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Simple Method To Identify Iodine Content From 2 Kind Of Table Salt Using Cassava Juice And Study The Potency Of Their Solution As Alternative Energy Source

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ABSTRACT

Table salt was known as sodium chloride (NaCl) compound was found useful in human life since contain mineral and some additional micronutrient such as Iodine. However not all tables salt is iodized. Besides, when salt dissolved in water, they are able to conduct electricity makes it potential as an alternative energy source. Meanwhile, its not well known how much the concentration of salt is needed to produce an electric current. The purpose of this study is to present a simple methode in testing iodine content qualitatively in salt using cassava juice and their correlation on electrical current which could be generated when this salt in form of solution. The iodine content was testing throught with various amount of cassava juice namely, 10, 20 and 30 grams with 20 grams of salt. The result clearly indicated that the color of mixture cassava juice and salt slowly changed into dark colour after dripped with 10 gram of cassava juice. In other words, the amount of salt must be greater than quantity of cassava juice since the iodine content in salt is very little, around 30 ppm. Meanwhile in order to generated electrical current, we use two electrode plates namely a copper plate as a positive electrode and a Zinc Plate as a negative electrode. Both plates are immersed in a glass filled with salt solution water and arranged in series circuit. This study was conducted with various mass of salt namely 20, 30, 40, 50 and 60 grams and dissolved into 190 mL of waters. Furthermore, the electrical characteristic of salt solution was also investigated with various electrode distance namley 1, 2, 3 and 5 cm, repectively. The measurement result indicated that the amount of salt is proposional to their electrical characteristic. Meanwhile, the distance of the electrodes conversely proportional with to electrical characteristic. The greater the distance of the electrodes resulting smaller value of their resulting electrical current and voltage. No significant difference electrical characteristic between sea salt and branded table salt.

Keywords: Iodine, cassava juice, electrical conductivity

INTRODUCTION

One of the familiar kitchen spices that are always used and which is usually used to add a salty taste to food is salt. Table salt was known as sodium chloride (NaCl) compound was found useful in human life since contain mineral and some additional micronutrient such as Iodine. The higher iodine content in iodized salt, the more iodine needs are fulfilled [1]. Lack of iodine in the human body causing several diseases, one of which is goiter. The additional content of iodine (I) in table salt is one step to overcome the problem lack of iodine (I) in the human body. Lack of iodine (I) content in the body can result in disorders due to iodine deficiency (IDD). IDD is a major nutritional problem in Indonesia, as well as in the world. IDD can affect all ages, including fetuses, babies, children, adolescents, even adults. The most common type of IDD at various ages is

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goiter. Households with sufficient iodine salt consumption Indonesia in 2013 were 77.10%. This coverage increased compared to the coverage in 2007, namely 62.30%. However, this coverage has not met the target of USI coverage by WHO and the target of National Action Plan for Food and Nutrition (RANPG) 2011-2015 with 90% dan 80% coverage [2]. However not all tables salt sold in the market is iodized. To fullfill the needed of iondine peoples need to know how to find and testing a product contain ionized salt or not in the market. The simple methode to test the iodine content in table salt we can used foods that are very easy to find, namely cassava.

Besides, when salt dissolved in water, they are able to conduct electricity makes it potential as an alternative energy source. Salt dissolved in water can be called an electrolyte solution. Electrolyte solution is a solution that can conduct electric current very well. Aqueus solution from salt can produce electrical energy. The electrical energy produced is the breakdown of ions contained in the NaCl brine solution [3]. Salt consists of ionic compounds consisting of positive ions and negative ions to form neutral compounds [4]. Meanwhile, its not well known how much the concentration of salt is needed to produce an electric current. Then to generated electrical current, we use two electrode plates namely a copper plate as a positive electrode and a Zinc Plate as a negative electrode. Both plates are immersed in a glass filled with salt solution water and arranged in series circuit. This study was conducted with various mass of salt namely 20, 30, 40, 50 and 60 grams and dissolved into 190 mL of waters. Furthermore, the electrical characteristic of salt solution was also investigated with various electrode distance namley 1, 2, 3 and 5 cm, repectively.

However, almost 97,3% of indonesian peoples does not meet the requirements amount iodized salt consumtion [5]. According to Presidential Decree no 69, 13 Oktober 1994, all table salt for human consumtion is needed to enriched with iodine as much as 30-80 ppm [6]. Iodine can be obtained not only from salt but can also be obtained from drinking water, vegetables, yogurt, and other foods that come from the sea. Humans is required to consume iodine at least 30 ppm of iodine as potassium iodate. The iodized salt consumption survey conducted by the Central Bureau of Statistics in 2004 showed an increase in iodized salt consumption from 58,1% in 1997, 65.43% in 2001, 68.53% in 2002 to 73.26% in 2003[7]. The use of iodized salt is one way to overcome the problem of iodine deficiency in the body or what is known as Iodine Deficiency Disorders (IDD). The prevention of IDD will be effective if salt entrepreneurs produce quality iodized salt in accordance with SNI 01-3556-2000 requirements, iodized salt is consumption salt which contains the main compenent of 94,7%, sodium chloride, 5% maximum water and 30% potassium iodate 30 ppm, as well as other compounds according to the requirements specified [8].

In general, it can be stated that IDD has not received the attention it deserves. Interpretation of IDD should be carried out at the population level using data taken from community groups in a particular area[9]. Currently, it is estimated that there has been a deficit of 140 million IQ points. If every year 1 miliion babies are born in the IDD risk areas, there will be an additional loss of 10 million IQ points each year[10]. This is caused by the impact of goiter, cretin, and babies born from areas that ae risk for IDD. Iodine that enters the human body will be excreted by the kidneys into urine more than 90%. The iodine content from food contributed to the urinary iodine level by 47.9%. Iodine requirements vary according to age and certain conditions. Certain physiological conditions of the body, such as in woman and nursing mothers, the amount of the body need for iodine will be different. Body needs per day around 1-2 Og per kg of body weight. The recommended sufficiency estimate is around 40-120 Og per day for adults. For pregnant and lactating women, it is recommended that each additional 10 Og/day(Depkes RI, 2001)[11].

Testing of iodized salt can be done qualitatively through a simple experiment at home using cassava juice [12]. Cassava and gadung are better foodstuffs to be used as Iodine salt test than bamboo shoots and rubber seeds. The conditions that must be considered in every iodized salt test are the intensity of the color that appears (not the type of color) and the length of time the color intensity lasts[13]. Tests using cassava, if the salt contains iodine it will turn blue [14].

Physically it can be seen that the salt is a white solid in the form of crystals which is a collection of compounds consisting of sodium chloride (>80%), magnesium chloride, magnesium sulfate, calcium chloride, and others. Sodium chloride salt is for cooking purposes and is usually enriched with elemental iodine (adding 5 g Nal per kg NaCl) [15]. Salt come from several natural sources including sea water, deposits in the soil or salt mines, and water sources in the ground. Salt has a salty taste, can conduct electricity, does not change the color of red or blue litus paper, and has a neutral pH of about 7[16]. To keep the salt content from being spoiled, it must be stored properly. How salt is stored can affect the quality of the salt content. Good storage is placed in a closed and opaque container[17]. Incorrect storage will destroy the quality of the iodine but it will still be there. The iodine content in salt will not be lost or will remain after repeated heating, direct sunlight and mixed with other spices during the cooking process[18]. The results of the survey of household consumption of iodine salt in 2000, salt that meets the requirements of 64.5% and IP-GAKY 2003 is only 73%[19]. This proves that there are still many sales of salt with iodine that do not meet SNI.

Salt is not only used for consumption but is also can be used as an environmentally friendly alternative energy and can be found easyly. Aqueous salt solution contains positive ions and negative ions that can be used to conduct electric current and acted as electrolyte solution. Electrochemical cell can be used to generated electrical current from aqueous salt due to redox reactions in these cells [21]. Voltaic cell or galvanic cell is a voltage source consisting of two electrodes that have different potential series in an electrolyte solution [22]. This kind of cell has a potential difference that can be able to conduct electric current from aqueous solution of table salt since it has high level conductivy. The electrical current can be generated after connected to electrochemical cell that was immersed in a glass filled with salt solution water and arranged in series circuit [23]. Conductivity is the ability of a solution to conduct electric current [24]. The aim of this study is to measured the ability of a table salt solution to conduct electric current [25]. In a salt solution there is not only an electric current, but there is also a voltage. The amount of salt in water does not have a significant effect on stress[26].

RESEARCH METHODS

In this test used 2 types of salt, namely sea salt and kitchen salt.

Iodine testing

The Iodine testing was conduted with two types of table salt namely sea salt and branded table salt, cassava juice, and vinegar as catalyst to enhance the process. All material was purchased from traditional market. This test was carried out with 20 grams of table salt, 10 grams of vinegar and different amounts of cassava juice namely 10, 20 and 30 grams of cassava juice. Firtsly, cassava must be clean and then grated and just extracted into juice. The juice mixed with table salt and vinegar. Then in a few minutes the mixed material will turn purple or bluish color. This indicates that the salt contains iodine element. The darker the color change that occurs, the more iodine levels are in the salt. The colours could be changed after observation for 5, 10, 15 and 20 minutes, respectively.

Electrical Conductivity measurement

The electrical conductivity was observed from two kinds of salt, two types electrodes,

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namely zinc and carbon, multimeter to observed the current generated from the solution, beaker glass, cables and crocodile clibs to connect both of the electrode. Meanwhile, LED lamps was used as indicator the presence of electrical current was generated. In this experiment, all component was assembled in series which connected with cables and crocodile clibs. The two electrodes are immersed in the electrolyte solution in a beaker glass containing with salt solutions. The zinc electrode as anode is connected to the positive pole of the power source and the carbon electrode as the cathode is connected to the negative pole of the power source [27] as can be observed in Figure 1. This test is carried out repeatedly using different amount of salt namely 20, 30, 40, 50 and 60 grams of salt, respectivley. Then the study continued with different electrode distances, namely 1, 2, 3 and 3 cm, respectively.

The amount of current generated from the cell is indicated by multimeter and also through the presence or absence of LED lights.

Figure 1. A series of measurement experiments using a salt dissolved in 190 mL of water as electrolyte solution (source: personal data)

Conductivity can be determined by calculating the value of electrical conductivity (DHL) using the following formula.

$$P = V\ I \quad \text{.....(1)}$$

Where:

P = Electrical Conductivity (Watt)

V = Voltage (V)

I = Electric Current (A)

RESULTS AND DISCUSSION

Testing of iodine levels in table salt was done qualitatively using ingredients that contain very high starch. In this study iodine content was tested using starch from cassava juice. The used of cassava juice to detected Iodine element from table salt is following the previous researched conduted by [28]. The experimental result clearly indicated that the color of mixture cassava juice and salt slowly changed into dark colour after dripped with 10 gram of cassava juice as presented in Table 1. In other words, the amount of salt must be greater than quantity of cassava juice since the iodine content in salt is very little, around 30 ppm.

Table 1. Results of Iodine Experiment In 20 Minutes Observation

Salt (20grams)	**Amount of cassava (Gram)**	**Period**	
		5 minute	**10 minute**
Branded Salt	10	Started to change	Looks a little purple
	20	Not change	Not change
	30	Not change	Not change
Sea Salt	10	Not change	Started to change
	20	Not change	Not change
	30	Not change	Not change
		Period	
		15 minute	**20 minute**
Branded	10	Purple	Looks a

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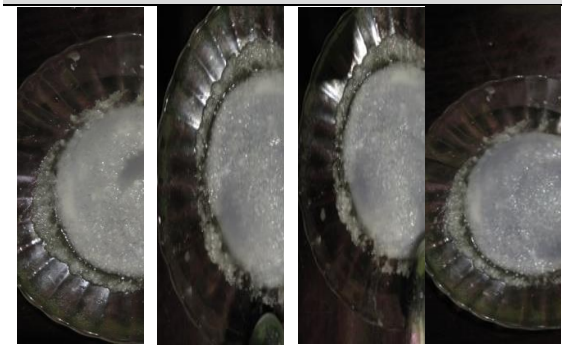
Salt	20	Not change	little purple
	30	Not change	Not change
			Not change
Sea Salt	10	Looks a little purple	Started to change
	20	Not change	Not change
	30	Not change	Not change

Table 2 presented image of mixture cassava juice with two different of table salt namely, branded table salt dan sea salt. From the images, it can be observed that the colour of sample changed into dark purple after mixtured 10 gram of cassava juice and 20 grams of salt after 20minute observation. The branded table salt takes shorter time to changed the color of sample into purple color compared that sea salt. After 5 minutes observation, addition of branded table salt into cassava juice was found begun changed their color, while mixture of cassava juice with sea salt doesnt changed into other colour at this time. After 10 minutes, mixture of cassava juice with branded table salt began to look purple, whereas mixture of cassava juice with sea salt began to show a slightly changed into purpler colour. After 15 minutes observation, mixture sample with branded table salt looks changed properly into purple color, while mixture sample with sea salt has change into slightly purple color. Finnaly, after 20 minutes observation, mixture of cassava juice with branded table salt has turned into dark purple, while the sea salt has turned purple. The color of sample become changed more intense over time, however this only applies before the salt has melted into water. Salt liquefaction could be occured due to the influence of open room temperature and they are more quickly melted if exposed to sunlight. Therefore, in conducting this test, it is needed to carried out the experiment in a room temperature without exposed to direct sunlight. The result clearly indicated that the color of mixture cassava juice and salt slowly changed into dark colour after dripped with 10 gram of cassava juice. In other words, the amount of salt must be greater than quantity of cassava juice since the iodine content in salt is very little, around 30 ppm.

Table 2. Image of mixture of cassava juice with various amount of branded table salt after observation for 20 minutes

Mixture of 20grams branded table salt with 10 gram of Cassava juice			
Time			
5 minutes	10 minutes	15 minutes	20 minutes
			
The color started changed	Looks a little purple	Purple	Dark purple
Mixture of 20grams branded table Salt with 20 gram of Cassava juice			
Time			
5 minutes	10 minutes	15 minutes	20 minutes

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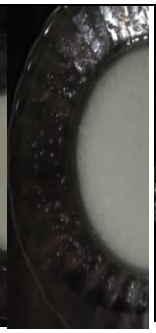
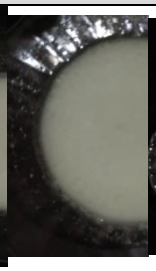
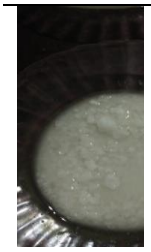
			
Not changed	Not changed	Not changed	Not changed
Mixture of 20grams branded table Salt with 30 gram of Cassava juice			
Time			
5 minutes	10 minutes	15 minutes	20 minutes
			
Not changed	Not changed	Not changed	Not changed

Table 3. Image of mixture of cassava juice with various amount of sea salt after observation for 20 minutes

Mixture of 10 grams Sea Salt with 10 gram of Cassava juice			
Time			
5 minutes	10 minutes	15 minutes	20 minutes
			
Not changed	Started to changed	Looks a little purple	Purple
Mixture of 10 grams Sea Salt with 20 gram of Cassava juice			
Time			
5 minutes	10 minutes	15 minutes	20 minutes
			
Not changed	Not changed	Not changed	Not changed
Mixture of 10 grams Sea Salt with 30 gram of Cassava juice			
Time			
5 minutes	10 minutes	15 minutes	20minutes
			
Not changed	Not changed	Not changed	Not changed

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In testing the electrical conductivity of salt, it can be done by mixing salt into water. Salt water power plant was reported pottetia as alternative and renewable energy. Salt water can conduct electricity because of the presence of high sodium chloride (NaCl) and the bonding between each element would be broken by water into Na^+ and Cl^- ions [29]. In order to generated electrical current, we use two electrode plates namely a copper plate as a positive electrode and a Zinc Plate as a negative electrode. Both plates are immersed in a glass filled with salt solution water and arranged in series circuit. This study was conducted with various mass of salt namely 20, 30, 40, 50 and 60 grams and dissolved into 190 mL of waters. Table 4 presented the result of electric current and voltage measurement with different electrode distance and various amount of branded table salt solution.

Tabel 4. Result of Electric Current and Voltage Measurement with Different Electrode Distance and Various Amount of Branded Table Salt Solution

No	Distance of electrode (l)	Voltage (V)	Mass (m) grams	Density (P) gram/mL	Electric Current (I) mA	LED Lamp
1.	1 cm	6.16	20	0.1	220	Light
		5.6	30	0.16	200	Light
		6.44	40	0.21	230	Light
		6.16	50	0.26	220	Light
		6.44	60	0.32	230	Brightly light
2.	2 cm	5.88	20	0.1	210	Light
		5.32	30	0.16	190	Light
		6.16	40	0.21	220	Light
		6.16	50	0.26	220	Light
		6.44	60	0.32	230	Light
3.	3 cm	5.6	20	0.1	200	Slightly light
		5.32	30	0.16	190	Slightly light
		6.16	40	0.21	220	Slightly light
		5.88	50	0.26	210	Slightly light
		6.44	60	0.32	230	Slightly light
4.	5 cm	5.88	20	0.1	210	Slightly light
		5.32	30	0.16	190	Slightly light
		6.16	40	0.21	220	Slightly light
		6.16	50	0.26	220	Slightly light
		6.44	60	0.32	230	Slightly light

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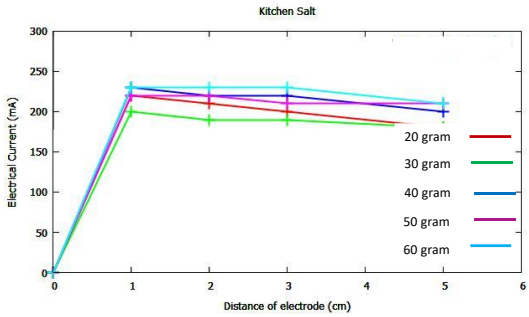

Figure 2. Current-Voltage relationships at a various amount of branded table salt

From the data above, it can be seen that the bigger amount of salt in a solution, the greater value of the electrical conductivity could be produced.

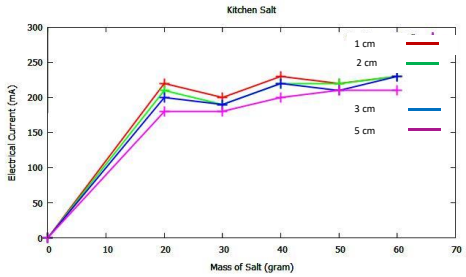

Figure 3. Current-Voltage relationships at a various distance of electrode from electrolyte solution of branded table salt

From figure 3, it can be seen that the electrode distance affects their electrical conductivity. The larger of electrode distance, the smaller of the electrical conductivity caould be obtained. Vice versa, the smaller electrode distance, the greater electrical conductivity could be generated.

Table 5 presented the result of electric current and voltage measurement with different electrode distance and various amount of sea salt solution.

Tabel 5. Result of Electric Current and Voltage Measurement with Different Electrode Distance and Various Amount of sea salt solution

No	**Distance of electrode (l)**	**Voltage (V)**	**Mass (m)** grams	**Density (P)** gram/mL	**Electric Current (I)** mA	**LED Lamp**
1.	1 cm	0.1	5.88	20	210	Light
			6.16	30		
			6.44	40		Light
			6.44	50	220	
			6.72	60		Light
		0.16			230	
		0.21			230	Light
		0.26			240	
		0.32				Brightly light
2.	2 cm	0.1	5.88	20	210	Light
			6.16	30		
			6.16	40	220	Light
			6.44	50		
			6.16	60	220	Light
		0.16			230	
		0.21			220	Light
		0.26				
		0.32				Light
3.	3 cm	0.1	5.88	20	210	Slightly light
			5.88	30		
			6.16	40	210	Slightly light
			6.16	50		
			6.44	60	220	Slightly light
		0.16			220	
		0.21			230	Slightly light
		0.26				
		0.32				Slightly light
4.	5 cm	0.1	5.6	20	200	Slightly light
			5.88	30	210	
			5.88	40	210	Slightly light
			6.16	50	220	
			6.44	60	230	Slig
		0.16				
		0.21				
		0.26				
		0.32				

	htly light
	Slig htly light
	Slig htly light

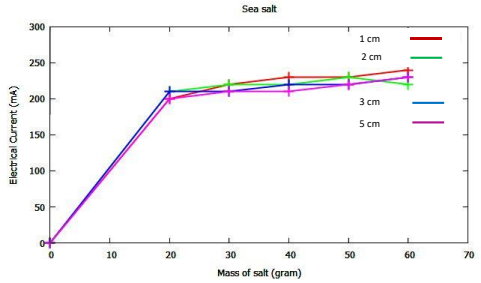

Figure 4. Current-Voltage relationships at a various amount of sea salt

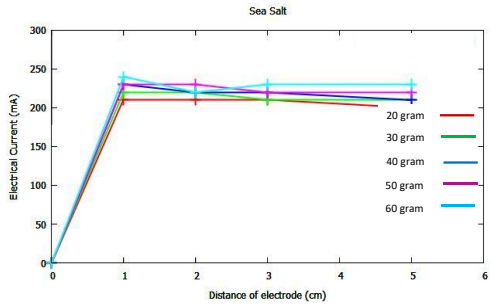

Figure 5. Current-Voltage relationships at a various distance of electrode from electrolyte solution of branded table salt

Based on Table 4 and 5, it can be seen that the amount of salt dissolved in constant volume of water was found has significat affect to their electrical current. The greater amount of salt dissolved in water, the larger value of the electric current generated from the cell. This is in accordance with the research was conduted by [30]. The addition of high amount of salt into solution, the greater current will be generated and significanly affected to their electrical power. The greater electric current generated, the larger power would be produced [31]. This is because electric power is affected by the amount of voltage and current in an electric conductor. The largest electric current is generated from solution with addition of 60 grams salt and the electrode distance of 1 cm. Almost 230 mA electrical current produced from branded salt and 240 mA generated from sea salt. Furthermore, the result indicated that the electrical current decreases as the distance between the electrodes increases. There is no significant difference in the value of electric current and voltage generated from two kind of salt. However, the electrical current and voltage generated from sea salt is greater compared to the electrical current and voltage generated from branded table salt.

CONCLUSION

It can be concluded that the color of mixture cassava juice and salt slowly changed into dark colour after dripped with 10 gram of cassava juice. In other words, the amount of salt must be greater than quantity of cassava juice since the iodine content in salt is very little, around 30 ppm. Meanwhile it was found that the amount of salt is proposional to their electrical characteristic. Meanwhile, the distance of the electrodes conversely proportional with to electrical characteristic. The greater the distance of the electrodes resulting smaller value of their resulting electrical current and voltage. No significant difference electrical characteristic between sea salt and branded table salt.

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