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Potential Bio Battery Of Moringa Paste (Moringa Oleifera) As A Source Environmentally Friendly Electricity

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ABSTRACT

Moringa organic compounds (Moringa Oleifera) are expected to be the main electrolyte material for high-capacity green generation generation electrical energy storage devices. Moringa extract will dissolve as a conventional organic electrolyte in water resulting in electrochemical performance. Interestingly, the organic-based Moringa(Moringa Oleifera) electrolyte solution not only has a high ionic conductivity, but also can alleviate the problem of solubility in liquids and is acidic in pH (Power Hydrogen) 4. Research on refined Moringa paste as much as 135.58 added 5 grams of salt and mixed with as much aqua water138.50milliliter and stirred until evenly distributed. Moringa-based solid organic battery paste form greatly improves battery life and achieves good level performance. Moringa-based electrolyte paste of salt substitution displays an initial electrical energy capacity of1.64V DC and the resulting electric current is 1.04 mA, at the retention level of the LED lamp usage capacity with specificationsa voltage of 1.6V, a current of 20 mA, the lamp looks bright when it is supplied with a voltage source from Moringa organic electrolyte paste and the lamp is able to light up for 7 hours., this discharging capacity can be increased when the addition of salt is maintained at about 2 grams . The test results have great application value in utilization as an environmentally friendly future energy because of its low cost and excellent electrochemical performance for use in small capacity electronic furniture.

Keywords: Moringa Paste, Environmentally, Friendly Electrical Energy.

INTRODUCTION

In modern society, energy and environmental problems are considered as big challenges for humans. The use of batteries as one of the electric cells is increasing according to the growth of the electronics industry for the sake of need (Poizot et al., 2020).

The efficient use of sustainable green energy without wasting natural resources or polluting the environment using materials in the form of organic liquids is a future solution for clean, environmentally friendly energy, it is very possible to independently control the power and energy. This has become an important role in sustainable energy storage that is sustainable intermittently efficient (Ding, 2016).

On the other hand, a good battery should be free of heavy metals and environmentally friendly, packaged well and should begin to research and utilize natural materials in abundance today, including looking at issues related to the environment, global warming and battery disposal waste which is toxic to the environment(Mahmud, et al., 2019).Moringa is known worldwide as a nutritious plant and WHO has introduced Moringa as an alternative food to overcome nutritional problems (malnutrition) (Broin, 2010). It is known that the Moringa plant or merunggai (Moringa oleifera) is a type of plant from the Moringaceae tribe. This plant has a stem height of 7-11 meters.In addition, there are many mineral content in Moringa leaves, including minerals such as calcium, phosphorus, sodium, iron, magnesium, copper, potassium and ascorbic acid (ShM, Thanaa, 2017).

Ascorbic acid in fresh Moringa leaves showed 43.26 mg% and also the estimated concentration of ascorbic acid in different storage conditions such as -20oC, 4oC, room temperature (RT), 40oC for six days of storageNair (2018).The results of this study showed a good amount of ascorbic acid in fresh leaves compared to different storage conditions. The results of the mineral content in Moringa leaves show a small amount. consumption of Moringa leaves to maintain good human health due to the sufficient amount of vitamins and minerals (Thippeswamy et al., 2020).

As far as researchers know about the use of moringa leaf-based battery materials at the international research level, researchers have never touched it, especially referring to its potential as a source of renewable electrical energy today. This is interesting for researchers to study in depth about the use of Moringa plant leaves as a new material that has the potential to be used as a battery material in the form of a paste sample and is useful for the future as environmentally friendly green energy.

LITERATURE REVIEW

Bio-battery is an energy storage device that is powered by organic compounds and was first popularized by researchers from Japan, where it was explained that the sources of bio-batteries are carbohydrates, glucose, enzymes and amino acids. Along with developments, researchers developed bio batteries from organic materials that are environmentally friendly and can replace commercial batteries (Fadilah et al., 2015).

The first battery research in Equaor was carried out by researchers with a comparison of bioelectricity production in Microbial fuel cells (MFC) devices reusing organic waste mixed with soil from various regions.According to Moqsud (2010), Microbial fuel cells (MFC) The terrestrial environment is now developed by separating the anode electrode from the cathode electrode with a layer of soil or sediment by presenting the reaction carried out in the anode compartment to produce carbon dioxide, protons and electrons. The principle of bio-battery only involves the transport of electrons between two electrodes separated by a conductive medium (electrolyte) and provides electromotive force in the form of electric potential and current.Andinata (2021). Polar covalent compounds when dissolved in water, will decompose into ions. This is because the covalent bonds in these compounds are easily broken in water solvents and produce ionsKamilah (2018).Organic solutes are ionic compounds and solutes are not ionic compounds but when dissolved in water, they produce ions. In the electrolyte conductor, electrons flow carried by ions and which can produce ions such as acids, bases and salts. Polar covalent compounds when dissolved in water, will decompose into ions (Zhang, 2018).The anode and cathode are the positive and negative areas of a battery that allow electrons to flow in and out (Manzetti, 2015). A significant advantage that bio-batteries have in comparison (with other batteries is their ability to recharge instantly(Meziane, 2021).

Ascorbic acid is a powerful functional food ingredient with a wide range of health applications. Proper intake helps to maintain health and prevent disease later in life (Pacier et al., 2015). Mineral content in Moringa leaves shows good quantity such as calcium, phosphorus, magnesium, sulfur, potassium, zinc, cobalt, iron, manganese, and copper (Okwar, 2015).

Table 1. Nutritional content of Moringa leaf flour per 100g (bk)

Nutritional Components	Moringa Leaf Flour
Water content (%)	7.5

Protein (g)	27.1
Fat (g)	2.3
Carbohydrates (g	38.2
Fiber (g)	19.2
Calories (Kcal/100g)	205
Calcium (mg)	2003
Potassium (mg)	1324
Vitamin C (Ascorbid acid) (mg)	17.3
Vitamin A (B Caratene) (mg)	16.3
Vitamin B1 (Thiamin) (mg)	2.64
Vitamin B2 (Riboflavin) (mg)	20.5
Vitamin E (Tocopherol) (mg)	113

Source: Lowell fuglie (1999).

Moringa leaf is one part of the Moringa plant that has been widely studied for its nutritional content and uses. Moringa leaves are very rich in nutrients, Misra, (2014). Other studies have shown that Moringa leaves contain vitamin C equivalent to vitamin C in 7 oranges, vitamin A equivalent to vitamin A in 4 carrots.

Table 2. The nutritional value of fresh and dried Moringa leaves per 100 g of Moringa leaves

Nutritional components	Fresh leaves	Dried leaves
Water content (%)	94	4.09
Proteins (%)	.01	2.74
Fat (%)	22.7	7.95
Ash content	-	57.01
Fiber (%)	4.65	12.63
Calcium (mg)	7.92	1600-2200
Energy (Kcal/100g)	350-550	307.30

Sources: Melo et al (2013); Shiriki et al (2015); Nweze&Nwafeo (2014); Tiea, (2015).

Research on the potential of Moringa electrolyte paste can be made in the form of an electrical energy source in the form of a dry battery because it is indicated that it contains important compounds as a source of electrical energy. Extraction is the transfer of solutes between two immiscible solvents, Tehranirokh., (2021). The clean biotechnology strategy allows the use of cheap and renewable resources for the production of various bioenergy-based compounds.Pleissner, Daniel, et al. (2017).Electrical energy can be generated from leaves and fruits, especially fruits that contain a lot of citric acid. Moringa fruit is often used as food, drink and a source of vitamins for the body's defense system, while the leaves also have the ability to produce electrical energy (Atina, 2015).

Organic flow battery with energy density solid state battery. It has solid organic steric and electronic properties for high capacity and voltaic efficiency which can be accessed to monitor the charge state as a function of time, thus exhibiting moderately high duty cycle and material utilization and reasonably high voltaic efficiency. Wong(2021), the resistance of the Moringa electrolyte paste material is measured in ohms. Resistance is how well something conducts electricity. The lower the resistance in the wire the better it conducts electricity. Copper has a lower resistance than other metals (Salil, 2018).

Described herein is a class of energy storage materials which exploit the advantageous chemical and electrochemical properties of a family of molecules known as active substances which undergo rapid and reversible two-proton two-electron reduction at the electrode in ascorbic acid. It is known that various minerals contained in the solid extract of Moringa leaves have the potential to produce oxidation reactions that can act as electrolytes to convert chemical reactions into electrical energy.Ferreira, et al. (2008), To produce optimum voltage and endurance, in the manufacture of bio-batteries, Moringa extract needs to be substituted by adding salt as an electrolyte strengthening agent, and aquadest water as an additional diluent.Makishima(2020), Based on the description of the results of previous studies, the researcher is interested in describing the manufacture of biobatteries derived from Moringa leaf extract (Moringa Oleifera) as an environmentally friendly battery by displaying the potential for electric current and voltage generated based on the results of tests and measurements in the form of experimental research.

RESEARCH METHOD

Researchers use the method with liquid solid by the process of separating one or more components from a homogeneous mixture using a water (solvent) aqua water based on its solubility in water solvent.

The type of water extraction liquid is considered as a filter because it is cheap and easy to obtain, stable, non-volatile, non-flammable, non-toxic and natural. Aqua water in addition to dissolving the salt and Moringa pulp, dyes and organic acids from the Moringa leaf material will also dissolve. Because the use of these materials is a solid extraction with a liquid (liquid solid extraction) without heating and does not reduce the active substance of the Moringa paste ingredients. Immersion is carried out for a period of 24 hours with stirring every 1-2 hours.

For uniformity in the pronunciation, the Moringa extract which is used as a sample will then be referred to as Moringa solid extract. A total of 20 grams of crushed Moringa leaves were placed in a beaker and given 5 grams of salt and 138.58 milliliters of aqua water while the mixing process in the extraction of Moringa slurry was left for 1 hour before being used to make the solution.

The equipment needed in this research is a blender, glass beaker, cell container made of acrylic material, pH meter, digital multimeter, cable and crocodile clip, cu-zn electrode and LED diode pH meter measuring instrument. stirrer, knife and storage container.

The implementation phase of research data collection includes:

a. Measure the pH (Power Hydrogen) of Moringa electrolyte paste with a pH meter. Measure the electric current from the Moringa electrolyte paste with the type of copper and Cu-Zn electrodes used.
b. Measuring the electric voltage of Moringa electrolyte paste with variations in addition and subtraction of salt in each mixture used 4. Adding electrolyte paste and water with variations in salt concentration in Moringa extract slurry as much as 20 grams and 2 grams with a constant volume of water at 138.58 milliliters liter.
c. Placement of the mixed materials in plastic containers measuring 20 grams each as many as 4 pieces with a diameter of 6 centimeters and a height of 2.5 centimeters.
d. The electrode materials used are zinc (Zn) and copper (Cu) plate electrodes with a height of 5 cm and a width of 5 cm, Irsan et al, (2015). Based on the electrode potential, Cu will undergo reduction which will act as cathode while Zn will undergo oxidation which will act as anode. Zn-Cu electrodes can be obtained easily in the market than other types of electrodes. Then the electrode is given a small hole to be connected with a cable.
e. The distance between the two electrodes is placed on the paste material 5 cm in a cylinder. In the container, two small holes are provided for access to cables connected to the electrodes. Placement of the electrode according to the position of the hole, and made as many as 5 cells that are mounted in series. Furthermore, each cell of the container is filled with 200 ml of Moringa slurry according to the sample under study. Then the measurement process is carried out with a volt meter measuring instrument to

determine the voltage and electric current generated.

RESULTS AND DISCUSSION

We investigated the volume of the extract to determine how varying the volume affected the difference in cell potential. While the electrolyte slurry of Moringa is dilute acid with a pH (Power Hydrogen) 4 at the same volume of each ingredient when measured before being added to the container. The stress was recorded for each set of volumes with respect to the addition of the salt material.

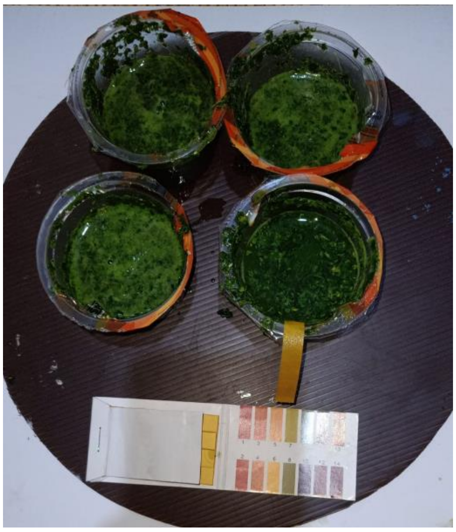

Figure 1. Measurement of Ph (Power hydrogen) of Moringa paste

Observation of the effect of increasing the electrode contact surface area of the voltage cell on a constant electrolyte while varying the addition of salt to Moringa paste and continuously observing changes in the material.

The results vary the electrolyte with the addition of salt to see how it affects the increase in the value of the voltage and electric current on the measuring instrument.

The placement of the copper plate electrode as the positive pole marked with red is placed with a connecting cable, and the black negative electrode made of zinc with a black connecting cable is placed into the extract material. In each cylindrical container containing the extract material, current and voltage flow will be measured using a voltmeter . The results are recorded in Table 1. Measurement of pasta ingredients without salt mixture in the first research stage.

The measurement results in Table 1 show how the volume of pure Moringa paste extract affects the electrochemical performance and shows that the electrolyte volume of 20 milliliters of Moringa resulted in an increase in the output voltage of 0.49 Mv. Electric current

0.60 mA.and power 29.4mW.

The increase in the volume of salt in Moringa paste aims to increase the electrical voltage on the material with an open circuit system, so it can be hypothesized that it is possible to increase the contact surface area by using a longer electrode with a larger diameter, then the voltage will increase because more surface is available for use. electron transfer takes place. Similar findings suggest that the use of an additional salt material on a paste with a larger contact surface area, including single-walled, on the surface can also increase the output voltage. The anode is the negative terminal of the electrochemical cell where the oxidation reaction takes place which is responsible for the regeneration of electrons and its properties greatly affect the overall electrochemical performance of the cell.

Indication of the nature of Ascorbic Acid pH (Power Hydrogen) value of 4 in Moringa paste ingredients has been found to be a better electrolyte when formulated with salt so that it shows better cell performance than before adding salt. The better battery performance of this study can be attributed to the increase the pH value (Power Hydrogen) in the paste mixture so that the reaction speed can be better in ion exchange.

The coating material for a solid-state Moringa paste battery and an open circuit voltage of 1.64 Volt in parallel is obtained in Figure 5. However, a circuit potential cell without added salt gave a multimeter reading of 0.49 mV or less than using a salt material. The potential application of Moringa paste and the addition of salt can accelerate and increase redox reactions in solid electrochemical cells of the paste material so that a complete electrolyte reaction occurs as well as an increase in pH (Power of Hydrogen) or the degree of acidity of the Moringa electrolyte paste which improves battery performance as research material which can be seen in Fig. table of measurement results 1 and 2 for comparison.

Table 3. Measurement of Electric Current and Voltage Moringa Paste Extract Without Mixed Salt Ingredients Test Results In Series No Lamp Load

No	**Moringa leaf solid extract**	**Voltage**	**Current/ Ampere mA**	**Watt/ mW**	**Extract volume /gram**
2	**Leaf Extract**	**0.49**	**0.60**	**29.4**	**20**

Figure 1. Test Series Without Additional Materials

The results of each composition can be seen as table 2 shows that the results of the best composition values with a comparison of the composition of 2 grams of salt added to Moringa paste ingredients produce a voltage of 1.73 Volts with an electric current of 0.843 mA and a power of 1.45 milli Watts in the test. in a parallel circuit system.

Table 4. Measurement of Electric Current and Voltage. Moringa Solid Extract With Addition Of Salt Mix 2 Grams Test Materials In The Circuit In The No-Load Series Circuit.

No	Moringa leaf solid extract	Voltage	Ampere Current mA	Watt mW	Extract volume /gram
1	**Solid extract**	**1.73**	**0.843**	**1.45**	**2**

Figure 2. Parallel voltage measurement in battery cells.

The results of the study as table 3 show that pure Moringa paste without a mixture of salt, produces a voltage of 0.27 milli Volts with an electric current of 0.2 mA and a power of 0.05 milli Watts in the test on a series circuit system without a load.

Table 5. Measurement of Electric Current and Voltage

No	Leaf solid extract moringa	Voltage	Ampere Current mA	Watt mW	Extract material volume /gram
1	Extract	0.27	0.20	0.05	2

The results of the study as table 4 show that Moringa paste with a mixture of 2 grams of salt in a series circuit without a load produces an electric voltage of 0.60 mV with an electric current of 2.07 mA and a power of 1.24 milli Watts.

Table 6. Measurement of Electric Current and Voltage Moringa Solid Extract With 2 Gram Salt MixMaterial Test In No-Load Series Circuit

No	**Moringa Solid Extract**	**Voltage Generated volts**	**Current /Ampere/ mA generated**	**Watts/mW Resulting from**	**Amount of extract material /gram**
1	**Extract**	**0.60**	**2.07**	**1.24**	**2**

The results of table 6. show that Moringa paste with a mixture of 133.26 grams of salt in a series circuit without a load is able to produce an electric voltage of 1.25 V with an electric current of 0.99 mA and a power of 1.23 milli Watts.

Table 5. Measurement of Electric Current and Voltage Solid extract of Moringa with the addition of a mixture of 20 grams of salt.

Table 7. Material Test On Series Circuit

No	**Moringa solid extract**	**Aquades Water /ml**	**Salt/NacL mg**	**Voltage/Volt generated**	**Current/ mA generated**	**Watt/ mW Generated**

	material volume/ gram					**power**
3	**133.26**	**138.58**	**133.26**	**1.25 V DC**	**0.99 ma**	**1.23**

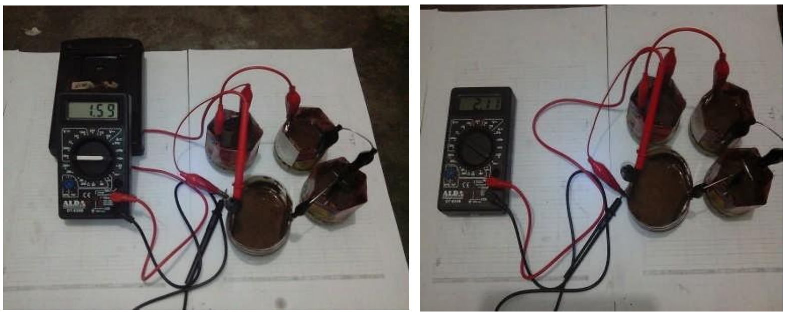

Figure 3. Testing Parallel Circuit

The results of the study as table 6 show that Moringa paste with a mixture of 20 grams of salt in a parallel circuit without a load is able to produce an electric voltage of 1.264 Volts with an electric current of 1.04 mA and a power of 1.79 milli Watts.

Table 8. Measurement of Electric Current and Voltage Moringa paste ingredients addition of 20 Gram Salt Mix Test In Parallel Circuit No Lamp Load

No	**Moringa solid extract material volume/ gram**	**Aqua Water Volume/ ml**	**Total Salt/NacL/ grams**	**Voltage /Volt/DC generated**	**Current /Ampere DC resulting from**	**Watt/ mW generated**
2	**133.26**	**138.58**	**5**	**1.64V DC**	**1.04 mA**	**1.79**

The results of testing the organic battery of Moringa paste on the Led lamp (Light Emitting Diode) with specificationsa voltage of 1.6V, a current of 20 mA, the lamp looks bright when it is supplied with a voltage source from Moringa organic electrolyte paste and the lamp is able to light up for 7 hours.

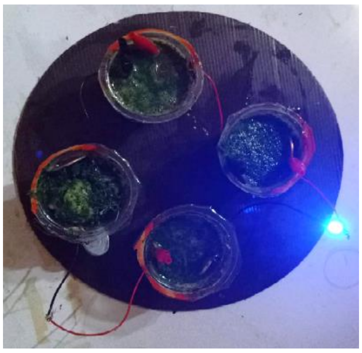

Figure 4. Testing the LED (Light Emitting Diode) in Parallel Circuit

Discussion

There are several factors that affect electrolysis including the immersed surface area and the metallic properties of the electrode material. And the composition of the material used in this study, the surface area of the immersed electrode is always the same for the measurement of each Moringa paste. The electrode plate that is immersed over time will appear coated/covered by a layer of oxidation results. The longer, the layer that covers the electrode plate is getting thicker, the researchers did not observe how big the oxidation layer that coats the plate is. Measurements regarding this can be done for future research. It's just that it seems clear that this layer changes due to the reaction in Moringa liquid which is organic acid due to the speed of oxidation of the existing liquid with the metal.

The resistance between the electrodes will be smaller if the distance is getting smaller and vice versa, the resistance will be even greater if the distance between the electrodes is getting further away so that it affects the value of the electric current and voltage generated. The electrodes used in this study were in a non-permanent position. Changes in the distance of the electrode element during measurement will certainly affect the measurement results. From the description above, it can be concluded that the use of fruit juice as an alternative electrical energy is quite effective because the current and voltage produced are relatively stable.

a. Chemical reactions that occur in Moringa paste battery materials produce substances from the reaction in the form of water, gas, and several other chemical substances. The products of this reaction will remain in the used battery, except for the gas which will evaporate to the outside.
b. Based on test table 1, Moringa paste extract which is acidic with pH (Power

Hydrogen) 4 without a mixture of salt ingredients produces an electric voltage of 0.49 Volts, an electric current of 0.60 mA and an electric power of 29.4 mW. or lower before adding salt. .

c. The addition of 20 grams of salt volume in Moringa paste can increase the voltage and electric current when compared to without the addition of salt volume in Moringa paste ingredients as well as an increase in pH and affect performance in increasing current and electric voltage because it is a good conducting electrolyte.
d. The increase in voltage and electric current in the series circuit experiment is not very stable in producing electric current and voltage even though the volume capacity and material composition are the same in the measuring circuit in parallel.
e. The results of the voltage measurement in the parallel test circuit of Moringa paste material in a cylindrical container are close to stable between the voltage and the electric current generated by 1.64 Volts. While the electric current generated is 1.04mA and the power generated is 1.79 mW.
f. To increase the voltage and current, it is necessary to have a larger volume of material capacity for salt, water and paste as well as to enlarge the electrode which is able to increase the distribution of electrons and improve the performance of the paste material while at the same time it will affect the type of parallel circuit.

The electrolysis of Moringa paste occurs due to a chemical change produced by an electric current passing through an electrolyte liquid. Electrons flow from the cathode through the electrolyte to the anode. The cathode is the negative electrode, which can be a copper wire, and the anode is the positive electrode, which can be a zinc wire. This process generates electricity in the same way as a voltaic battery. There are millions of electrons moving in all directions simultaneously. when a voltage is applied across the conductor, it pushes the free electrons away from a negative force to a positive force. An amp is the number of electrons passing a certain point in one second. To measure current you can use a voltmeter using the milliamp setting. Resistance is measured in ohms. Resistance is how well something conducts electricity. The lower the resistance in the wire the better it conducts electricity. Copper has a lower resistance than other metals.

The large electrode medium in the observations results in a better current and voltage distribution capacity. The unique combination of salt material with Moringa paste has more efficiency and a longer lasting life if without using salt as a substitute or additive. Even though it is far from the production and commercial period, the dependence on environmentally friendly battery-making materials in the Moringa market will reduce carbon dioxide in the earth's atmosphere. Conceptually, this battery can be used for the next generation of technology, especially utilizing the potential of organic materials into bio batteries. A simple battery prototype sourced from Moringa paste with salt substitution as an electrolyte enhancement material can increase the capacity of the voltage and electric current values in the research results.

5. Conclusion.

based on research findings, concluded that The solid formulation of Moringa extract is able to produce voltage and electric current that is quite good and quite optimal in Volt usage time with 7 hours of flame with light resistance in tests using LED (Light Emitting Diode) lamps. 1.5 V; Adding 20 grams of salt to the Moringa extract paste material can increase the maximum voltage capacity of the battery from 0.21 mV to 1.64 Volts; Unstable changes in current and voltage occur in the form of a series circuit, due to the absorption of a fairly large electric voltage in the LED (Light Emitting Diode) lamp and fluctuations in current and voltage, if the moringa paste material used has not been mixed with additional ingredients in the form of salt; The experimental circuit in parallel is closer to being stable, both the current and the voltage produced, marked by the brighter the light; The role and function of salt as an additive has the potential to increase the capacity of a good electrolyte because it has good electrical conductivity so that it increases the voltage and electric current more stable; In research researchers have found that Moringa paste contains substances such as Ascorbid acid, protein, carbohydrates and (an important chemical that produces cellular energy). Under certain circumstances this chemical acts as an electrolyte and then undergoes electrolysis; Although the bio battery is not yet ready to be sold commercially, several research teams and technicians are working to further advance the development of this battery in further research; The results showed that Moringa leaf paste has the potential to be used as an environmentally friendly biobattery material for DC (Direct Current) voltage battery capacity. Moringa paste battery material as a battery technology that will be able to rise to the next level as future energy by taking into account the value of the composition of the material and hydrogen power and the volume of additional ingredients in the form of salt.

Suggestions

This study recommends the importance of research on making Moringa paste biobattery can be carried out further research with a larger scale system and the addition of organic materials that can improve and increase the stability of hydrogen power or acidity so that the source of electrical energy, both voltage and current, is more stable with other methods that can be applied; The existence of advanced research by formulating Moringa extract with other organic additives can increase the performance of the energy produced and as much as possible enlarge the conducting electrode and determine the distance of the electrode which is able to produce a maximum electric voltage in use.

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