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Design A Mini Power Bank As A Storage Electrical Energy of Dragon Fruit Stems

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Abstract

Research has been done on designing a mini power bank using dragon paste as a source of electrical energy. The voltage and current generated by this dragon paste and power bank are measured using a digital multimeter. Dragon paste is used in series and parallel. The voltage generated by the dragon paste is connected to a DC step up. The use of step-up dc aims to increase the dragon paste voltage so that it can or can charge lithium-ion batteries that have been arranged in parallel using the power bank kit module.

INTRODUCTION

A power bank is a device used to feed electrical energy into a rechargeable battery. The function of the power bank is as a storage medium as well as a power supply on electoral devices such as smartphones, digital cameras, and others. The main function of the power bank is as a portable charger. Power banks are very suitable for people who work in the field or people who are often outside the room away from electrical energy sources. However, the power bank is the same as a smartphone battery, what if the power stored in the battery runs out, the power bank is charged or charged and this depends on the source of electrical energy, such as the source of electricity from PLN.

The dragon fruit stem can produce electrical energy but it has not been put to good use. Meanwhile, the amount of dragon fruit stem waste is relatively abundant. The stem of the dragon fruit plant has a high content of vitamin C, anti-oxidant, antimicrobial, and acidic compounds [1]. Solutions in the form of acidic compounds such as sulfuric acid compounds, oxalic acid, formic acid, and citric acid are known to be electrolyte solutions. The electrolyte is used in Galvani cells to deliver ions from the anode to the cathode so that it can generate electricity [2]. Dragon fruit has five types of variants with good opportunities to be developed in Indonesia, one of which is the type of red meat dragon fruit (Hylocereus polyrhizus). Usually, what is used from dragon fruit is only the contents and the skin is thrown away for nothing [6].

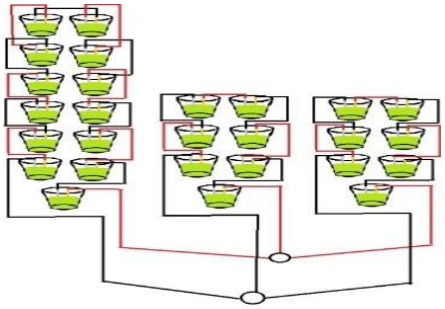
Dragon fruit stem paste is a smoothed dragon fruit stem so that the dragon fruit stem becomes liquid or it can be called a paste. The paste from the dragon fruit stem has a strong electrolyte (conductor) so that the dragon fruit stem paste can generate higher energy compared to the dragon fruit stem [10].

In addition, the provision of electrical energy is still very dependent on non-renewable energy sources derived from natural resources such as petroleum, coal, and natural gas. [3][11]. Many methods have been obtained from this problem, such as the use of a solar cell power bank, which converts sunlight into electrical energy. However, there are many obstacles obtained in the use of this power bank sell which depends on solar heat and weather conditions [4][5][7].

From the above problems, the author seeks to solve the problem of charging the power bank using dragon fruit stem paste as a source of electrical energy. The dragon fruit stem paste is assembled in series and parallel and connected to the dc step up to raise the voltage on the dragon paste so that the output voltage can be set to 5V.

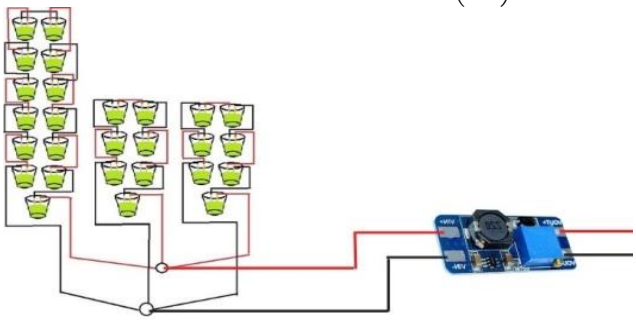
RESEARCH METHODS

In the research method, it is necessary to design dragon fruit stem paste, where in making dragon fruit stem paste as a source of electrical energy, a way is needed in its manufacture, namely preparing ingredients and equipment, where the dragon fruit stem paste is cut into small pieces and then blended until smooth. Once in the blender put in a container weighing 20 grams each [8][12]. Insert the copper (Cu) and Zinc (Zn) obtained from the nail into a container with the positive pole copper and the negative pole nail. Then each container is connected in series and parallel [9].



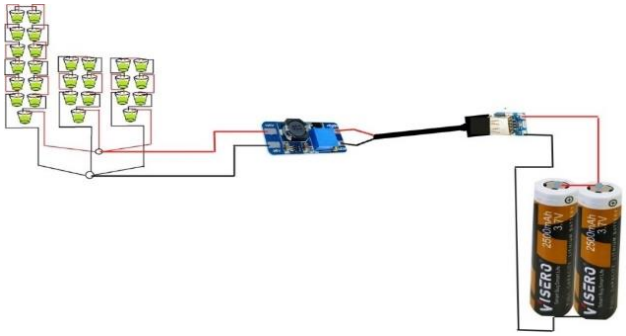
Picture 1. Design of pasta naga assembled in series and parallel

The arrangement of dragon paste in series and parallel with red wires is a cable connected with copper (Cu) and a black cable is a cable connected with Zinc (Zn) obtained from nails.



Picture 2. Dragon paste series to step up DC

The addition of a dc step up aims to raise the voltage generated by the dragon fruit stem paste. The voltage is set at the dc step up so that the resulting constraints are 5V.



Picture 3. Hardware design

The assembly is done from dragon paste connected with step up dc to raise the voltage and connected to the power bank for charging or recharging the power bank battery.

RESULTS AND DISCUSSION

The measurements of the dragon fruit stem paste are assembled in series and parallel with a weight of 20 g in each paste container and have been connected using a dc step up. The results of the measurements of voltage, current, and power carried out are presented in Table 1. The following are the results obtained from the measurements made.

Table 1. Voltage, current, and power of dragon paste series and parallel circuits using step-up DC

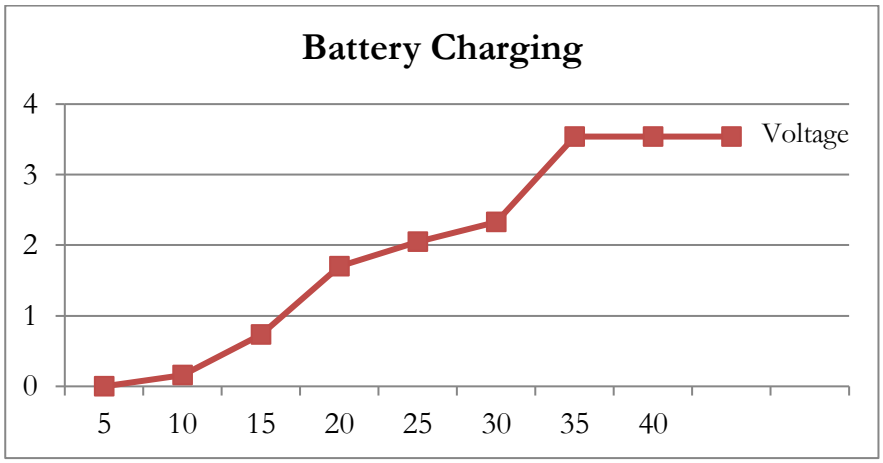
Time (Minutes)	Voltage (V)	Current (A)	Power (W)
5	5,16	3,48	17,96
10	5,16	2,68	13,83
15	5,11	2,57	13,13
20	5,05	2,42	12,22
25	4,83	2,39	11,54
30	4,82	2,36	11,38
35	4,76	2,21	10,52
40	4,60	2,20	10,12
45	4,56	2,18	9,94
50	4,50	2,17	9,77
55	4,46	2,16	9,63
60	4,38	2,14	9,38
65	4,35	2,12	9,22

Measurement results in table 1. show the influence of the dragon fruit stem paste on the duration of its use. The longer the use of dragon paste, the voltage generated will decrease.

Table 2. Charging lithium-ion batteries by using dragon paste

Time (Minutes)	Voltage (V)	Current (A)	Power (W)
5	0.1594	18,94	$3{,}02\text{x}10^{-3}$
10	0.7305	19,09	0,014
15	1,7	180,2	0,31
20	2,05	193,1	0,40
25	2,33	197,4	0,46
30	3,54	432	1,52
35	3,54	432	1,52
40	3,54	432	1,52

The measurement results were obtained from charging lithium-ion batteries with dragon fruit stem paste as a source of electrical energy. Where the highest charging occurs at the 30th minute with a current generated of 443mA and a calculated voltage on the battery of 3.56V.

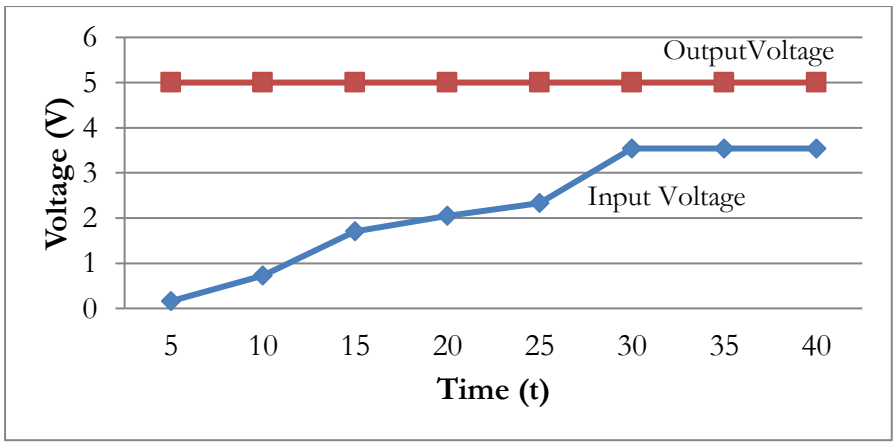


Picture 4. Graph of the relationship of voltage to time variations on charging lithium-ion batteries

Table 3. Power bank input and output measurement data

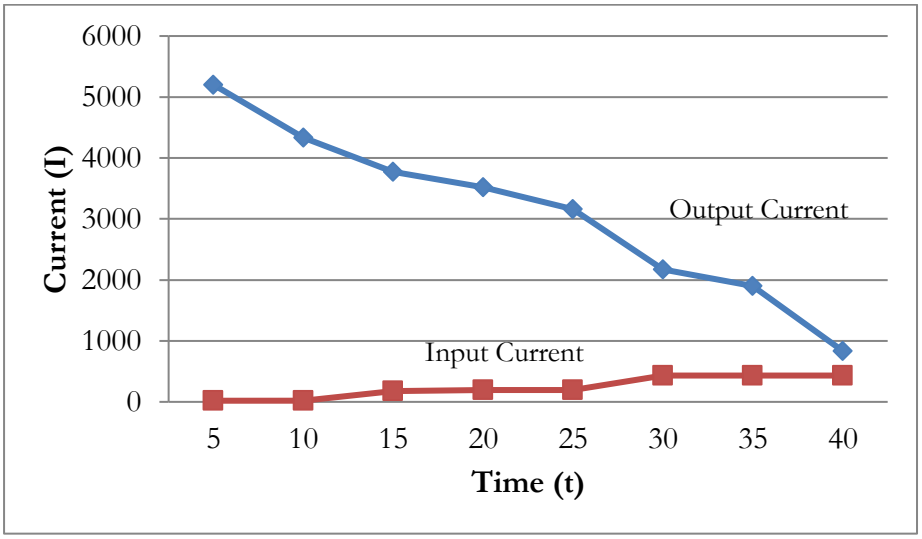
No	Time (minutes)	Input		Power (watt)	Output		Power (watt)	Efficiency (%)
		Voltage (volts)	Current (mA)		Voltage (volts)	Current (mA)		
1	5	0.1594	18,94	$3{,}02x10^{-3}$	5	5200	26	86,09
2	10	0.7305	19,09	0,014	5	4330	21,65	15,46
3	15	1,7	180,2	0,31	5	3770	18,85	60,80
4	20	2,05	193,1	0,40	5	3520	17,6	44,00
5	25	2,33	197,4	0,46	5	3160	15,8	34,34
6	30	3,54	432	1,52	5	2170	10,85	71,38
7	35	3,54	432	1,52	5	1900	9,5	62,5
8	40	3,54	432	1,52	5	835	4,175	27,46

The test was carried out by connecting a power bank with a Samsung A-30 smartphone. Based on the test results, in the first 5 minutes at the time of charging the smartphone with a current of 5200mA and when charging the power bank, the current calculated was 18.94mA. The resulting power efficiency is calculated to be high with an efficiency of 86.09%.



Ficture 5. Graph of the relationship of the charge voltage and discharge of the power bank to the time variation

In figure 5 testing charging and discharging on a power bank where the voltage issued is always stable, is because the power bank kit module used has been set to produce an output voltage of 5V.



Ficture 6. Graph of the relationship of the charge and discharge currents of the power bank to the time variation

It can be seen in figure 6 that when charging the power bank battery, this very long charging is due to the battery used as a storage medium is quite large, namely 5400 mAh, and when the discharge is carried out connected to the Samsung A-30 smartphone, the reduction in the battery in the power bank is quite significant [13], this is because the Samsung A-30 smartphone battery has a large capacity so that the power bank battery is quickly reduced.

CONCLUSION

After conducting research on dragon paste as a source of electrical energy with a power bank as a storage medium, it can be concluded that the electrical energy produced by dragon paste will run out depending on the length of use or the length of time dragon paste is used. The voltage generated by dragon paste is unstable so it is necessary to step up dc MT3608 to make the output voltage stable and large. Charging the power bank battery requires quite a long time because the battery used in the power bank is quite large.

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