

# THE RAW MATERIALS OF BIOETHANOL BY SOME CASSAVA VARIETY

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## ABSTRACT

About 6 kg until 7 kg of cassava usually used as the raw materials of one litre bioethanol. The Cellulose content, Moisture content and Total Sugar content of cassava, will influence the amount of cassava as the raw material for bioethanol respectively. Fermentation and Sacharification process is two step of Bioethanol production will continue by fermentation process along 72 hours. There are many variety of cassava which are able to use as the raw materials of bioethanol. In this research was examined several variety of cassava in laboratory scale which were, Umas Jaya-3, Kaserstaat, Caspro, and Malang 6. The result of the fermentation that is bioethanol content along 72 hours of fermentation process showed different concentration of bioethanol between Umas Jaya-3, Kaserstaat, Malang -6 and Caspro respectively.

**Key Words :** Cassava, Bioethanol, Malang 6, Umas Jaya-3, Kaserstaat., Caspro.

## 1 INTRODUCTION

There are some possibility to use raw materials of cassava which has economical value for Bioethanol. This raw materials should easy to get in standard quality and enough of quantity and also as the first priority among another raw material which is available around the production center. Cassava, sweet potato, potato, corn, cane and another starchy plant are able to be the raw materials of Bioethanol. But the master plant of Bioenergy National program decided that cassava and cane as the raw materials which total area up to 3 million hectare nowadays in Indonesia. Cane usually used as raw materials for bioethanol in Thailand, Brazil, India, and Corn used as raw materials of bioethanol in the United States of America.

The content of starch in cassava, will influence the amount of cassava as the raw material for bioethanol. Hydrolysis process and Sacharification process is one step of Bioethanol production which will continue by fermentation process along 72 hours. The final step is distillation which is produce technical grade 95 % to 96 % (v/v) Bioethanol. Dehydration process will get Fuel grade of Bioethanol.99.8% (v/v) which can be used as gasoline for internal combustion engine.

The weakness of cassava as the raw materials of bioethanol are Cassava is easy to be damaged by bacteria and some other microorganisms such as fungus, that make bad condition (deterioration) of cassava about two or three days after harvesting. The Root colour change become blue and yellowish. The starch content was decrease. This problem can be solved by making cassava flour, cassava starch, dry chips, dry solid, sawut etc. This way would increase manpower need and suitable with the master plan of The National Bioenergy program that increasing the job availability and reducing the jobless. There are some variety of cassava with high starch content but which one is the best for bioethanol raw material

is we don't know yet. This research will answer which one is the best for raw materials in laboratory scale.

The objection of this research are : 1) To evaluate bioethanol production in laboratory scale for several cassava lines.2) To make the scale of priority for several high starch and low starch cassava lines as the raw materials.

## 2. MATERIALS AND METHOD

Several cassava variety that are : Kaserstaat (Umas Jaya-5), Malang 6, Umas Jaya-3 and Caspro were used as raw materials in the production trials at laboratory scale. The Somogy's method was used to analysis the Total Sugar of each variety respectively. There is 0.238 gr Alpha Amilase, 0.475 gr Beta amylase used in saccharification process before fermentation process which used nutrient : 0.99 gr Urea, 0.17 gr NPK, and 0.20 gr NH<sub>4</sub>-NH<sub>4</sub> HPO<sub>4</sub> respectively. Total sugar content was 15 % to 20 % at the beginning of fermentation. The total sugar content, pH and ethanol concentration examined on the age 0 hours and 72 hours of fermentation (inoculation) respectively. Each treatment was done 3 repetition respectively.

## 3. RESULT AND DISCUSSION

The result of analysis of water content, starch content and cassava roots production of several cassava variety showed in table 1 respectively.

Table 1. The result of analysis of Water content, Starch content and Fresh Root production of several cassava variety.

No	Cassava variety	Moisture content %	Starch content %	Fresh root (ton/ha)
1	Malang-6	54,77	16,75	19,8
2	Caspro	55,94	16,75	28,7
3	Kaserstat	61,85	26,8	30,0
4	Umas Jaya 3 (UJ-3)	60,25	27,7	25,0

The result of ethanol production trial in laboratory scale from several cassava variety under this research are present in table 2, 3, 4 and 5. respectively.

Table 2 . The result of inoculation trial of bioethanol process in laboratory scale for Umas Jaya-3 variety

Raw Material		Cassava (UJ-3)			pH	Total weight	Δ	Alcohol (%vv)	
Date	Age (hrs)	Time (hrs)	Total Sugar (%wv)						
first	0	18.00	20.06	6.76	510.32	15.2	25.3	Repetition I	
	8	2.00	-		495.12				
	16	10.00	495.12		15.2				
second	24	18.00	485.01	25.3	480.99	29.3	479.39		30.9
	32	2.00	479.39	30.9	478.62	31.7	478.33		32.0
	40	10.00	478.62	31.7	478.09	32.2	477.71		32.6
	48	18.00	477.71	32.6	477.71	32.6	477.71		32.6
third	72	18.00	0.86	4.86	477.71	32.6	477.71		32.6
	72	18.00	0.86	4.86	477.71	32.6	477.71		32.6
	72	18.00	0.86	4.86	477.71	32.6	477.71		32.6
First	0	15.20	20.06	6.76	509.08	15.5	25.3	Rep. II	
	8	23.20	-		493.59				
	16	7.20	493.59		15.5				
second	24	15.20	483.78	25.3	479.80	29.3	478.55		30.5
	32	23.20	479.80	29.3	477.44	31.6	477.17		31.9
	40	7.20	477.44	31.6	476.94	32.1	476.94		32.1
	48	15.20	476.94	32.1	476.66	32.4	476.66		32.4
third	72	15.20	0.86	4.82	476.66	32.4	476.66		32.4
	72	15.20	0.86	4.82	476.66	32.4	476.66		32.4
	72	15.20	0.86	4.82	476.66	32.4	476.66		32.4
first	0	15.20	20.06	6.76	515.56	15.8	15.8	11.80	
	8	23.20	-		499.78				
	16	7.20	499.78		15.8				

first	0	15.20	20.06	6.76	515.56	15.8	15.8
	8	23.20	-		499.78		
	16	7.20	499.78	15.8			

second	24	15.20			489.83	25.7	
	32	23.20			485.69	29.9	
	40	7.20			483.99	31.6	
	48	15.20			483.20	32.4	
	56	23.20			482.95	32.6	
	64	7.20			482.71	32.9	Rep.III
third	72	15.20	0.86	4.81	482.41	33.1	11.80
						Av.	11.83

Table 3 . The result of inoculation trial of bioethanol process in laboratory scale for Kaserstaat variety

Raw Material		Cassava (Kaserstaat)			pH	Total weight	Δ	Alcohol (%vv)	
Date	Age (hrs)	Time (hrs)	Total Sugar (%wv)						
First	0	18.00	17.56	6.83	529.93	14.8	24.0	Repetition I	
	8	2.00	-		515.10				
	16	10.00	515.10		14.8				
second	24	18.00	505.90	24.0	503.53	26.4	502.89		27.0
	32	2.00	502.89	27.0	502.33	27.6	502.09		27.8
	40	10.00	501.83	28.1	501.83	28.1	501.83		28.1
	48	18.00	501.83	28.1	501.56	28.4	501.56		28.4
third	72	18.00	0.58	4.38	501.56	28.4	501.56		28.4
First	0	15.20	17.56	6.83	577.20	13.2	23.2		Rep.II
	8	23.20	-		564.04				
	16	7.20	564.04		13.2				
Second	24	15.20	554.05	23.2	550.88	26.3	550.06	27.1	
	32	23.20	550.88	26.3	549.46	27.7	549.21	28.0	
	40	7.20	549.46	27.7	548.95	28.3	548.95	28.3	
	48	15.20	548.95	28.3	548.66	28.5	548.66	28.5	
third	72	15.20	0.86	4.41	548.66	28.5	548.66	28.5	
First	0	15.20	17.56	6.83	504.12	15.1	22.8	9.40	
	8	23.20	-		489.05				
	16	7.20	489.05		15.1				
second	24	15.20	481.33	22.8	479.59	24.5	479.00		25.1
	32	23.20	479.59	24.5	479.00	25.1	479.00		25.1
	40	7.20	479.00	25.1	479.00	25.1	479.00		25.1
	40	7.20	479.00	25.1	479.00	25.1	479.00		25.1

	48	15.20			478.52	25.6	
	56	23.20			478.30	25.8	
	64	7.20			478.04	26.1	Rep. III
third	72	15.20	0.58	4.37	477.79	26.3	9.40
						Av.	9.40

Table 4 . The result of inoculation trial of bioethanol process in laboratory scale (Caspro)

Raw Material	Cassava (Caspro)			pH	Total weight	Δ	Alcohol
Date	Age	Time	Total Sugar				
	(hrs)		(%wv)				(%vv)
first	0	15.20	13.30	6.44	504.40		
	8	23.20			498.81	5.6	
	16	7.20			489.13	15.3	
second	24	15.20			486.49	17.9	
	32	23.20			484.68	19.7	
	40	7.20			483.76	20.6	
	48	15.20			483.34	21.1	
	56	23.20			483.02	21.4	Repe
third	64	7.20			482.78	21.6	titon I
	72	15.20	0.51	4.56	482.54	21.9	8.00
first	0	15.20	13.30	6.44	529.84		
	8	23.20			526.48	3.4	
	16	7.20			514.00	15.8	
second	24	15.20			510.40	19.4	
	32	23.20			508.39	21.5	
	40	7.20			507.30	22.5	
	48	15.20			506.85	23.0	
	56	23.20			506.46	23.4	
third	64	7.20			506.21	23.6	Rep.II
	72	15.20	0.52	4.62	505.97	23.9	7.90
first	0	15.20	13.30	6.44	505.30		
	8	23.20			502.35	2.9	
	16	7.20			491.15	14.2	
second	24	15.20			487.45	17.9	
	32	23.20			485.52	19.8	
	40	7.20			484.51	20.8	
	48	15.20			484.10	21.2	
	56	23.20			483.72	21.6	
third	64	7.20			483.46	21.8	Rep.III
	72	15.20	1.15	4.62	483.21	22.1	7.80
						Av	7.90

Table 5 . The result of inoculation trial of bioethanol process in laboratory scale for Malang- 6 variety

Raw Material	Cassava (Malang - 6)			pH	Total weight	Δ	Alcohol
Date	Age	Time	Total Sugar				
	(hrs)		(%wv)				(%vv)
First	0	15.20	17.38	6.64	503.97		
	8	23.20			501.13	2.8	
	16	7.20			489.37	14.6	
Second	24	15.20			484.29	19.7	
	32	23.20			481.40	22.6	
	40	7.20			479.32	24.7	
	48	15.20			477.78	26.2	
	56	23.20			476.69	27.3	Repe
third	64	7.20			476.15	27.8	titon I
	72	15.20	2.02	4.20	475.73	28.2	9.30
first	0	15.20	17.38	6.64	515.97		
	8	23.20			513.64	2.3	
	16	7.20			503.98	12.0	
second	24	15.20			498.53	17.4	
	32	23.20			495.54	20.4	
	40	7.20			493.39	22.6	
	48	15.20			491.80	24.2	
	56	23.20			490.75	25.2	
third	64	7.20			490.23	25.7	Rep. II
	72	15.20	0.87	4.20	489.82	26.2	9.30
First	0	15.20	17.38	6.64	519.13		
	8	23.20			516.95	2.2	
	16	7.20			507.48	11.7	
second	24	15.20			501.74	17.4	
	32	23.20			498.70	20.4	
	40	7.20			496.57	22.6	
	48	15.20			494.97	24.2	
	56	23.20			493.86	25.3	
third	64	7.20			493.30	25.8	Rep.III
	72	15.20	0.52	4.14	492.90	26.2	9.40
						Av	9.33

The data in table ,2,3,4 and 5 indicate that UJ-3 is the highest speed in reducing weight of the media along inoculation time and also UJ-3 showed the value of bioethanol concentration 11.83% in 72hours of inoculation or fermentation. The bioethanol content of Kaserstaat, Malang 6 and caspro are 9.40% , 9,33 % and 7,90 % respectively.

#### 4.CONCLUSION

. The highest starch content of cassava lines got the highest concentration of bioethanol. The lowest starch content of cassava lines got the lowest concentration of bioethanol. In this research showed tht the second grade and the third grade in producing bioethanol are Kaserstaat and Malang-6 respectively. There are different concentration of bioethanol in each cassava lines along 72 hours of inoculation

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