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Analysis of Water Quality for the Development of Eucheuma Cottoni Seaweed Cultivation in Mandalle Beach, Pangkep Regency, Indonesia

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Abstract:
The purpose of this study was to determine the possibility of developing Eucheuma cottoni seaweed cultivation around Mandalle Beach, Pangkep Regency, South Sulawesi Province, Indonesia based on the physical and chemical aspects of the waters and the substrate of the research site. Determination of research locations based on differences in environmental characteristics at each research location. Location A is located to the north of Mandalle Beach, Location B is around the Pier of Pangkep State Agricultural Polytechnic campus and location C is in the southern part of Mandalle Beach which is located around a mangrove forest. The data obtained were collected and analyzed by descriptive analysis.
The results showed that the research location consisting of location A, location B and location C had the potential for the development of Eucheuma cottoni seaweed cultivation. Around Mandalle Beach in terms of physical and chemical aspects of waters and substrates.

Keywords: *Water quality, seaweed, eucheuma cottoni, mandalle*

1. Introduction

Seaweed is one of the marine product commodities in the form of non-fish and is also an export commodity and has economic value, this is because seaweed has a high carrageenan content (Zain et al., 2012).

Seaweed cultivation is inseparable from the suitability of the waters. The main factors that become obstacles in the development of seaweed cultivation in Indonesia are the incompatibility of the location of the waters and the data of water quality parameters that are not suitable. In addition, determining the location of cultivation is often based on feelings (Akbar, 2014). The suitability of the waters is important to know, because the determination of the location of the waters that are suitable for aquaculture, so it is hoped that in the future this suitable location can be utilized as much as possible.

According to Hardjowigeno in Jailani and Semedi (2015) that land suitability is the suitability of a land for certain use purposes, through determining the value (class) of land and land use patterns associated with the potential of the area, so that success in seaweed cultivation activities can be achieved.

In general, the problem in the development of seaweed cultivation is the incompatibility of the location of the waters for cultivation. Generally, the determination of the location of cultivation is often based on hereditary information and local knowledge (Samad, 2011). In addition, the suitability of the waters, the shape or characteristics of the coastal area is also influential in determining the carrying capacity of seaweed cultivation. Generally, the calculation of the carrying capacity of seaweed cultivation only uses the method for coastal areas near the coast, as in the study of Jailani and Semedi (2015) stated that the estimation of carrying capacity was carried out in coastal areas that were not archipelagic areas, and using a comparison of the area of an area used with the unit area of the seaweed cultivation method. This method does not include the distance between units so that the estimation results can be excessive.

The level of water quality required for each particular activity has different quality standards, Therefore, testing must be carried out to determine the suitability of water quality with its designation. Water quality is one of the success

factors in seaweed cultivation. Water quality that is not in accordance with cultivation standards will cause problems in the cultivation process. Problems that can arise from poor water quality such as the emergence of various diseases to the death of the seaweed itself. Water quality testing needs to be carried out to ensure the suitability of the value of each measurement result to the requirements of water quality standards for seaweed cultivation, especially *Eucheuma cottoni*.

Mandalle Village, Mandalle District, Pangkep Regency is one of the areas where a lot of people carry out seaweed cultivation activities, and for more than 10 years the community has been cultivating seaweed. However, in recent years, at the location of seaweed cultivation, a pier has been built as a place for fishing boats to rest. Based on this, it is suspected that it has an effect on water quality in conducting seaweed cultivation activities, especially *Eucheuma cottoni*. Therefore, a research has been conducted on water quality at Mandalle Beach to identify whether Mandalle Beach is still suitable for *Eucheuma cottoni* seaweed cultivation activities or not.

2. Research Purposes

The purpose of this study was to determine the possibility of developing Eucheuma cottoni seaweed cultivation around Mandalle Beach, Pangkep Regency, South Sulawesi Province, Indonesia based on the physical and chemical aspects of the waters as well as the research site substrate.

3. Method

The research was carried out for 3 months, namely from June to August 2021 by conducting four sampling times. Determination of research locations based on differences in environmental characteristics at each research location. Location A is located on the north side of Mandalle Beach, Location B is around the Pier of Pangkep State Agricultural Polytechnic campus and location C is in the southern part of Mandalle Beach, which is around the mangrove forest.

The materials used in this research are seawater samples, basic substrates. The tools and methods used to measure or collect water quality data, and the basic substrate needed in this study are presented in Table 1.

Parameter	Unit	Tools and Methods
1. Physics-Chemistry of water		
- Temperature	^oC	Water Checker U-10/*insitu*
- Water flow speed	m/sec	Water Checker U-10/*insitu*
- Light intensity	lux	Water Checker U-10/*insitu*
- Salinity	ppt	Water Checker U-10/*insitu*
- Phosphate (PO_4)	ppm	Water Checker U-10/*insitu*
- Nitrate (NO_3)	ppm	Water Checker U-10/*exsitu*
- pH	-	Water Checker U-10/*insitu*
- Dissolved oxygen	ppm	Water Checker U-10/*exsitu*
- Total Organic Ingredients	ppm	Water Checker U-10/*exsitu*
- Total Solid Suspension (TTS)	ppm	Water Checker U-10/*exsitu*
2. Substrate Physics-Chemistry		
- Texture	%	mechanic
- pH	-	pH meter
- Organic Ingredients	%	Tetrik metrik
- N-Total	%	Tetrik metrik
- Phosphate	ppm	Tetrik metrik

Table 1: Tools And Methods for Collecting Physical, Chemical and Substrate Data
Source: Jaelani (2006)

The research method used is descriptive survey and field observation. Descriptive survey is intended to provide an accurate description of a symptom and the main concern is a careful measurement of one or more dependent variables in a sample, while field observation is intended to make observations in the field regarding the object to be studied. The physico-chemical parameters of the substrate or sediment were analyzed at the Pangkep State Agricultural Polytechnic Soil Laboratory. After the data is collected and processed, the next process is to analyze the data using descriptive analysis methods.

4. Results and Discussion

4.1. Water Physics Parameters at the Research Site

The condition of the water physics parameters at the research site which consists of parameters of current velocity (m/sec), water temperature (^oC) and light intensity (Lux) can be seen in Table 2.

No.	Parameter	Unit	Results
1	Water Flow Speed	m/sec	0,01-0,02
2	Temperature	^{0}C	30-32
3	Light intensity	lux	5.230-65.500

Table 2: Water Physics Parameter Data at the Research Site
Source: Primary Data after Processing, 2021

Current is the flowing motion of a mass of water caused by several factors, namely, by wind, changes in seawater density, long wave movements, and can also be caused by tides. . Therefore, currents have a direct influence on the spread of living organisms from one place to another (Junaidi, 2010). Table 2 shows that the current velocity values for all research locations consisting of location A, Location B and Location C are in the range of 0.01-0.01 m/sec.

The water temperature for all research sites consisting of location A, location B and location C was in the range of 30-32^{o}C. Based on the temperature aspect, the water temperature at the research site is still in the appropriate category. Water temperature can affect various biological, physical and chemical processes of water. The increase in temperature that can still be tolerated by the organism will be followed by an increase in the degree of metabolism and photosynthetic activity of natural food (phytoplankton).

An increase in temperature causes an increase in viscosity, chemical reactions, evaporation, and valtilization, and can reduce the solubility of gases in water. Besides that, it causes an increase in the speed of metabolism and respiration of aquatic organisms, which in turn will increase oxygen consumption (Effendi, 2003). Temperature measurement using a thermometer. The use of a thermometer is to insert the tip of the thermometer into the water to be measured.

The aspect of light intensity is closely related to the aspect of brightness. At this research location, it still meets the requirements for light intensity and water brightness. Brightness (transparency) shows how clear the water in a water is so that the brightness can reflect the amount of plankton in the waters. Brightness is a description of the depth of water that can be penetrated by sunlight and can be seen by the general eye. The brightness of water is determined by suspended particles such as clay, organic matter and microorganisms. The light intensity values for all research locations consisting of location A, location B and location C were in the range of 5,230-65,500 Lux. Effendi (2003) explains that the brightness value is strongly influenced by the time of measurement, suspended solids, weather conditions, turbidity and the accuracy of the person taking the measurement. The low value of brightness obtained during the measurement affects the process of photosynthesis in the pond. Waters that have low brightness values during normal weather can provide an indication or indication of the number of suspended particles in these waters (Hamuna et al., 2018). Water brightness is determined by suspended particles such as clay, organic matter and microorganisms (Hardjowigeno and Widiatmaka, 2001).

4.2. Water Chemical Parameters at the Research Site

Water chemical parameter data consisting of water pH, salinity (ppt), Phosphate (PO_4) (ppm), Nitrate (NO_3) (ppm), Total Organic Matter (BOT) (ppm) and Total Solid Suspension (TTS) (ppm) is presented in Table 3.

No.	Parameter	Unit	Results
1	pH	-	7,76-7,86
2	Salinity	ppt	37-40
3	Phosphate (PO_4)	ppm	0,001-0,009
4	Nitrate (NO_3)	ppm	0,001-0,002
5	Total Organic Ingredients	ppm	48,8-55,46
6	Total Solid Suspension (TSS)	ppm	215-317

Table 3: Water Chemical Parameter Data for Research Sites
Source: Primary Data after Processing, 2021

Table 2 shows that the pH values for all study sites are in the range of 7.76-7.86. The higher the pH value, the higher the alkalinity value and the lower the free carbon dioxide level. The pH ranges from 0-14, a pH value of less than 7 indicates an acidic environment while a value above 7 indicates an alkaline environment. for pH = 7 is referred to as neutral. Most aquatic animals are sensitive to changes in pH. The preferred pH for aquatic biota ranges from 7-8.5. Changes in pH values greatly affect the biochemical processes of waters. At a neutral pH, bacteria generally grow well, while fungi prefer a low pH. Therefore, the decomposition of organic matter can take place quickly at neutral and alkaline pH conditions (Effendi, 2003).

The pH of the water affects the fertility of the waters because it affects the life of microorganisms. At low pH (high acidity) dissolved oxygen content will decrease, consequently oxygen consumption will decrease, respiratory activity increases, and appetite will decrease. The opposite happens in an alkaline environment. Generally, the pH of seawater is between 7.6-8.7, while for normal fish growth it is at a pH of 6.5-9.0. A good pH range for marine biota based on seawater quality standards is 7-8.5 (Kordi, 2011).

Salinity is the concentration of the entire salt solution obtained in seawater, where the salinity of the water affects the osmotic pressure of the water, the higher the salinity, the greater the osmotic pressure (Widiadmoko, 2013). The salinity of the waters during the study was in the range of 37-40 ppt.

Phosphate (PO4-P) is one of the essential elements for metabolism and protein formation. Phosphate is one of the most important nutrient compounds in the ocean. In marine waters, phosphate is in the form of dissolved inorganic and organic as well as particulate phosphate (Moriber, 1974 *in* Affan, 2010). The water phosphate value during the study was in the range of 0.001-0.009 ppm. According to Moriber (1974) *in* Affan (2010) that phosphate compounds in waters come from natural sources such as soil erosion, waste from animals and weathering of plants. Concentration increases with the entry of domestic, industrial and agricultural or plantation waste that contains a lot of phosphate, crushed organic matter and phosphate minerals.

Based on the total phosphorus content, the waters are classified into three, namely: waters with low fertility levels, which have a total phosphate content of 0-0.02 mg/L, moderate fertility levels, total phosphate levels 0.021-0.05 mg/L, and waters with a total phosphorus content of 0.021-0.05 mg/L. high fertility rate, which has a total phosphate content of 0.051-0.1 mg/L (Effendi, 2003).

4.3. Research Site Substrate Data

4.3.1. pH of Substrate

The pH value of the substrate at the research site consisting of Stations A, B and C can be seen in Figure 1.

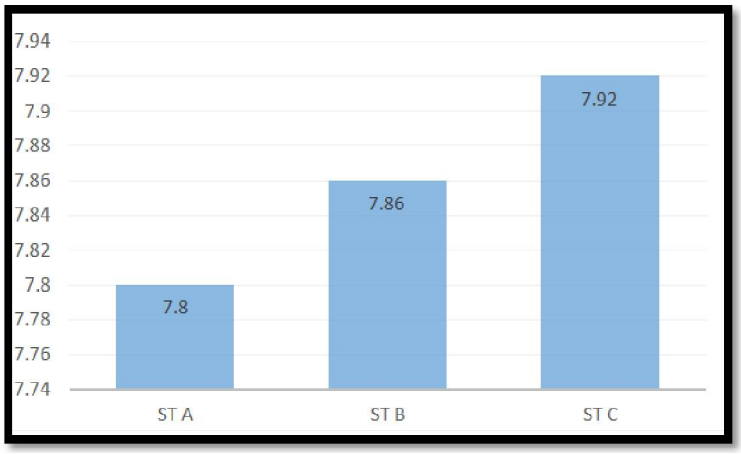

Figure 1: Substrate pH Value

Figure 1 shows that the pH value of the substrate at the study site has a range of 7.8-7.92 with the highest pH value at Location C (ST C) of 7.92 following Location B (ST B) of 7.86 and the lowest at Location A (ST A) of 7.8. The pH value of the substrate in this research location is still higher than the results of research by Patang et al (2021) who conducted research on Barombong Beach with a substrate pH range of 2.5-4.3.

4.3.2. Nitrogen of Substrate (%)

The nitrogen value (%) of the substrate at the research site consisting of location A (ST A), Location B (ST B) and Location C (ST C) can be seen in Figure 2.

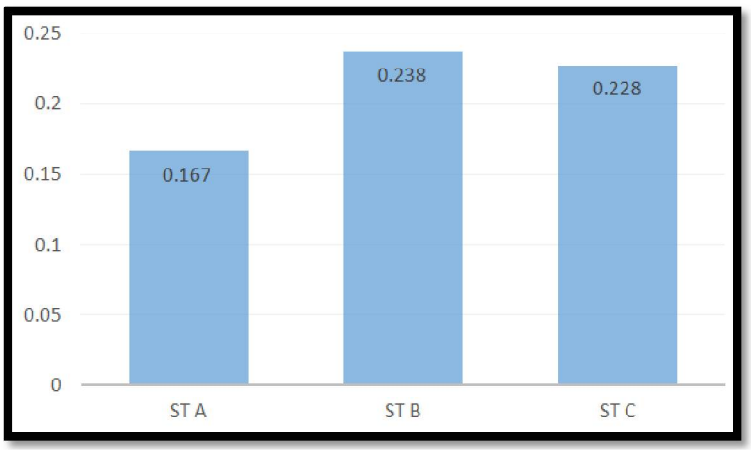

Figure 2: Substrate Nitrogen Value (%)

Figure 2 shows that the substrate nitrogen value at the study site was in the range of 0.167-0.238%, with the highest substrate nitrogen value obtained at location B (ST B) of 0.238% followed by location C (ST C) of 0.228% and the lowest at location A (ST C) of 0.167%. The nitrogen value of the substrate in this study was still higher than the results of research by Patang et al (2021) who conducted research at Barombong Beach, Makassar with the highest nitrogen value of 0.106%.

4.3.3. Substrate Organic Matter (%)

Substrate organic matter at the research site consisting of 3 stations, namely station A (ST A), station B (ST B) and station C (ST C) can be seen in Figure 4. Figure 4 shows that the value of substrate organic matter at the research site is in the range of 0.87-5.2%, with the highest substrate organic matter content obtained at station B (ST B) of 5.2%, followed by station C (ST C) of 3.87% and the lowest at location A (ST A) of 0.87%. Substrate organic matter in this study was still greater than the results of research conducted by Patang et al (2021) who conducted research at Barombong Beach, Makassar, with the highest substrate organic matter content of 0.36%.

Figure 3: Value of Substrate Organic Matter (%)

4.3.4. Phosphate Substrate (PPM)

The phosphate content (ppm) of the substrate at the research site consisting of location A (ST A), location B (ST B) and location C (ST C) can be seen in Figure 4.

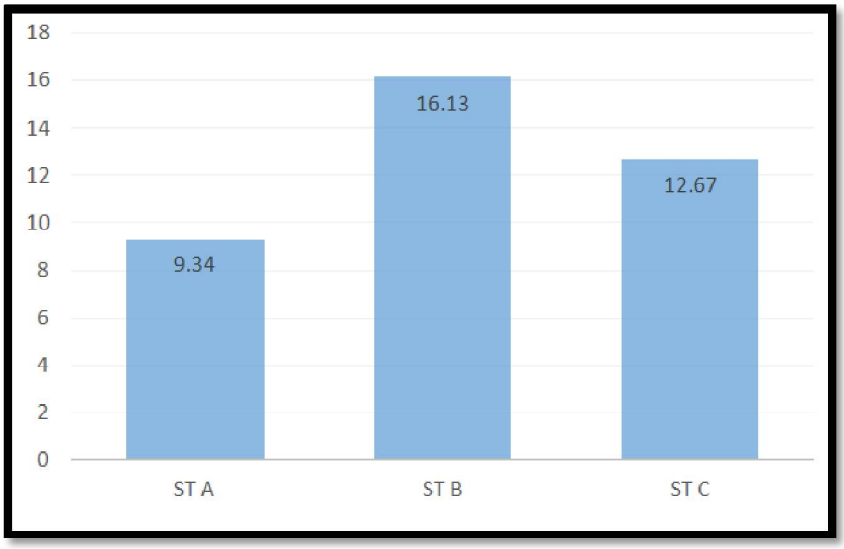

Figure 4: Phosphate Substrate Value (%)

Figure 4 shows that the phosphate content of the substrate at the study site has a value in the range of 9.34-16.13 ppm, with the highest phosphate content obtained at station B (ST B) of 16.13 ppm, followed by location C (ST C) of 12.67 ppm and the lowest is at location A (ST A) of 9.34 ppm. The value of phosphate content at the research site is still greater than the results of research conducted by Patang et al. (2021) who conducted research on Barombong Beach with the highest phosphate content of 8.69 ppm.

4.3.5. Substrate Texture Value

Table 4 shows that the texture of the substrate at the three research locations, namely station A (ST A), station B (ST B) and station C (ST C) has a texture value ranging from sandy to clayey sandy loam, with a sandy texture found at the station. A (ST A) and station C (ST C) while at station B (ST B) it has a sandy loam texture.

No.	Research Sites	Texture
1	ST A	Sandy
2	ST B	Sandy Clay
3	ST C	Sandy

Table 4: Texture Value of Research Site Substrate
Source: Primary Data after Processing, 2021

5. Conclusion

Based on the results of the study, it can be concluded that the research location has the potential for the development of *Eucheuma cottoni* seaweed cultivation around Mandalle Beach in terms of water physics aspects. The research location also has the potential to develop *Eucheuma cottoni* seaweed cultivation around Mandalle Beach in terms of water chemistry aspects.

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