Advances in Tropical Biodiversity and Environmental Sciences
7(3): 121-124, October, 2023
e-ISSN:2622-0628
DOI: 10.24843/ATBES.2023.v07.i03.p06
Available online at: https://ojs.unud.ac.id/index.php/ATBES/article/view/583

Mineral Content Comparison of Sea Grapes (*Caulerpa lentillifera*) Cultivated in Controlled and Free Waters

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Abstract. The availability of sea grapes is still very limited, so activities are needed to support the preservation of sea grapes that are rich in mineral content. This research activity aims to determine growth, water quality, and comparison of mineral content found in *C. lentillifera*. This type of research is descriptive qualitative. As a research model, namely the mineral content of *C. lentillifera* in cultivation sites and free waters. On the growth of *C. lentillifera*, calculate the number of ramuli and water quality such as pH, temperature, and salinity with a water quality checker. Data on the mineral content in *C. lentillifera* was obtained by atomic absorption spectrophotometry (AAS). Based on the results of absorption measurements from several solutions at the cultivation location, the results for Potassium (K) were 2,592.364 mg/kg, Calcium (Ca) with a yield of 896.033 mg/kg, Iron (Fe) with a total of 174.323 mg/kg and for Zinc (Zn) of 468.804 mg/kg. In the waters of Serangan, based on the results of absorption measurements from several standard solutions Potassium (K) obtained results of 2,169,732 mg/kg, Calcium (Ca) with results of 1,677,829 mg/kg, Iron (Fe) with results of 1,669.607 mg /kg and for zinc (Zn) with a yield of 44,090 mg/kg.

Keywords: *Caulerpa lentillifera*; controlled cultivation; waters free; mineral content

I. INTRODUCTION

Sea grapes are included in macroalgae which are one of the products of the fisheries and marine sectors that have the potential to be developed, one of which is sea grapes commonly known as *Caulerpa lentillifera* which are widely distributed in Indonesian waters [1] Sourced data from the Department of Maritime Affairs and Fisheries Bali Province explained that potency cultivation grass The sea in Bali covers five districts that are Buleleng Jembrana Badung Klungkung and Karangasem. *C. lentillifera's* shape and taste resemble Caviar fish, known as "Green Caviar." Grass sea as one source of the national currency, is a source of income for the public coast besides can be used as material, food, drink, and medicine [2] Grass sea own content very high nutrition like carbohydrates, vitamins, and fats, and also contains mineral content such as Calcium (Ca), Potassium (K), Zinc (Zn), Substance Iron (Fe), and Selenium (Se) which are very potential developed in various industry [3].

This very potential seaweed must have supporting factors in a sound cultivation system to develop even higher [4]. *Caulerpa lentillifera* cultivation activities must consider several parameters, such as temperature, salinity, and light intensity. The cultivation of *C. lentillifera* in Bali areas is carried out traditionally on the beach habitat. However, some have cultivated *C. lentillifera* intensively by using small tubs as cultivation media. The cultivation containers are usually placed near the coast to make filling seawater into the tanks easier, such as the cultivation of *C. lentillifera* at PT. Bulung Bali Prosperous Musi area, Gerokgak District, Buleleng Regency [5].

Benefits *C. lentillifera* can maintain a healthy heart, as well as the eyes, strengthen bones and joints, prevent enlargement of gland thyroid, overcome diabetes and hypertension, prevent Obesity, guard beauty, hair, and skin as an anti-cancer, overcome constipation, and can make material raw and cosmetic also as processed material food other [6] If body man mineral deficiency cause disturbance health such as anemia, goiter osteoporosis and osteomalacia Fulfillment needs in humans can be obtained with method consume material

food good origin from plant or vegetable minerals nor animal or animal minerals [7]

Caulerpa lentillifera is still very minimal availability. Therefore, cultivation is needed to support the continuity of industrial businesses and provide new food sources that are healthy and rich in protein and minerals. *C. lentillifera* cultivated in controlled tanks was carried out by planting *C. lentillifera* in nets made from the base of the pipe as a planting medium. Knowledge about the mineral content in *C. lentillifera* is still limited because the mineral content in *C. lentillifera* is very important to study further. Based on this, it can be concluded that the purpose of this research activity is to determine the omparison of the mineral content of cultivated sea grapes (*Caulerpa lentillifera*) by means of controlled cultivation and free water.

II. METHOD

Approach and Type Study

The research approach used is qualitative research which is used to investigate, find, describe, and explain the quality or features of a research activity being carried out.

Research Locations

This study activity was carried out at PT. Bulung Bali Sejahtera, located at Musi Village District Gerokgak Regency Buleleng Province of Bali, also carried out an activity taking *C. lentillifera* in the area beach Serangan Denpasar, Bali. Research time starts in September 2022 and is until done.

Data Collection

The research data was collected by conducting field notes since the first time conducting research activities. This field observation activity was carried out in an earnest way, where data was recorded including data on the initial development of *C. lentillifera*, data on the number of ramuli, and water quality data taken for 45 days. Data on mineral content in *C. lentillifera* obtained by atomic absorption spectrophotometry (AAS) method. Besides, it is an activity study; this is also done through technique data collection like observation or field observations place activity going on as well do review literature in journals nor existing articles For help good data acquisition.

Data Analysis Methods and Techniques

This Research uses a technique or method Spectrophotometry Atomic Absorption (AAS) is an analysis based on the absorption process of energy radiation by the atoms that are on the level of energy basic.

III. RESULTS AND DISCUSSION

Mineral content data of *C. lentillifera* in second place, namely at PT. Bulung Bali Sejahtera on a tub controlled and on water free area Serangan Beach got seen results from testing performed with method spectrometry atomic absorption (AAS). Analysis of the mineral content of the preparation samples that can be checked at the analytical laboratory of Udayana University is the mineral content of K, Ca, Fe, and Zn carried out by wet ashing procedure, *C. lentillifera* powder is dry or has been mashed to pass a 100 mesh sieve weighed a number of samples containing 5-10 gram of solid and put into Kjeldahl flask. Then add 10 ml H_2SO_4 and 10 ml or more HNO_3 and some boiling stones. Heat slowly until the solution is dark in color avoid excessive foam formation by adding HNO_3 and heat for 5-10 minutes until the solution is no longer dark (all organic matter has been oxidized) then cool. Add 10 ml of distilled water (the solution will be colorless or light yellow if it contains Fe) and heat it until it smokes, let the solution cool down again. Then add 5 ml of distilled water, bring to a boil until it smokes, then cool and dilute to a certain volume. Data on the mineral content of *C. lentillifera* can be seen in Table 1. Analysis of the mineral content of Potassium (K), Calcium (Ca), Iron (Fe), and Zinc (Zn) in sea grapes known as *C. lentillifera* in this study was analyzed using atomic absorption spectrometry (AAS). Based on the results, measurement uptake from several solutions of Potassium (K) standard was obtained with results of 2,592.364 mg/kg, Calcium (Ca) with a yield of 896.033 mg/kg, Iron (Fe) with results of 174.323 mg/kg and for zinc (Zn) with results of 468.804 mg/kg.

TABLE 1.
MINERAL CONTENT DATA OF *C. lentillifera*
PT. PROSPEROUS BALINESE BULUNG

Parameter	Method	Unit	Result
Potassium (K)	Spectrometry	mg/kg	2.592,364
Calcium (Ca)	Spectrometry	mg/kg	896,033
Iron (Fe)	Spectrometry	mg/kg	174,323
Zinc (Zn)	Spectrometry	mg/kg	68,804

As seen in Table 2 research, this is based on results of measurement uptake from several solution Potassium (K) standards was obtained yield of 2,169.732 mg/kg, Calcium (Ca) with a yield of 1,677.829 mg/kg, Iron (Fe) with results of 1,669.607 mg/kg and for zinc (Zn) with results of 44.090 mg/kg.

TABLE 2
MINERAL CONTENT DATA OF *C. lentillifera* SERANGAN BEACH

Parameter	Method	Unit	Result
Potassium (K)	Spectrometry	mg/kg	2.169,732
Calcium (Ca)	Spectrometry	mg/kg	1.677,829
Iron (Fe)	Spectrometry	mg/kg	1.669,607
Zinc (Zn)	Spectrometry	mg/kg	44,090

Macro and micro minerals are needed To support body system metabolism [8]. Potassium is essential for controlling membrane stimulation, optimizing structural function and regulation, increasing cell growth, and helping guard pressure blood to remain normal [9]. Calcium includes one macro trace element, minerals the body needs in more than 100 mg daily. Calcium is one macro element besides sodium, potassium, manganese, phosphorus, chloride, and sulfur. Element macro functions as an active Substance in metabolism or as part important from structure cells and tissues. Calcium, manganese, and phosphorus are essential in structure, cells, and tissues.

In contrast, elements other include the balance of fluids and electrolytes [10]. Iron (Fe) and zinc (Zn) are metal essentials needed by man in an amount small <100 mg/ day, which plays a significant role in the metabolism body. Case lack of prevalence of Fe and Zn metals Enough Lots worldwide especially in developing countries this related with Power buy public will material food and patterns low consumption. Fe is a micronutrient essential in producing functional hemoglobin in transporting oxygen from the lungs to network body transport electrons in cells and synthesis enzymes. Zn is a cofactor system enzyme (cytochrome C- oxidase) that stabilizes membranes, hormones, and acids nucleate [11].

The results of the analysis showed that *C. lentillifera* at PT. Bulung Bali Sejahtera and Serangan Beach contain macro and micro minerals. The highest macro mineral content was found in both places, namely K and followed by Ca, while the highest micro minerals were Fe and Zn. Additional data collection activities were also carried out on the growth and number of ramuli on *C. lentillifera* as well as observing water quality parameters of salinity, temperature, and pH.

With the availability of data on the content of elements K, Ca, Zn, and Fe in *C. lentillifera*, it can be used as an alternative to consuming sea grapes. Good for diet use because it contains low calories and is equipped with Ca, K, Zn, and Fe, it should also be noted that in the body's system, the absorption of Zn and Fe from animal sources reaches 30%, better than vegetable ingredients 10-20%, this is because high levels of phytic acid in vegetable materials inhibit the absorption of Zn and Fe [13] *C. lentillifera* is one type grass mineral rich sea with different composition in accordance condition waters. This shows that mineral content in sea grapes is influenced by the growth habitat the magnitude variation in quantities of minerals and components organic on a basis of waters and properties depth waters distance from land and environment influence the amount of minerals present in the sea grapes [14].

In this research conducted by Alfonsina Martina Tapotubun in 2018 regarding the chemical composition of seaweed (*Caulerpa lentillifera*) from Kei Maluku waters with different drying methods, the results obtained were mineral content drying with sunlight Ca 47.392 mg/100g, K 446 mg/100g, Zn 1.028 mg/100g, and Fe 0.0016mg/100g. Meanwhile, drying *C. lentillifera* with air yielded Ca 53.536 mg/100g, K 453 mg/100g, Zn 2.011 mg/100g, and Fe 0.0019 mg/100g.

The chemical components contained in dried *C. lentillifera* show that *C. lentillifera* has good nutrition and can be used as a good functional food ingredient. *C. lentillifera* contains high levels of carbohydrates, ash, and fiber, crude and low in fat, so it is very good for daily consumption [15]. The results of this study indicate that *C. lentillifera* contains high levels of macro and micro minerals so that it can replace foodstuffs that are low in minerals. The advantage of *C. lentillifera* from Kei waters is the high macromineral content, especially Ca and K. The results showed that *C. lentillifera* dried using the wind-dry method produced a higher mineral composition compared to drying with direct sunlight and atomic absorption spectrometry methods.

TABLE 3.
MINERAL CONTENT DATA OF *C. lentillifera* VERAVAL WATERS

Mineral	*C. lentillifera* (mg/100 g DW)
Ca	780
K	970
Fe	9.3
Zn	2.6

The superiority of minerals in *C. lentillifera* origin Kei Archipelago is generally tall compared to several species of *C. lentillifera* in India and Gujarat Veraval waters station cultivation Amphor Banhlam Bangkok. Also, it results from mineral content in place cultivation at PT. Bulung Bali Sejahtera and waters free on the beach Attack Grass mineral content sea influenced by water habitat and processing.

IV. CONCLUSION

View mineral content data through testing spectrometry atomic absorption with analysis mineral content of the preparation K, Ca, Fe, and Zn samples were carried out with procedure ashing wet Based on results measurement uptake from several solutions in place cultivation obtained results standard Potassium (K) of 2,592.364 mg/kg, Calcium (Ca) with yield 896.033 mg/kg, Iron (Fe) with results of 174.323 mg/kg and for zinc (Zn) with results of 468.804 mg/kg. On waters free on the beach Attack based on results measurement uptake from several solutions, Potassium (K) standards have obtained a yield of 2,169.732 mg/kg, Calcium (Ca) with a yield of 1,677.829 mg/kg, Iron (Fe) with results of 1,669.607 mg/kg and for zinc (Zn) with results of 44.090 mg/kg.

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