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Effectiveness of dioscorine removal system via determination of water quality parameters

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ABSTRACT

This paper introduced the development and effectiveness of discorine removal machine for *Dioscorea hispida* tubers. *Dioscorea hispida* is also known as 'ubi gadong' is a large tuber, underground tubers that have fibrous root, the tuber are produced near the soil surface and are extremely poisonous, alkaloid that is dioscorine. The tubers are sliced into small pieces before wash by flowing water using the machine, the circulation of water play important role in the operation. The tuber maybe easily rub each other during water circulation and make the dioscorine more faster to move out from tuber. As a result for this study, the measurements on water quality of washed tubers are showing the effectiveness this machine application.

KEYWORDS

Mechatronic;
Microcontroller and sensor;
Stand alone machine;
Farm mechanization;
Machine effectiveness.

INTRODUCTION

The essentialness of agriculture shown within the righteous book of Al-Quran which is there are about eighty three sentences mentioning about agriculture like plant as indicated as benefit of mankind. Dioscorea hispida (Ubi Gadong) is a poisonous plant where scientific studies have shown that its tuber contains toxic poison and can be consumed after the poison of is removed which traditionally the tubers put on flowing water of the rives in several days. These plants are normally found in wildlife forest and could potentially replace the primary daily food.

This developed machine is used to replace and reduce the human work in the production, operating by circulation of water and fully automated.

A water pump is used to move fluid by mechanical action, pump operate in some mechanism such as rotary and used energy source like electricity to perform mechanical work that can make the fluid is moving. A solenoid valves are used to control water inlet and water outlet, it can be on (open) and off (closed) automatically for control input and output signal from the sensor. A solenoid valve is an electromechanically operated valve that controlled by an electric current through a solenoid. Valves mechanically open and closed when receive mechanical energy that has convert from an electrical energy.

LITERATURE REVIEW

Prior to processing the fruits and vegetables are

washed and rinsed by means of flumes, soak tanks, water sprays, flotation chambers, or any combination of these methods. Great quantities of water are used. Detergents and ultrasonic techniques are also being tested for increased cleaning efficiency. Blanching is accomplished by putting the products in contact with water or steam. In almost all cases for preparation of vegetables to be frozen, it is imperative that the blancher processes be terminated quickly.

The system of washing represented in the product brushed and displaced by the moving brush until arriving to dryer sheet. The discharged out, so the foreign materials are removed from the surface of the product or dissolving in discharged water. The water discharged after washing through the filter that removes the suspended materials from the water. The cleaned water pumped to the washing machine outlets. The turbidity measuring device used is Japan Model. HORIBA with High sensitive turbidity sensor ranged between 0 and 1,000 NTUs (Nephelometric Turbidity Units) was used to check water quality[1].

The process of potato washing on vibrating devices of continuous action, develop and produced at the department of equipment of working chamber. With the increasing the vibration intensity, the tuber adhesion decrease and they begin to loose the contact with the vibrating working chamber, potato loosening and intensive circulation take place, it favor qualitative washing. The speed of tubers movement in the washer was determined by means of measurement of time during which the marked tubers passed the working chamber[2].

Instantaneous water quality measurements include any measurements taken by field instruments, such as single- or multi-parameter probes. Data are recorded on a field sheet, discharge measurement sheet, or habitat assessment sheet. In-situ water quality parameters may include water temperature, pH, dissolved oxygen, specific conductivity, and turbidity and percent oxygen saturation. Turbidity is an optical property of water that causes light to be scattered and absorbed rather than transmitted in straight line through the sample[3]. It is caused by the molecules of water itself, dissolved substance, organic and inorganic suspended matter. All turbidity measurements detect the amount of light either transmitted through or scattered by the particles in a sample of water[4]. Over the past several decades, instrument technology has advanced dramatically and many turbidity measurement techniques have resulted.

The best accounts of detoxification of D. hispida are given by Ochse and van den Brink. One method is to cut the tubers in pieces, cover the surface with wood ashes for 24 hours, and then steep them in seawater for several days. The pieces are then washed with freshwater and dried[5].

METHODOLOGY

Discorine removal system is a machine that used to remove the discorine with the water. It is a simple machine with two tanks which the upper tank used to hold ubi gadong and water and lower tank consist of water pump. The discorine removal system is depends on the electrical power supplier to function. Discorine removal machine is a machine that included several electronic

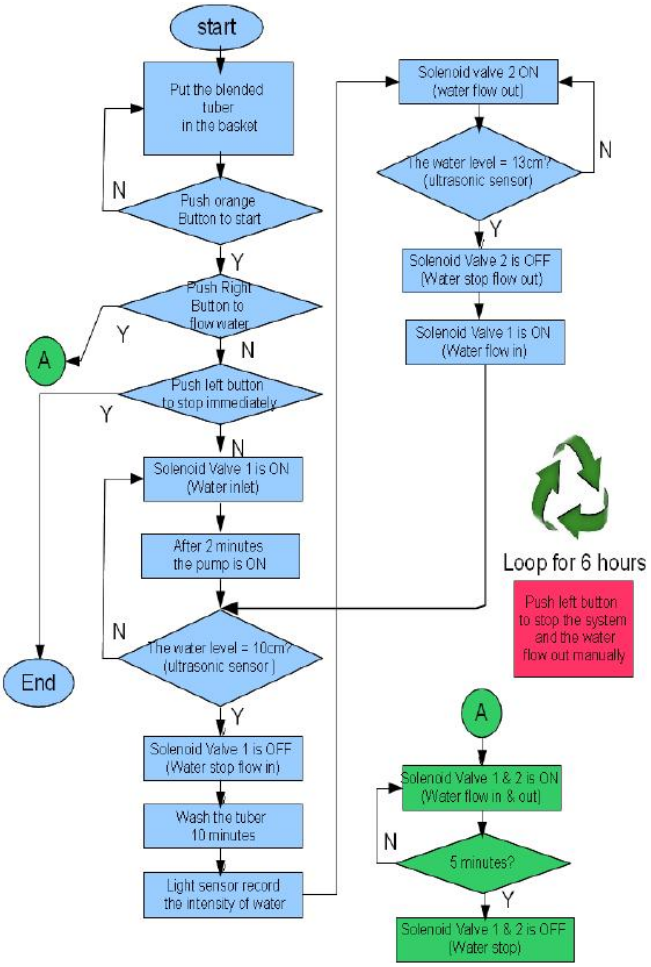

Figure 1 : show the algorithm process of machine.

components for automation to remove the discorine found in ubi gadong which is toxic. Figure 1 show the algorithm process from developed stand alone machine.

Figure 2 shows the overview of developed stand alone machine. The sensors play an important role in manages the input and output source[7]. Controller with timer is also important in manage the timing when water will be renewed and removed. Water pump provides water force which will cause the rotation of water. A few modifications may help improve the machine to operate more efficiently[8].

Figure 2 : Shows the overview of stand alone machine

After run the machine, the water quality of discorine waste is measure by using water quality checker to make sure the poison is out and to measure the effectiveness. Parameter measurement commonly made for water quality is temperature, pH, conductivity and dissolved oxygen. Water quality is referring to the biological characteristic, physical and chemical properties. In waste water contain total solid may refer to matter total suspended solid, materials which are not dissolved in water that cannot filterable and total dissolved solid, materials that are completely dissolved in water. We use natural tap water as a control to measure the water quality of *Dioscorea hispida* waste. For this experiment we are used 4 containers which content 2kg of sliced tuber, with mixed with 1kg of salt and 1kg sour pieces on each. The container A and B are soaked with 24 hours while C and D are soaked within 48 hours. Each sliced tubers on each containers are then soaked with 30 liter tap water on every day within 3 day. All measurements on water soaked with sliced tuber are measure and record as in TABLE 1.

RESULT AND DISCUSSION

Figure 3, 4 and 5 show the ph, turbidity and conductivity measurement with soaked water of sliced tubers.

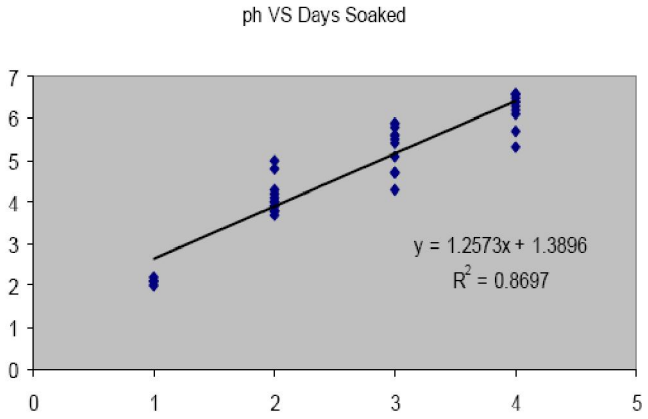

Figure 3 : ph value versus days soaked

From Figure 3 the value of ph on all containers of A, B, C and D having strong relationship with the number of days soaked. The regression value of R2 is more than 0.8 as indicated 0.86. This statement also is same that mentioned by Hudzari et. al., which stated that the discorin of toxic in tubers will further removed if a lot of water is applied[9].

From Figure 4 the value of turbidity on all containers of A, B, C and D having maximum on first day

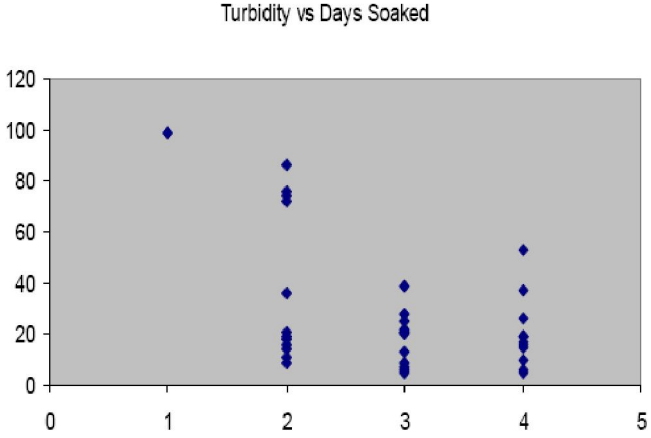

Figure 4 : ph value versus days soaked

TABLE 1 : Measurements of water quality

Container	Days soaked	pH	Conductivity	Turbidity	Dissolved Oxygen	Salinity
A	1	2.2	100	99	0	4
	2	4.1	5.5	11	0.1	0.3
	2	4.3	4.1	72	0.2	0.2
	2	4.8	1.2	19	0	0.1
	3	4.7	0.73	39	-0.2	0
	3	5.8	0.17	21	0	0
	3	5.9	0.08	21	0	0
	4	6.3	0.09	5	0.1	0
	4	5.7	0.36	53	0	0
	4	6.6	0.05	15	0	0
B	1	2.1	100	99	0	4
	2	3.9	5.8	21	0	0.3
	2	5	3.4	76	0	0.2
	2	4.2	1.8	9	0	0.1
	3	4.3	1.1	7	0	0
	3	4.7	0.25	9	-0.2	0
	3	5.6	0.09	6	0	0
	4	5.3	0.05	19	0	0
	4	6.2	0.04	6	-0.1	0
	4	6.4	0.04	17	-0.1	0
C	1	2	100	99	0	4
	2	3.8	7.4	74	0	0.4
	2	3.7	6	18	-0.1	0.3
	2	3.8	3.3	14	0	0.2
	3	5.6	0.49	28	-0.1	0
	3	5.9	0.14	20	0	0
	3	5.5	0.07	22	0	0
	4	6.5	0.04	16	0	0
	4	6.6	0.04	26	-0.1	0
	4	6.6	0.04	19	0	0
D	1	2.1	100	99	0	4
	2	4	5.6	86	0	0.3
	2	4	3	36	0	0.2
	2	3.9	2.7	16	0	0.1
	3	4.7	0.4	13	-0.1	0
	3	5.1	0.14	5	0	0
	3	5.4	0.07	25	-0.1	0
	4	6.6	0.05	37	0	0
	4	6.4	0.04	19	0	0
	4	6.1	0.05	10	-0.1	0

soaked. Otherwise there is no relationship between numbers of days soaked with turbidity value. While for Figure 5 strong relationships is found between the conductivity of water with the number of days soaked. The regression relationship of 2nd polynomial order stated more than 0.8 as indicated in Figure 5.

The removal machine developed in this study is used to remove the toxic; there is alkaloid in *Dioscorea hispida*, the alkaloid need to detoxification for safety before used. The water is added in the machine, also slice tuber and make sure the machine is working and circulate the water; power of pump is used to supply

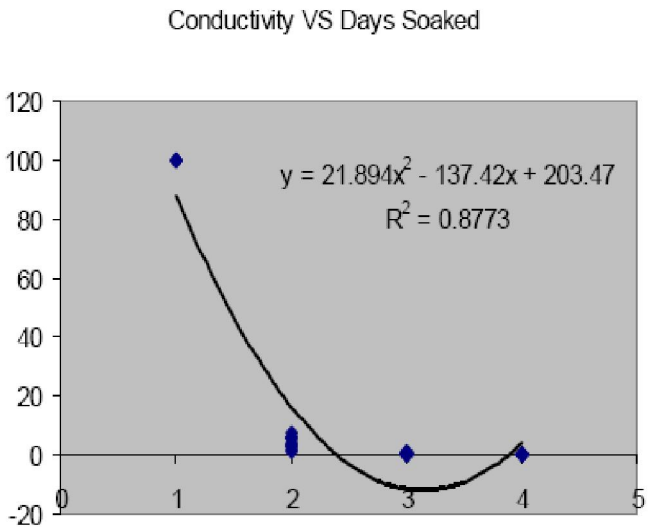

Figure 5 : Conductivity value versus days soaked

the power. This developed machine which used only not more than 60 liters tap water and within 6-7 hours operation to remove toxic from 2kg of sliced tubers. Using this machine the removal of alkaloid more efficient if compare to traditional method, it also can save the operation time.

CONCLUSION

The essentialness of agriculture shown within the righteous book of Al-Quran which is there are about eighty three sentences mentioning about agriculture for mankind see the greatness of Allah subhanahuwaatala. This developed machine is used to replace and reduce the human work in the production, operating by circulation of water with fully automated operation that the farmers should have for tubers processing of detoxification on their home.

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