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Terbit 2 kali setahun, Juni dan Desember. Elkawnie merupakan jurnal Integrasi keilmuan Sains dan Teknologi dengan Islam yang mencakup riset dan teknologi dalam bidang kajian Arsitektur, Biologi, Kimia, Teknik Lingkungan, Teknlogi Informasi dan Komunikasi, Teknik Fisika serta bidang sains dan teknologi lainnya. Secara khusus jurnal Elkawnie membahas perkembangan riset dan teknologi dalam memberikan kontribusi pembangunan sebagai bagian dari sumbangsih pemikiran ilmuan muslim dalam lingkup akademis.

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DAFTAR ISI

CHEMICAL ANALYSIS OF ENVIRONMENTAL CONDITIONS OF SEAWEED CULTURE IN PULO RAYA KABUPATEN ACEH JAYA, ACEH PROVINCE

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Abstract: Research has been carried out on the analysis of the environmental conditions of seaweed cultivation in the Pulo Raya area of Aceh Jaya Regency, Aceh Province. Aceh Province is the westernmost province of the Indonesian archipelago. Geographically, Aceh is a peninsula area of the island of Sumatra which is directly bordered by the Indian Ocean so that Aceh has several small islands. With this condition, it has the potential to be used as a place for seaweed cultivation. An analysis of environmental conditions is needed to produce good quality seaweed. Examination parameters include pH, temperature, heavy metal content, COD and salinity. Sample examination is carried out based on Standar Nasional Indonesia (SNI) No. 7578.1: 2010 and Decree of the Minister of Environment (KemenLH) No. 51: 2004. The results obtained showed a pH level of 6.22; temperature of ± 28 ^{o}C; levels of lead metal ions (Pb (II)) 0.001 ppm and copper (Cu (II) metal ions of 0.002 ppm; The COD level is 137 ppm and the salinity level is 28.75 ppm. With the results of the chemical analysis obtained, the Pulo Raya area is feasible to become a seaweed cultivation area.

Keyword: seaweed; cultivation; chemical analysis; environmental; Aceh

1. Introduction

Indonesia is the largest archipelagic country in the world with a coastline of more than 81,000 km with 17,508 islands. Stretched on the equator with a tropical climate, flanked by two oceans namely the Pacific Ocean in the east and the Indian Ocean in the West. One of the western provinces of Indonesia is Aceh Province. Aceh is the westernmost province in Indonesia which has many small islands which are very potential to develop seaweed cultivation. The area of Aceh Jaya Regency is one of the producers of seaweed. The geographical location of Aceh Jaya Regency, especially in the Pulo Raya area of Sampoinet sub-district, is very supportive for seaweed cultivation. So it is expected to become one of the largest producing areas of seaweed for the western region of Indonesia. So far, the Province of South Sulawesi and the Province of the

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Islands of Bali have become the largest producers of seaweed producers in Indonesia, followed by other islands. (Badan Pusat Statistik, 2017)

Seaweed is an algae that lives in the sea, including the Thallophyta. Various types of seaweed exist in Indonesia, divided according to the nature of the plants. Thalus is soft like gelatin (gelatinous), hard contains lime (calcareous), soft like cartilage (cartilaginous) and fibrous (spongeous) (Meiyana, 2001). The seaweed business has good prospects, given a very short maintenance period, which is around 45 days (Belson, 2013). If processing is guaranteed, it is estimated that seaweed is a commodity of the future.

The types of seaweed that are widely cultivated include Eucheuma cottonii or known as Kappaphycus alvarezii as a source of carrageenan (Alam, 2011). The success of seaweed cultivation depends on the right location, which affects its life force and the quality of carrageenan content. Coastal areas protected from strong winds and waves (currents < 20-40 m / sec), with mud free bases are suitable locations for E. cottonii. The depth of seawater is between 2-15 m at the lowest tide. Suitable water temperature is 20-28 °C with a maximum daily fluctuation of 4 °C. High brightness level not less than 5 meters. The recommended water salinity for seaweed cultivation is 28-35 ppt because it contains enough food in the form of macro and micronutrients. (Qumain et al, 2016). Phosphate content is very good if it is in the range of 0.10 - 0.20 mg/L, while nitrates insufficient conditions are usually in the range of 0.01 -0.7 mg/L. According to this statement, it is necessary to identify the environmental conditions of seaweed cultivation in the Pulo Raya area of Aceh Jaya Regency in Aceh Province so that in the future fisherman cultivation can develop rapidly and the quality of seaweed produced can compete as an export commodity with other regions nationally and internationally.

2. Experimental

This research is laboratory experimental and compares data obtained with references used. This research was conducted in February 2018. The sample used came from the Pulo Raya area of Sampoinet Sub-district, Aceh Jaya Regency, Aceh Province.

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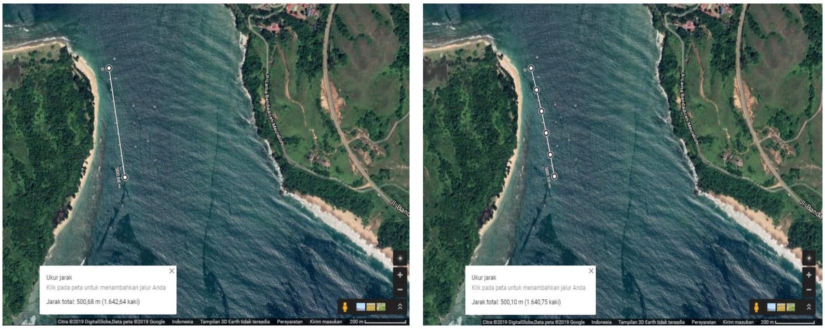
Samples were taken using sampling techniques in accordance with Standar Nasional Indonesia (SNI) 6964.8: 2015.

a. Apparatus and Reagents

In this study, the equipment used was standard glassware, sample bottles, plastic funnels, filter paper, spray gourds, universal indicators, mercury thermometers, pH Meters, pipettes, analytic balance with an accuracy of 0,0001 g, and Atomic Absorption Spectrophotometer. The materials used are distilled water, standard copper (Cu) solution, standard lead (Pb) solution, nitric acid (HNO_3), sulfuric acid (H_2SO_4), silver sulfate ($AgSO_4$), mercury sulfate ($HgSO_4$), potassium dichromate ($K_2Cr_2O_7$), ferrous ammonium sulfate, etc.

b. Sampling technique

The samples taken came from the residents' seaweed cultivation area in the Pulo Raya area of Aceh Jaya Regency. Samples were taken randomly at a certain point with a depth of 50 cm. Samples are packed using dark sample bottles and do not contain air bubbles.



(a) (b)

Figure 1. (a). Sampling distance. (b). Sampling point

c. Determination of the degree of acidity (pH)

The samples obtained were tested for pH using a pH meter. Then the results are recorded.

d. Determination of temperature

The sample obtained is measured in temperature using a digital thermometer. Then the results are recorded. (Amalia, 2013).

e. Determination of levels of Pb (II) and Cu (II) metal ions

Before measuring metal content, first, measure the standard solution curves of each metal. The standard Pb 0.00 mg / L metal series solution (blank) measured its absorbance using Atomic Absorption Spectrophotometry at λ specific 283.3 nm. The treatment was done 3 times. The same is done for the Pb 0.00 standard series solution (blank); 0,1; 0,2; 0,3; 0,4 and 0,5 mg / L. With the same treatment of standard solutions of Cu at specific λ 324.7 nm. While the treatment of the sample was dissolved in 40 mL HNO_3 (p) then heated to 80 ° C until HNO_3 evaporated. Then cooled and diluted with distilled water to a volume of 100 mL. After cold, the sample is filtered using filter paper. The resulting filtrate was measured pH 3.5-5 and then put in a 50 mL measuring flask to the marked line. Then determined the elemental content of the Pb element level at λ specific 283.3 nm and the content of Cu element at λ specific 324.7 nm using the Atomic Absorption Spectrophotometer (AAS). (Ramchander et al., 2015) (Radulescu et al., 2014)

f. Determination of Chemical Oxygen Demand (COD) levels

Most of the organic matter contained in the sample through the COD test is oxidized by the solution $K_2Cr_2O_7$ in a boiling acid state. During this reaction lasting 2 hours, the steam is refluxed with a condenser, so that volatile organic matter (volatile) does not disappear out. Silver sulfate (Ag_2SO_4) is added as a catalyst to accelerate the reaction. While $HgSO_4$ is added to eliminate chloride interference which is generally present in wastewater. To ensure that almost all organic substances are oxidized, the oxidizing agent $K_2Cr_2O_7$ still has to be left after refluxing. $K_2Cr_2O_7$ remaining in the solution is used to determine how much oxygen has been used. The remaining $K_2Cr_2O_7$ is determined by titration with ferrous ammonium sulfate (FAS). The ferroin indicator is used to determine the endpoint of the titration when the bluish green solution turns to reddish brown. The remaining $K_2Cr_2O_7$ in the blank solution is the initial $K_2Cr_2O_7$ because it is expected that the blank does not contain organic substances which can be oxidized by $K_2Cr_2O_7$.

Piped 10 mL of sample and pipetted 40 mL of distilled water. Then put in Erlenmeyer sharpening. Piped 50 mL of distilled water into a sharpened Erlenmeyer for blank. Sharpening Erlenmeyer is placed on top of a basin of ice and 1-2 grams of mercury sulfate (Hg_2SO_4), 5 mL of reagent sulfate, and some boiling stones are added. Stir until homogeneous. With the sharpening Erlenmeyer still in the basin of ice, add 25 mL of potassium dichromate solution ($K_2Cr_2O_7$) 0.25 N slowly (with a volumetric pipette) and stir until homogeneous. Then 70 mL of sulfate reagent was added slowly, stirring until homogeneous. Erlenmeyer sharpening is refluxed (using a condenser) with a hot plate for 2 hours. After 2 hours, Erlenmeyer is cooled, then 8-10 drops of ferroin indicator are added, then titrated with a FAS 0.25 N solution until the endpoint is brownish red, and the volume is recorded.
Calculation is :

$$COD\left(\frac{mg}{L}\right) = \frac{(b-a)\ x\ N\ x\ 8\ x\ 1000}{S}$$

Information:
b = FAS volume required for blank titration.
a = FAS volume needed for sample titration.
N = Normality of FAS used
S = Volume of the sample used.

g. Determination of salinity levels

Salinity using the Argentometry method, this method uses painter Silver Nitrate ($AgNO_3$) 0.28 N and indicator K_2CrO_4 (Underwood A.L, Quantitative Chemical Analysis). Here there is complete deposition of the ion being determined with a silver solution, for example for titration of chloride ions, first, a white precipitate of AgCl will form until all chloride ions have reacted. The presence of a small number of chromate ions is able to form red-brown deposits with excess silver (I) ions. All AgCl will settle first because the solubility result (Qsp) is smaller than Qsp Ag_2CrO_4. Before measuring salinity, standardization of $AgNO_3$ 0.28 N must be standardized. Sodium Chloride (NaCl) solution is pipetted as much as 25 mL of NaCl solution and then put into

Erlenmeyer. 6 drops of K_2CrO_4 indicator are added and titrated with $AgNO_3$ until the endpoint is formed by brown precipitate. Then a sample solution of seawater was prepared and then transferred to a 400 mL glass cup. Piped as much as 25 mL, transferred to 500 mL sharpened Erlenmeyer. 6 drops of the K_2CrO_4 indicator are then homogenized. After homogeneity, it is titrated with $AgNO_3$ 0.28 N with the end point of the brown precipitate.

3. Results and Discussion

a. Determination of the degree of acidity (pH)

Determination of pH levels aims to determine the acidity of seawater as a growth medium of seaweed

Table 1. pH levels from several sample points

No	Sample (Seawater)	pH
1	Point I	6,40
2	Point II	5,70
3	Point III	5,80
4	Point IV	6,98

From the data obtained shows that the pH level found at each sample point shows a not significant difference. The highest pH is shown in sample point IV. If averaged, the resulting pH is 6.22. If viewed from SNI 7578.1: 2010 concerning seaweed production, part 1 is the basic off-method that pH is an external factor with optimal values obtained between 6.8-8.2.

b. Determination of temperature

Temperature determination aims to determine the conditions of seawater as a growth medium of seaweed. This temperature measurement is carried out in the morning before noon. The temperature obtained has been carried out on average throughout the day.

Table 2. The surface temperature of several sample points

No	Sample (Seawater)	Temperature
1	Point I	±29 °C
2	Point II	±27 °C
3	Point III	±27 °C
4	Point IV	±28 °C

From the data obtained shows that the temperature contained in each sample point shows insignificant differences. The highest temperature is shown at sample point I. If average, the temperature ranges from 28°C. This is reinforced in accordance with Mubarak's (1990) research on his article regarding the rate of growth of seaweed with a 3% increase in seaweed growth per day with an optimal temperature of 22°C - 28°C. If viewed from SNI 7578.1: 2010 concerning seaweed production part 1 the basic off method that the optimal temperature obtained is between 25°C-28°C.

c. Determination of Pb (II) and Cu (II) metal ions

From several samples taken from several points determined according to the samples taken, the measurement results are obtained as follows:

Table 3. Concentration of Pb from several sample points

No	Sample (Seawater)	Pb (II) (ppm)
1	Point I	0,001 ± 0,00002
2	Point II	0,001 ± 0,00002
3	Point III	0,0015 ± 0,00002
4	Point IV	0,001 ± 0,00002

From the data obtained shows that the Pb metal content found at each sample point shows a not significant difference. The highest level is shown at sample point III. The metal content of Pb obtained is probably derived from contamination produced by fishermen's transportation equipment. (Ogoyi et al, 2011) (Khatimah, 2016) (Koesmawati et al, 2017). If averaged,

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the concentration obtained ranges from 0.001 ppm. If viewed from the Decree of the Minister of Environment (KemenLH) No. 51: 2004, dissolved Pb metal content is less than 0.005 ppm.

Table 4. Concentrations of Cu from several sample points

No	Sample (Seawater)	Cu (II) (ppm)
1	Point I	0,003 ± 0,00001
2	Point II	0,001 ± 0,00001
3	Point III	0,003 ± 0,00001
4	Point IV	0,001 ± 0,00001

From the data obtained shows that the levels of Cu metals found at each sample point show a significant difference. The highest levels are shown in sample points I and III. If averaged, the concentration obtained ranges from 0.002 ppm. If viewed from the Decree of the Minister of Environment (KemenLH) No. 51: 2004, dissolved metal Cu is less than 0.005 ppm.

d. Determination of Chemical Oxygen Demand (COD) levels

From the results of the measurement of the sample, the following data are obtained:

Table 5. COD levels from several sample points

No	Sample (Seawater)	COD (ppm)
1	Point I	127
2	Point II	130
3	Point III	150
4	Point IV	141

From the data obtained shows that the COD levels contained in each sample point showed insignificant differences. The highest level is shown at sample point III. If average, the concentration obtained is around 137 ppm.

e. Determination of salinity levels

From the results of the measurement of the sample, the following data are obtained:

Table 6. Salinity levels from several sample points.

No	Sample (Seawater)	Salinity (ppm)
1	Point I	27
2	Point II	30
3	Point III	27
4	Point IV	31

From the data obtained shows that the salinity levels contained in each sample point showed insignificant differences. The highest salinity is shown in sample point IV. If averaged, the salinity obtained is 28.75 ppm. If viewed from SNI 7578.1: 2010 concerning seaweed production, part 1 is the basic off-method that salinity levels are between 15-30 ppm.

4. Conclusion

Based on the data generated shows the chemical analysis of seawater includes a pH level of 6.22. Followed by temperature measurements obtained at ± 28 ^{o}C. Determination of the levels of lead metal ions (Pb (II)) 0.001 ppm and copper (Cu (II)) ions of 0.002 ppm. For COD levels of 137 ppm and salinity levels of 28.75 ppm. So it can be concluded that the Pulo Raya area is feasible to be used as a seaweed cultivation area in accordance with the testing parameters contained in the Indonesian National Standard (SNI) No. 7578.1: 2010 and Decree of the Minister of Environment (KemenLH) No. 51: 2004.

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