity 36 watts increased from the fourth day to the seventh day and decreased on the eighth day, but the highest density growth rate was on the seventh day.

The effect of salinity and light on the density of spirulina platensis using Walne media can be seen in Figure 8, which is a daily growth graph of spirulina platensis. The graph shows that the total density of spirulina platensis in all treatments continued to increase since the day of planting, namely on day 0 to day 1 of all treatments, the density growth of spirulina platensis was slow and tended to be stable, as according to(Indrastuti et al., 2014)that the slow growth at the beginning of the study could be caused by the content of very high concentrations of particulate matter so that it was necessary to adapt to spirulina platensis.

Measurement of cell density in Spirulina platensis culture was carried out every day at 17.00 for 8 days of maintenance. The density growth pattern of Spirulina platensis (Figure 8) followed four normal growth patterns,namely the lag phase, the exponential phase (logarithmic), the stationary phase, and the declination phase. The lag phase is the adaptation of the cell to environmental conditions.. On the first day until entering the second day, it can be seen that spirulina platensis is still adapting to its new environment, especially to high light exposure and salinity., Then the exponential phase in which the number of cells increases rapidly which occurs starting on the third and fourth days, while the stationary phase, namely running out of nutrients in the culture media can cause Spirulina platensis cells to stop growing. This happens because each treatment is different during this phase. stationary and the declination phase of growth (death) is the final phase of Spirulina growth.

The lag phase (adaptation) is the initial phase of adding the abundance of microalgae that occurs in small amounts, this lag phase of spirulina platensis undergoes adjustments first. In the lag (adaptation) phase consisting of all treatments, an increase in cell growth has been seen for 1 day, this shows that spirulina platensis cultured using Walne media adapts well and is able to utilize the nutrients contained in Walne media, this is in accordance with the opinion(Prayitno, 2016)which states that the adaptation phase of microalgae will be faster if the cells come from cultures that are in the exponential phase.

The exponential phase in this study begins with cell division which is marked by an increase in the growth rate so that the density of Spirulina increases. The exponential phase in each treatment was marked by an increase in the amount of Spirulina density. So this exponential phase has utilized the nutrients in the media, the nitrogen element in the medium is large enough to allow biosynthesis and rapid cell metabolism which causes peak growth to occur. As stated by Kabinawa (2006),

The death phase is marked by a decrease in the abundance of cells, based on research that has been carried out this death occurs on different days. The death phase is characterized by a decrease in the density of the number of microalgae cells that are affected by nutrients. The absence of nutrient additions during the culture led to a decrease in the number of cells in a faster time. The decrease in cell density can also be caused by several factors such as salinity

and light intensity. As stated by*(Fakhri et al.*,2020a)Cell death can be caused by a decrease in water quality and accumulation of metabolites, as a result the rate of cell death is greater than the rate of cell growth.

Based on the best results, it can be seen in the graphic growth pattern that occurs in the treatmentS3C3 (salinity 30 and light intensity 36 watts) because on day 7 it reached the highest density and at stationary and entered the death phase of spirulina platensis this showed a stable growth pattern, then in the treatmentS1C3 (10 ppt salinity and 36 watts of light) , S3C2 (30 ppt salinity and 21 watts of light), then followed by S1C2 (10 ppt salinity and 21 watts of light), S2 C3 (20 ppt salinity and 36 watts of light) and S2C2 (20 ppt salinity and 21 watts of light) compared to S3C1 (30 ppt salinity and 16 watts of light), S1C1 (10 ppt salinity and 16 watts of light), S2C1 (20 ppt salinity and 16 watts of light) which were relatively low..

The results of the analysis of variance showed that factor C had a very significant effect (Fcount > Ftable), while factor S and the combination of SC factors did not have a very significant effect (Fcount < Ftable), for more details, it can be seen in table 8.

Table 3. List of analysis of variance of density results of spirulina platensis

Source of Diversity	Db	JK	KT	F-Count	F Table	
					5%	1%
S	2	363616590.3	181808295.1	0.30663tn	3.55	6.01
C	2	15104343790	7552171895	12,73757**	3.55	6.01
SC	4	4109662793	1027415698	1,73285tn	2.93	4.58
Error	18	10672289489	592904971.6			
Total	26	30249912663				

** = Very real = 0.01, tn = not real = 0.01

The results of analysis of variance showed that factor S did not have a very significant effect because FCount 0.30663 was smaller than FTable 6.01 (level 1%), factor C had a very significant effect because FCount 12.73757 was greater than Ftable 6.01 (level 1%) and the SC factor does not have a very significant effect because the FCount 1.73285 is smaller than FTable 4.58 (1% level). The results of the BNT further test showed that there was a difference in the density value of Spirulina between treatments. The results of the further BNT test can be seen in the table 4.

Treatment	Average	Average+BNT
C1	96,921	126,192 a
C2	119,816	149,086 a
C3	154.458	183,729 b

The penetration of light that enters the culture media is reduced, so that the photosynthesis process cannot take place normally and causes the death rate to be high, as stated by Diharmi (2001). normal, thereby interfering with subsequent cell biosynthesis. The light used in the photosynthesis process in Spirulina platensis can come from nature or from lamps.

The growth process of spirulina platensis in addition to the light intensity that affects the photosynthesis process, there is also salinity which indicates that the S treatment was not significantly different based on the results of the research on cell density in the S3C3 treatment, and S3C2 was higher than the other treatments, because at 30 ppt salinity was the optimum salinity for growth of spirulina platensis, so that cells grow and develop better than other treatments, this is in accordance with the opinion(Febriani et al., 2020)where the highest average cell density of spirulina platensis is 30 ppt, while the lowest cell density is at

10 ppt salinity, this is because spirulina platensis cells are unable to tolerate too low a salinity so they cannot optimize their growth. These conditions in microalgae culture can affect the high and low population density of spirulina platensis.

The results of the research on the density of Spirulina from each treatment were different due to the factors that influenced the growth of the density of Spirulina sp. including the use of Walne media as a growth medium for Spirulina sp. has a complete composition and nutrient content so that it can support the density of Spirulina sp for a longer time. In addition to environmental conditions, internal factors such as genetics have a very important influence in terms of accelerating the growth of Spirulina sp., This is related to the nature of growth in organisms (Christiani, 2009).

The combination of salinity and light intensity, if the salinity is high and the light intensity is low, the growth of spirulina platensis will decrease, and growth will be slower, because the growth of spirulina platensis requires optimal salinity and can photosynthesize quickly.(Febriani et al., 2020)Salinity that is too extreme will cause the ion exchange to be too high between the environment and the fluid in the cell so that it can interfere with the metabolic processes of photosynthetic organisms, while light affects the photosynthesis process because light can trigger cell growth activity.(Rahayu Kusdarwati, 2011)

B. Wet Biomass and Dry Biomass Spirulina platensis

Harvesting of spirulina platensis was carried out on day 8, where the growth of spirulina platensis reached its peak population. Harvesting can be done using a sieve, then the resulting biomass is weighed based on its wet weight (wet biomass) after which the biomass is dried for 2-3 days in the sun, then weighed until dry weight (dry biomass) is obtained. Wet weight (wet biomass) can be seen in Figure 9.

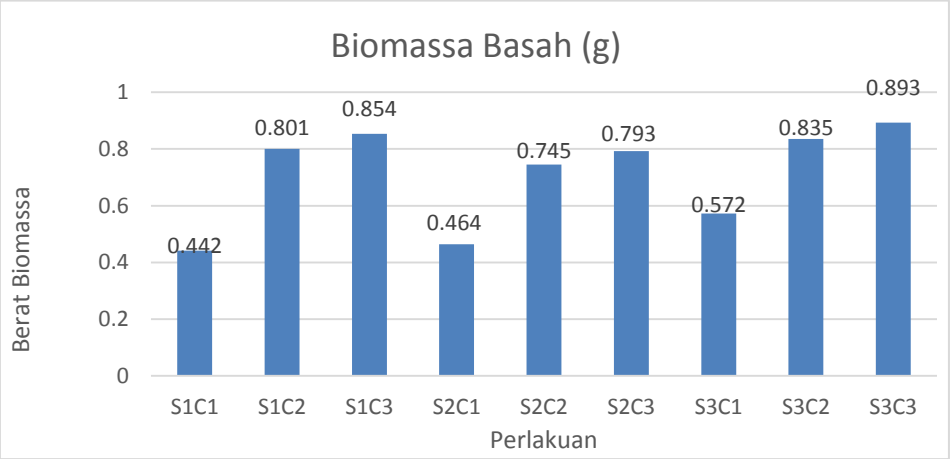

Figure 2. Wet Biomass Weight Graph (g) spirulina platensis

Based on the graph of the wet biomass weight of spirulina platensis in Figure 9, it shows that the highest treatment at, S3C3 treatment (30 ppt salinity and 36 watts of light) with the amount of 0.893 salt, it is suspected that 30 ppt salinity is the optimal salinity for growth and biomass formation.S1C3 treatment (salinity 10 ppt and light 36 watts) with a total of 0.854 grams, then followed by S3C2 treatment (30 ppt salinity and 21 watts of light) with a total of 0.835 grams, S1C2 treatment (10 ppt salinity and 21 watts of light) 0.801 grams, S2C3 treatment (salinity 20 ppt and 36 watts of light) with a total of 0.793 grams, the S2C2 treatment (20 ppt salinity and 21 watts of light) amounted to 0.745 grams, while the lowest was in the S3C1 treatment (30 ppt salinity and 16 watts of light) with an amount of 0.572 grams, the S2C1 treatment (20 ppt salinity and 16 watts of light) in the amount of 0.464 grams, the S1C1 treatment (10 ppt salinity and 16 watts of light) in the amount of 0.442

grams.

The increase in biomass in microalgae was due to spirulina platensis carrying out the photosynthesis process by utilizing light from irradiation with 21 watt TL and 36 watt TL lamps and utilizing good salinity of 20 ppt and 30 ppt. Light is a source of energy for microalgae and can carry out photosynthesis. If spirulina platensis lacks light in its culture environment, photosynthesis will take place abnormally. Lighting in culture can be affected by the level of light intensity(Sinaga et al., 2020). Wet biomass can be seen in appendix 11.

Spirulina platensis dry biomass was obtained from the harvest at the end of the study which had been dried in the sun, then after the sample was dry the sample was tested proximately for protein content to the productivity and water quality laboratory of FIKP (Faculty of Marine and Fisheries Sciences) Hasanuddin University, Makassar. The dry biomass weight graph can be seen in Figure 10.

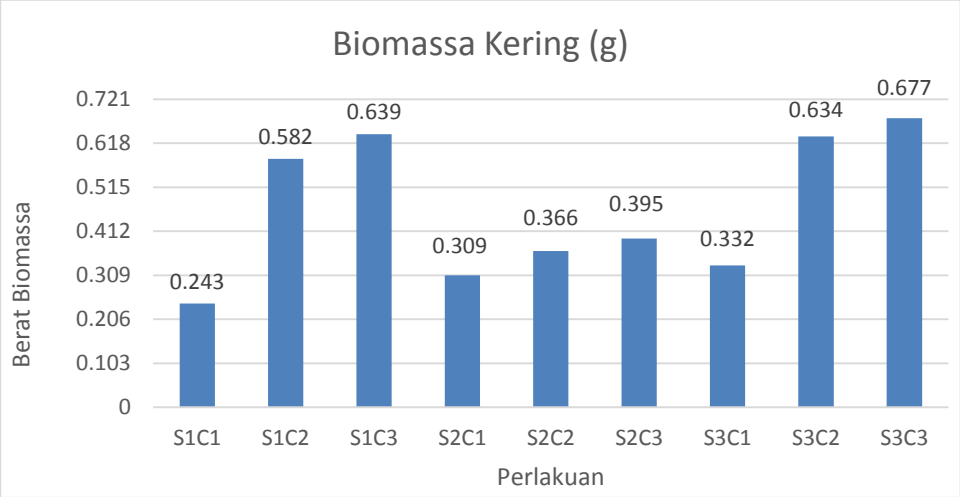

Figure 3 Graph of Dry Biomass Weight (g) spirulina platensis

Based on the graph of dry biomass weight of spirulina platensis, it can be seen that the dry weight in each treatment has a different pattern, the highest biomass weight is found in the highest treatment at, S3C3 treatment (salinity 30 ppt and light 36 watts) with the amount of 0.677 salt,S1C3 treatment (salinity 10 ppt and light 36 watts) with a total of 0.639 grams, followed by S3C2 treatment (30 ppt salinity and 21 watts of light) with a total of 0.634 grams, S1C2 treatment (10 ppt salinity and 21 watts of light) 0.582 grams, S2C3 treatment (salinity 20 ppt and 36 watts of light) with a total of 0.395 grams, the treatment, the S2C2 treatment (20 ppt salinity and 21 watts of light) amounted to 0.366 grams, while the lowest was in the S3C1 treatment (30 ppt salinity and 16 watts of light) with an amount of 0.332 grams, the S2C1 treatment. (20 ppt salinity and 16 watts of light) in the amount of 0.309 grams, the S1C1 treatment (10 ppt salinity and 16 watts of light) with the amount of 0.243 grams.

C. Protein Content

Proximate analysis used to analyze the nutritional content of spirulina platensis, namely protein. Spirulina which was analyzed proximately was harvested at the end of the study, after being weighed to determine its biomass. The results of the proximate analysis of protein content can be seen in Figure 11.

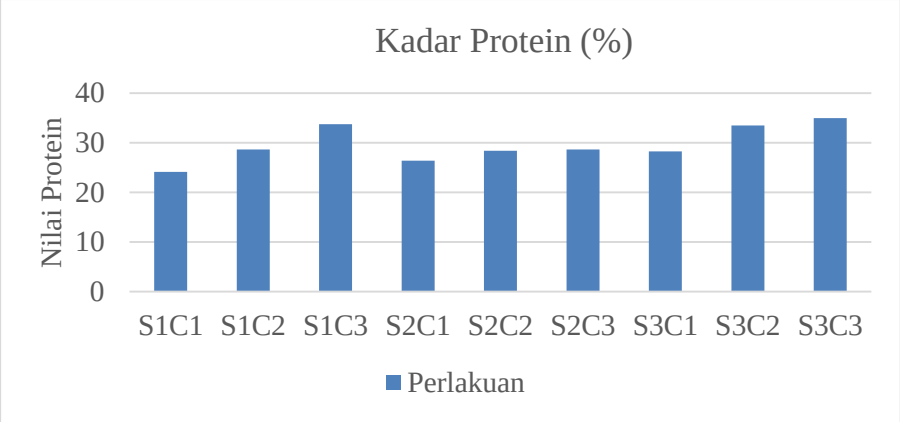

Figure 4 . Graph of Protein Content (%) of spirulina platensis

Based on Figure 11 above, the results of the proximate analysis of spirulina platensis were harvested at the age of 8 days of maintenance. The S3C3 treatment resulted in a relatively higher protein content (34.99%) than the other treatments, while the lowest protein content compared to other treatments was found in the S1C1 treatment, namely protein content (24.12%).

The results showed that treatment using Walne culture media had the highest protein content with an average of 34.99 ± 24.12%. This is presumably because the concentration of Nitrogen in sodium nitrate (NaNO3) contained in the culture media is quite high. when compared with other fertilizers such as TMRL and Zarrouk media According to a research report conducted by Colla et al., (2005), that nitrogen is needed in the process of synthesizing amino acids as a constituent of proteins in cells. Then it is said that the lower the NaNO3 concentration, the lower the protein value of the cell will be.

Likewise for the treatment with using Walne culture media already has a fat content of the value of fat content in cells, treatment with Walne culture media is also the best medium when compared to other media

D. Water quality

Water quality parameters were carried out once in 8 days during the study. The results of the average range of water quality parameter measurements during the study can be seen in Table 9

Table 5. Average range of water quality parameters during the study

TREATMENT	WATER QUALITY PARAMETERS				
	DO(mg/L)	TEMPERATURE (oC)	PH	NITRATE	PHOSTATE
S1C1	5.95 - 6.37	27 - 28	7.09 - 8.30	1,849	0.4100
S1C2	5.92 - 6.33	27 - 28	7.09 - 8.73	3,294	0.1154
S1C3	5.95 - 6.71	27 - 28	7.11 - 8.43	0.609	0.0899
S2C1	5.66 - 6.55	26 - 28	7.12 - 8.65	2,868	0.2789
S2C2	5.62 - 6.32	27 - 28	7.02 - 8.60	4,968	0.4432
S2C3	5.67 - 6.74	26 - 28	7. 01 - 8.92	3.165	0.0882
S3C1	5.72 - 6.70	26 - 28	7.07 - 8.39	2,890	0.0533
S3C2	5.71 - 6.82	27 - 28	7.11 -	4,484	0.1068

			8.88		
S3C3	5.72 - 6.71	26 - 28	7. 12 - 8.93	4,308	0.3194

An important factor influencing the growth of Spirulina platensis during the research was water quality, namely the physical and chemical conditions of the medium. The water quality parameters in table 9 show a good range for the growth of Spirulina platensis density. Temperature measurement is one of the factors that affect the productivity of microalgae, because each species has its own optimal temperature, during the study the temperature ranged from 27 to 28oC.(Hariyati, 2012)Spirulina platensis can grow maximally at temperatures between 20 – 30 °C. Temperature range during culture maintenance of Spirulina platensis. still in optimal condition because the culture was carried out in a controlled temperature room, meaning that the temperature during the study was in the optimal temperature range.

pH (power of hydrogen) is an environmental factor supporting the growth of Spirulina platensis, the range of pH values during the study was 7.01 – 8.93, this range was suitable for the growth and development of Spirulina sp. According to(Astiani et al., 2016)said that most cells, including phytoplankton, are very sensitive to the degree of acidity of the fluid that surrounds them. The degree of acidity is measured on a pH unit scale. The optimal pH value for Spirulina is 7.2 – 9.5.

Dissolved oxygen (DO) during the study ranged from 5.62 – 6.82 mg/l this range is a good range as according to(Astiani et al., 2016)Optimum oxygen for phytoplankton growth ranges from 4.65 to 6.27 mg/l. The availability of oxygen in culture media is an important factor for phytoplankton, because it is directly used as material to form organic molecules through the process of photosynthesis.

Nitrates in spirulina platensis culture media ranged from 0.609 to 4.968 mg/L and phosphate from 0.0533 to 0.4432 mg/L, this value indicates the range according to(Buwono & Nurhasanah, 2018b)that the range of nitrate for density growth of spirulina platensis is 13.1 mg/L and 0.5 mg/L. the nitrate content contained in the culture of spirulina platensis reached the optimum value. while the phosphate is 0.05 – 0.20 mg/L generally in small amounts in water. High phosphate levels in water can trigger excessive microalgae growth. High phosphate is good for supporting the growth of spirulina platensis.

CONCLUSION

A. Conclusion

The conclusions obtained after conducting this research are as follows:

1. Salinity had no significant effect on Walne media on the density of Spirulina platensis.
2. Light intensity has a significant effect on walne media on the density of Spirulina platensis
3. The combination of salinity and light intensity has no effect on the density of Spirulina platensis on Walne media

BIBLIOGRAPHY

1. Ahmad, S. (2008). Influence of light quality and intensity in the cultivation of Spirulina platensis from Toliara (Madagascar) in a closed system. Journal of Chemical Technology & Biotechnology, 83(May), 1163–1169. https://doi.org/10.1002/jctb
2. Ali, SK, & Saleh, AM (2012). Spirulina - An overview. International Journal of Pharmacy and Pharmaceutical Sciences, 4(SUPPL.3), 9–15.

https://doi.org/10.1201/9780203025901.ch14

3. ana evita, Yunita Maimunah, HS (2020). THE USE OF LAMTORO (Leucaena Leucocephala) LEAF EXTRACT AS A FERTILIZER WITH DIFFERENT SALINITY ON GROWTH RATE, BIOMASS AND CHLOROPHIL-A IN CHLORELLA VULGARIS MICROALGAE Ana. 5, 47–55.
4. Astiani, F., Dewiyanti, I., Mellisa Department of Aquaculture, S., Syiah Kuala, U., & Aceh, B. (2016). EFFECT OF DIFFERENT CULTURE MEDIA ON GROWTH RATE AND BIOMASS OF SPIRULINA sp. EFFECT OF DIFFERENT CULTURE MEDIA ON GROWTH RATE AND BIOMASS OF Spirulina sp. Scientific Journal of Marine and Fisheries Students Unsyiah, 1 (November), 441–447.
5. Benjamin, W. (2019). EFFECT OF DIFFERENT PHOTOPRIODES ON CULTURE OF Chlorella sp. WITH A CONTINUOUS PHOTOBIOREACTOR SYSTEM. 3, 1–9.
6. Buwono, NR, & Nurhasanah, RQ (2018a). Population Growth Study of Spirulina sp. on Different Cultural Scales
<i>[Study of Spirulina sp. Population Growth in The Different Culture Scale]<i>. Scientific Journal of Fisheries and Marine Affairs, 10(1), 26. https://doi.org/10.20473/jipk.v10i1.8516
7. Buwono, NR, & Nurhasanah, RQ (2018b). Study of population growth of spitulina sp. on different cultural scales. Scientific Journal of Fisheries and Marine Affairs, 10(1), 26–33.
8. Caturwati, LN, & Setyati, RH (2020). Optimization of Spirulina sp. Growth in Walne Media with Variation of Urea and NaHCO3 Supplements. Journal of Tropical Biodiversity and Biotechnology, 5(1), 53–58. https://doi.org/10.22146/jtbb.53635
9. Cells, S. (2009). USE OF TECHNICAL CULTURE MEDIA ON THE PRODUCTION AND NUTRITIONAL CONTENT OF Spirulina platensis Cells Using of Technical Culture Media on The Production and Nutrition Contents of. 4(2), 53–61.
10. Fakhri, M., Antika, PW, Ekawati, AW, & Arifin, NB (2020a). Growth, Pigment Content, and Protein of Spirulina platensis Cultured on Ca(NO3)2 with Different Doses. Journal of Aquaculture and Fish Health, 9(1), 38–47.
11. Fakhri, M., Antika, PW, Ekawati, AW, & Arifin, NB (2020b). Growth, Pigment Content, and Protein of Spirulina platensis Cultured On Ca(NO3)2 With Different Doses. Journal of Aquaculture and Fish Health, 9(1), 38–47.
12. Febriani, R., Hasibuan, S., & Syafriadiman. (2020). Effect of Different Salinity on Density and Carotenoid Content of Dunaliella salina. Journal of Fisheries and Marine Affairs, 25(1), 36–46.
13. Fithriani, D., Amini, S., Melanie, S., & Susilowati, R. (2015). Phytochemical Test, Total Phenol Content and Antioxidant Activity of Microalgae Spirulina sp., Chlorella sp., and Nannochloropsis sp. Journal of Postharvest and Marine and Fishery Biotechnology, 10(2), 101. https://doi.org/10.15578/jpbkp.v10i2.270
14. Grassi, TLM, Paiva, NM, Oliveira, DL, Taniwaki, F., Cavazzana, JF, da Costa Camargo, GCR, Diniz, JCP, Bermejo-Poza, R., Borghesi, R., Villarroel, M., & Ponsano , EHG (2020). Growth performance and flesh quality of tilapia (Oreochromis niloticus) fed low concentrations of Rubrivivax gelatinosus, Saccharomyces cerevisiae and Spirulina platensis. Aquaculture International, 28(3), 1305–1317. https://doi.org/10.1007/s10499-020-00527-y
15. Hariyati, R.-. (2012). Growth and Biomass of Spirulina sp in a Laboratory Scale. Biome:

Biological Scientific Periodic, 10(1), 19. https://doi.org/10.14710/bioma.10.1.19-22

16. Hutami, H. (2015). Comparison of the growth rate of spirulina platensis at different temperatures in a laboratory scale. 4, 74–81.
17. Indrastuti, C., Muskananfola, MR, Studi, P., Sumberdaya, M., Department, P., Diponegoro, U., & Chlorophyll-a, K. (2014). STUDY OF DIFFERENT LIGHT INTENSITY ON THE CONCENTRATION OF chlorophyll-a ON GROWTH OF MICROALGAE Spirulina platensis IN LABORATORY SCALE. 3, 169–174.
18. Maulana, PM, Karina, S., & Mellisa, S. (2017). Utilization of Tofu Liquid Waste Fermentation Using EM4 As An Alternative Nutrient For Microalgae Spirulina sp. Unsyiah Marine and Fisheries Student Scientific Journal, 2(1), 104–112.
19. Merry. (2018). Effect of Salinity Differences on Biomass Growth of Spirulina plastensis Microalgae Cultivation. Merry, 3(2), . http://journal.stainkudus.ac.id/index.php/equilibrium/article/view/1268/1127%0Ahttp://publicacoes.cardiol.br/portal/ijcs/portugues/2018/v3103/pdf/3103009.pdf%0Ahttp://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0121-75772018000200067&lng=en&tlng=
20. Mutia, S., & Nedi, S. (2021). EFFECT OF NITRATE AND PHOSPATE CONCENTRATION ON Spirulina platensis WITH INDOOR SCALE. 4(April), 29–35.
21. Notonegoro, H., Setyaningsih, I., & Tarman, K. (2018). Active Compound Content of Spirulina platensis Grown on Walne Media with Different Concentrations of NaNO3. Journal of Postharvest and Marine and Fishery Biotechnology, 13(2), 111. https://doi.org/10.15578/jpbkp.v13i2.555
22. Pandey, JP, Pathak, N., & Tiwari, A. (2010). Standardization of pH and Light Intensity for the Biomass Production of Spirulina platensis. Journal of Algal Biomass Utilization, 1(2), 93–102.
23. Prayitno, J. (2016). Growth Patterns and Harvesting of Biomass in Microalgae Photobioreactors for Carbon Capture. Journal of Environmental Technology, 17(1), 45. https://doi.org/10.29122/jtl.v17i1.1464
24. Radmann, EM, Reinehr, CO, & Costa, JAV (2007). Optimization of the repeated batch cultivation of microalga Spirulina platensis in open raceway ponds. Aquaculture, 265(1–4), 118–126. https://doi.org/10.1016/j.aquaculture.2007.02.001
25. Rahayu Kusdarwati. (2011). The Effect of Light Color Differences on the Growth of Spirulina sp. , 66(July), 37–39.
26. Saniyatul et.al. (2018). Protein Content of Spirulina platensis In Culture Media With Nitrate Concentration. 7(2), 98–102.
27. Santosa, V., & Limantara, L. (2007). Spirulina Cultivation. Popular Biology Magazine, 1(2), 14–24.
28. Sari Afriani, Uju, & Setyaningsih, I. (2018). The chemical composition of plantesis spirulina cultivated in a photobioreactor with different photoperiods. Indonesian Journal of Fishery Products Processing, 21(3), 471–479.
29. Setyaningsih, I., & Saputra, AT (2011). CHEMICAL COMPOSITION AND PIGMENT CONTENT Spirulina fusiformis AT DIFFERENT HARVESTING AGES IN FERTILIZER MEDIA. Indonesian Journal of Fishery Products Processing, 14(1), 63–69. https://doi.org/10.17844/jphpi.v14i1.3430

30. Sinaga, R., Effendi, I., & Ambarsari, H. (2020). Spirulina platensis Growth in Polluted Domestic Waste Water Medium and Its Utilization As a Raw Material for Biogas Production. 3(April), 38–48.

31. suminto. (2011). USE OF TECHNICAL CULTURE MEDIA ON PRODUCTION AND NUTRITIONAL CONTENT OF Spirulina platensis CELLS. FISHERIES SAINTEK : Indonesian Journal of Fisheries Science and Technology, 4(2), 53–61. https://doi.org/10.14710/ijfst.4.2.53-61

32. Syaichurrozi, I., & Jayanudin, J. (2017). Cultivation of Spirulina Platensis In Nutritious Media Tofu And Synthetic Liquid Waste. Journal of Renewable Natural Materials, 5(2), 68–73. https://doi.org/10.15294/jbat.v5i2.7398

33. Utomo, NBP, Winarti, & Erlina, A. (2005). Growth of Spirulina platensis cultured with Inorganic Fertilizer (Urea, TSP and ZA) and Chicken Manure. Indonesian Aquaculture, 4(1), 63–67.