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UTILIZATION *Mangifera indica* SKIN AND SALT AS ALTERNATIVE ENERGY

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Abstract.Efforts to reduce the use of polluting chemicals environment needsinnovation to overcome these problems. One of them is by replacing the chemicals contained in the battery by utilizing mango skin waste became bio-battery. Even mango skin waste in the community is not properly utilizedso that mango skin becomes waste that has no value. The purpose of this research is to utilize mango skin as a bio-battery material not only to produce current and voltage sources but it is also expected to be able to reduce the negative effects of disposing of community mango skin waste residue into the environment and reduce dependence on chemicals as battery electrolyte paste which has been used so far. The test parameters carried out were the electricity of the bio-baterry using mango skin and salt samples. This research used 3 weight ratios between mango skin solution and salt solution, namely 15:5 gr, 20 gr:5 gr, and 25:5 gr. The main stages of this research consisted of 3 stages, namely preparation, pH testing, characterization of electrical properties, and electrical analysis of mango skin. The results of the research that has been done, it can be concluded that the smallest measurements of pH, electric voltage, and electric currentare produced at a volume of 30 ml (15 gr) of 3.55, 0.53 V, and 1.8 mA. Whilethe highest was produced at a volume of 44 ml of 3.53, 1.53 V, and 1.9 mA.

Keywords : *Bio-battery, mango skin, and electricity*

1. INTRODUCTION

In life, the use of mango skin is very rare so that if the mangoskin is thrown away it will become waste. If waste is disposed of carelessly or piled up without proper management, it will cause serious environmental and health impacts. For this reason, mango skin is reused into a product that is suitable for use.

Mango (*Mangifera indica L.*) is a plant that is commonly foundin Indonesia, but is not native to Indonesia. Mango tastes from India,the fruit has a dominant sweet-sour taste, soft texture, and yellow- orange in color[9]. Mango contains various nutrients that are beneficialto health. The content of antioxidants such as karoteoid (vitamin A)

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and vitamin C play a role in preventing cancer. Compounds such asphenol and ellagic acid, gelatonin, and mangiferin can increase the body's immunity and act as anti-inflammatories[3]. The reason for using mango as a raw material to replace voltaic cells is because mango skin contains citric acid which can produce a certain amount of electricity and is a natural electrolyte paste which is of course friendly to the environment with minimum residue than ordinarychemical electrolyte paste.

The need for electricity-producing materials is a topic that is widely discussed today. Electrification is something that is being widely heralded by the government because it is considered more environmentally friendly. One form of electrification is the existence of vehicles whose energy source is electricity. Electricity is considered environmentally friendly because it does not produce gas emissions like gasoline-fueled vehicles. Electric vehicles certainly require storage and production of energy sources that are used to propel the vehicle. The producer of the source of electrical energy referred to here is the battery.

The battery is an electrochemical cell that can convert chemical energy into electrical energy[6]. Usually the battery containszinc as the anode, and carbon is used as the cathode. The principleis to convert chemical energy into electrical energy directly and the oxidation and reduction reactions that occurs at the electrode[2]. The use of batteries from year to year has increased very rapidly because people are starting to switch to energy that is more environmentally friendly. However, the more the battery is wasted, the more problemsit will have to be dealt with carefully.

Battery waste is waste that is classified as hazardous and toxic waste (B3). If these batteries are disposed of carelessly, they can contaminate groundwater and harm living things. Heavy metals suchas Pb, Cd, Ni, Co, Cr, and Li are metals that are difficult to decompose and if they enter the body can cause poisoning and damage to organs[1]. Batteries contain paste which is used as a source of electrical energy. We can replace this with something more environmentally friendly which we can call the Bio-Battery formulation.

Bio-Battery is a tool or material that can generate electric current from used organic and inorganic materials[2]. Bio-Battery can also function as an energy storage device supported by organic compounds[1]. The existence of this Bio-Battery is intended so that humans are not always dependent on something that has the potential to damage and can replace the electrolyte paste with something that is more environmentally friendly. One of the raw materials that can be used to make battery paste is that it can be made using mango skin waste.

The purpose of this research is to utilize mango skin as a bio-battery material not only to produce current and voltage sources butit is also expected to be able to reduce the negative effects of disposing of community mango skin waste residue into the environment and reduce dependence on chemicals as battery electrolyte paste which has been used so far.

2. Method and Experimental Details

This research was conducted at the Laboratory of UIN SunanGunung Djati Bandung in April-May 2023 using an experimental method. The test parameters carried out were the electricity of the bio-baterry using mango skin and salt samples. The mango skin usedin this research is community waste in the Sayang Village area, Jatinangor sub-district, Sumedang Regency.

The tools used are a digital multimeter, 200 ml cup size, pH meter, blender, stirrer, beaker glass, and knife. This research used 3weight ratios between mango skin solution and salt solution, namely15:5 gr, 20 gr:5 gr, and 25:5 gr. The main stages of this research consisted of 3 stages, namely preparation, pH testing, characterization of electrical properties, and electrical analysis of mango skin.

2.1. Sample preparation

Sample preparation begins with crushing the mango skin intoa paste using a blender. Then the mango skin paste was weighed 15gr, 20 gr, and 25 gr. The weighing results were put into a 200 ml glasscup with the addition of 5 ml of salt each and 20 ml of water each.

2.2. pH testing

The test was carried out to determine the acidity level of the mango skin which had been filtered and which had been added withsalt as an electrolyte solution. Filtration is done by carrying out an extract between mango skin and water (H2O) and a long soaking timeor extraction process with an interval of 1 hour. In the sample that has been made, then the pH value is measured using a pH meter todetermine the pH value of the sample. Then the pH value of the mango skin resulting from the extraction process will be compared with the pH value of the mango skin and salt solution.

2.3. Characterization of electrical properties with variations inelectrolyte solution volume

Electrical identification was carried out including current (mA)and voltage (mV) using a digital multimeter (YX-360TRE-B). The mango skin solution which became the electrolyte for the bio-batterywas varied in volume to 30 mL, 37 mL, and 44 mL, respectively. According to Pawarangan & Jefriyanto (2022) The more plates that are immersed in the electrolyte solution, the easier it is for the transferof electrons so that voltages and currents can be generated.

2.4. Electrical analysis of mango skin

The electrical properties of the mango skin bio-battery were taken every 24 hours and then an analysis test was carried out on allsamples for further research.

3. Result and Discussion

3.1. Mango Skin Extraction

Extraction is a process of processing materials from a mixture using a suitable solvent[10]. Mango skin that has been skined from theflesh is then separated as an ingredient for making electrolytes. In order to be used as an electrolyte for mango skin, the mango skin isextracted as a liquid electrolyte by adding H2O (water) as the mediation, so that it can be utilized as well as possible as anelectrolyte for batteries. Air hasil ektraksi antara H2O dengan kulit mangga ini sudah dapat digunakan sebagai bahan elektrolit pada baterai. However, due to the nature of the water and the content of dissolved mango skin acids, the water and mango skin are less effective if used directly as an electrolyte in a battery because the extracted water and mango skin will eventually form a precipitate sothat the electron particles that were mixed perfect with H2O over timethe electron particles will also precipitate. Therefore the use of salt as an additional electrolyte.

According to Haq., et al (2018) Salt water can be used as analternative energy source as a medium used to produce electrical energy sources. The electrode and electrolyte are connected by a salt bridge, an oxidation reaction will occur at the anode, negatively charged while a reduction reaction occurs at the cathode, positively charged.

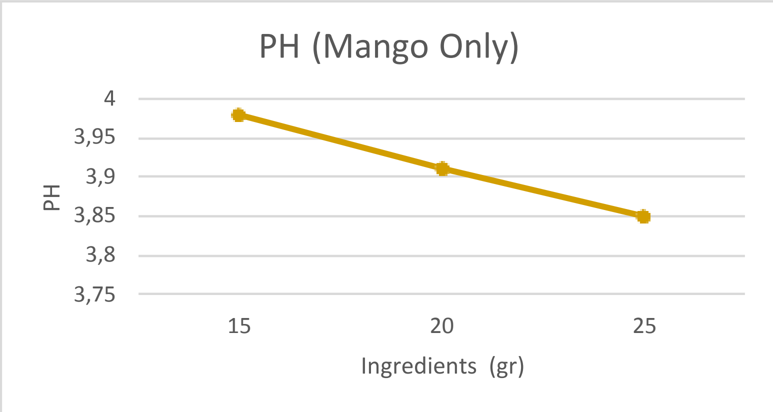
In sample preparation, 3 comparisons of test samples were used, namely extracts of 15 grams, 20 gr , and 25 gr with each salt weight of 5 gr and 20 ml of water, which later these samples would be tested for electrical properties.

Picture 1. Three comparisons of test samples

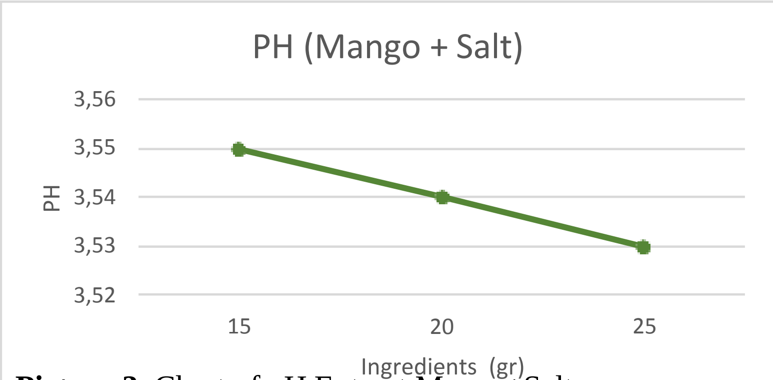
3.2. pH test analysis (Acidity)

Table 1. Data tabulation of Mango skin extract pH and Mango skinextract + salt pH in each comparison sample

Repetition	Mango skin extract pH			Mango skin extract +salt pH		
	15gr	20gr	25gr	15gr	20gr	25gr
1	4.03	3.95	3.86	3.58	3.57	3.53
2	3.97	3.92	3.83	3.53	3.52	3.58
3	3.96	3.86	3.86	3.55	3.53	3.50
Average	3.98	3.91	3.85	3.55	3.54	3.53



Picture 2. Chart of pH Extract Mango



Picture 3. Chart of pH Extract Mango+Salt

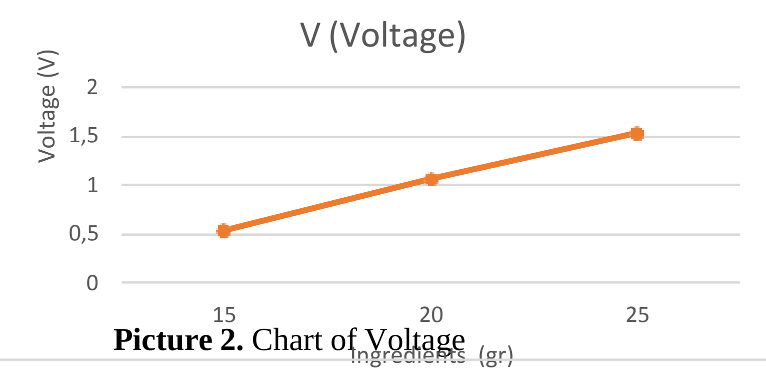
Testing of pH is carried out as a way to determine the degreeof acidity (pH) of mango skin. In carrying out the pH test, the mangoskin is added with H2O solution because the mango skin cannot decompose completely so that the measured pH cannot be read on a pH meter measuring instrument.with each salt weight of 5 grams. So it is necessary to add a liquid so that the mango skin is easily decomposed so that it can be read on the pH meter, besides that theaddition of H2O is also to facilitate a flow of electrons in the electrolyte. With this acidic condition, the electrolyte can produce cations and anions as a voltage generator in the bio-battery[8].

Based on data tabulation (table 1) that all mango skin extracts show an acidic pH. Mango skin extract with a weight of 25 grams showed high acidity compared to the sample weight at 15 grams and 20 grams. Meanwhile, when compared to the acidity of the mango skin + salt, the mango skin extract + salt has a more acidicpH than the pH of the mango extract alone is 3.53. The average pH of mango skin extract weighing 15 gr, 20 gr, 25 gr respectively were3.98, 3.91, and 3.85. While the average pH of mango skin extract + salt on a weight of 15 gr, 20 gr, 25 gr respectively is 3.55, 3.54, and 3.53. This shows that the cations and anions produced are high as voltage generators in the bio-battery.

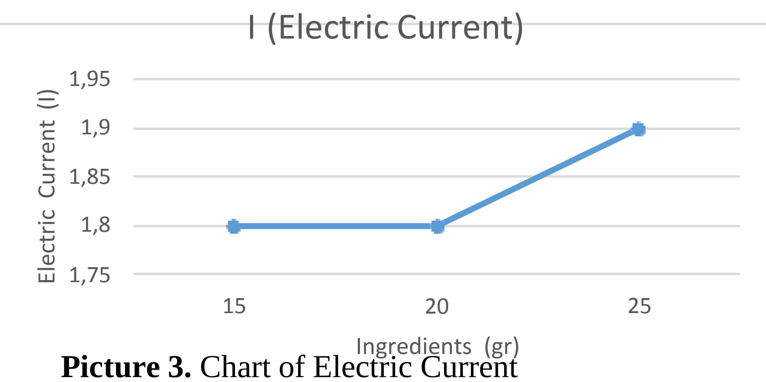
3.3. Characterization of electrical properties with variations inelectrolyte solution volume

Table 2. Data tabulation of voltage (V) and electric current(I) of mango skin extract bio-baterry sample and salt in each comparison sample

Repetition	V			I		
	15gr	**20gr**	**25gr**	**15gr**	**20gr**	**25gr**
1	0.8 V	1 V	1.6 V	1,8 mA	1,8 mA	1,9 mA
2	0.4 V	1 V	1.4 V	1,9 mA	1,8 mA	1,9 mA
3	0.4 V	1.2 V	1.6 V	1,8 mA	1,9 mA	1,9 mA
Average	0,53 V	1.06 V	1,53 V	1,8 mA	1,8 mA	1,9 mA



Picture 2. Chart of Voltage



Picture 3. Chart of Electric Current

Based on table 2 shows an increase in the value of voltage and electric current. In this case, the value of the electric voltage is directly proportional to the electric current generated. The more volume and weight of the solution used, the greater the value of the voltage and electric current produced by the bio-battery. This is consistent with the observations made that samples weighing 25 gr have higher average values of voltage and current than samples weighing 15 gr and 20 gr. The average electrical voltage of mango skin at 15 gr, 20 gr, and 25 gr respectively were 0.53 V, 1.06 V, and 1.53 V. While the average electrical current of mango skin at 15 gr, 20 gr, 25 gr respectively were 1.8 mA, 1.8 mA, and 1.9 mA. Semakinbanyak luas permukaan yang tercelup ke dalam larutan maka semakin tinggi nilai tegangan listrik yang dihasilkan[5].

4. Conclusion

From the results of the research that has been done, it can be concluded that the smallest measurements of pH, electric voltage, andelectric current are produced at a volume of 30 ml (15 gr) of 3.55, 0.53V, and 1.8 mA. While the highest was produced at a volume of 44 ml of3.53, 1.53 V, and 1.9 mA. The more volume of solution used, the greaterthe surface area of the electrode immersed in the mango skin electrolytesolution so that the greater the value of the voltage and electric currentgenerated by the bio-battery.

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