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APPENDIX A

Table 1: TSS, pH, glucose for bioethanol produced at different yeast concentrations.

Yeast Concentration		pH		TSS		Glucose
		Initial	After	Initial	After	
2g/L	R1	5.8	4.45	33.20	24.2	9.35
	R2	5.8	4.40	32.8	24	9.47
	R3	5.8	4.35	33	23.8	9.59
	Ave	5.8	4.40	33	24	9.47
3 g/L	R1	5.8	4.25	32.70	23.33	8.92
	R2	5.8	4.30	32.50	23.25	9.03
	R3	5.8	4.35	32.90	23.41	8.82
	Ave	5.8	4.30	32.70	23.33	8.92
5 g/L	R1	5.8	4.21	32.2	21.2	6.14
	R2	5.8	4.26	32	21.2	6.34
	R3	5.8	4.31	31.8	21.2	6.24
	Ave	5.8	4.26	32	21.2	6.24
7 g/L	R1	5.8	4.39	33.2	20.2	7.38
	R2	5.8	4.49	33	19.8	7.28
	R3	5.8	4.44	32.8	20	7.18
	Ave	5.8	4.44	33	20	7.28

10 g/L	R1	5.8	4.45	33.2	17	8.19
	R2	5.8	4.40	33	16.8	8.33
	R3	5.8	4.35	32.8	17.2	8.46
	Ave	5.8	4.40	33	17	8.32

Table 2: Variation in TSS, pH, glucose for bioethanol produced at different fermentation period

Days		pH		TSS		Glucose
		Initial	After	Initial	After	
Day 2	R1	5.8	4.70	33.2	24.2	13.10
	R2	5.8	4.65	33	24	13.31
	R3	5.8	4.75	32.8	23.8	12.89
	Ave	5.8	4.70	33	24	13.10
Day 3	R1	5.8	4.25	32.7	22.33	11.97
	R2	5.8	4.35	32.5	22.25	12.38
	R3	5.8	4.30	32.9	22.41	12.17
	Ave	5.8	4.30	32.7	22.33	12.17
Day 4	R1	5.8	4.26	33.2	19.2	10.28
	R2	5.8	4.21	33	19.2	10.38
	R3	5.8	4.31	32.8	19.2	10.18
	Ave	5.8	4.26	33	19.2	10.28

Day 5	R1	5.8	4.26	33.2	19.2	7.30
	R2	5.8	4.21	33	19	7.28
	R3	5.8	4.31	32.8	19	7.42
	Ave	5.8	4.26	33	19	7.30
Day 6	R1	5.8	4.23	32.8	18.80	8.50
	R2	5.8	4.28	33	18.80	8.40
	R3	5.8	4.33	33.2	18.80	8.60
	Ave	5.8	4.28	33	18.80	8.50

Table 3: TSS, pH, glucose for bioethanol produced at different pH

Different pH		pH		TSS		Glucose
		Initial	After	Initial	After	
5.0	R1	5.0	4.45	33.2	24.2	8.52
	R2	5.0	4.40	33	24	8.12
	R3	5.0	4.35	32.8	23.8	8.32
	Ave	5.0	4.40	33	24	8.32
5.8	R1	5.8	4.30	32.7	23.33	6.76
	R2	5.8	4.25	32.5	23.25	6.71
	R3	5.8	4.35	32.9	23.41	6.81
	Ave	5.8	4.30	32.7	23.33	6.76

7.0	R1	7.0	4.26	32.2	21.2	8.69
	R2	7.0	4.21	32	21.2	8.58
	R3	7.0	4.31	31.8	21.2	8.47
	Ave	7.0	4.26	32	21.2	8.58
7.5	R1	7.5	4.44	33.2	20.2	9.71
	R2	7.5	4.39	33	19.8	9.58
	R3	7.5	4.49	32.8	20	9.84
	Ave	7.5	4.44	33	20	9.71

Table 4: TSS, pH, glucose for bioethanol produced at different temperature

Temperature		pH		TSS		Glucose
		Initial	After	Initial	After	
28°C	R1	5.8	4.45	33.2	24.2	5.52
	R2	5.8	4.40	33	24	5.47
	R3	5.8	4.35	32.8	23.8	5.57
	Ave	5.8	4.40	33	24	5.52
35°C	R1	5.8	4.65	32.7	23.33	8.51
	R2	5.8	4.77	32.5	23.25	8.63
	R3	5.8	4.72	32.9	23.41	8.75
	Ave	5.8	4.72	32.7	23.33	8.63

40°C	R1	5.8	4.61	32.2	21.2	9.50
	R2	5.8	4.71	32	21.2	9.92
	R3	5.8	4.66	31.8	21.2	9.71
	Ave	5.8	4.66	32	21.2	9.71

Table 5: TSS, pH, glucose for bioethanol produced at different water content

Water percentage		pH		TSS		Glucose
		Initial	After	Initial	After	
20%	R1	5.8	5.30	-	-	0
	R2	5.8	5.35	-	-	0
	R3	5.8	5.25	-	-	0
	Ave	5.8	5.30	-	-	0
30%	R1	5.8	4.67	-	-	10.03
	R2	5.8	4.72	-	-	10.38
	R3	5.8	4.77	-	-	9.68
	Ave	5.8	4.72	-	-	10.03
40%	R1	5.8	4.66	35	32.20	10.05
	R2	5.8	4.61	35	32.40	9.81
	R3	5.8	4.71	35	32	9.57
	Ave	5.8	4.66	35	32.20	9.81
50%	R1	5.8	4.41	34.5	29.60	5.88
	R2	5.8	4.36	34.3	29.20	5.77
	R3	5.8	4.46	34.1	29.40	5.99
	Ave	5.8	4.41	34.3	29.40	5.88

60%	R1	5.8	4.23	32.2	23.20	4.70
	R2	5.8	4.28	33	23.40	4.82
	R3	5.8	4.18	32.8	23	4.58
	Ave	5.8	4.23	33	23.20	4.70
80%	R1	5.8	4.12	33.2	17.50	4.70
	R2	5.8	4.17	33	17.70	5.10
	R3	5.8	4.22	32.8	17.30	4.90
	Ave	5.8	4.17	33	17.50	4.90

Table 6: Content of glucose, TSS and pH of different parts of fruits

Parts of fruits		pH		TSS		Glucose
		Initial	After	Initial	after	
Seedless Dates	R1	5.8	3.55	33	24.2	2.35
	R2	5.8	3.45	33	24	2.25
	R3	5.8	3.50	33	23.8	2.45
	Ave	5.8	3.50	33	24	2.35
Crush Seeds	R1	5.8	3.15	11.60	9	3.10
	R2	5.8	3.05	12.40	9	3.34
	R3	5.8	3.10	12	9	3.22
	Ave	5.8	3.10	12	9	3.22

Seeds (whole)	R1	5.8	3.35	4.30	3.4	6.52
	R2	5.8	3.30	4	3.4	6.82
	R3	5.8	3.25	3.70	3.4	6.22
	Ave	5.8	3.30	4	3.4	6.52

Table 7: Viscosity and acid value measurement at different days of fermentation.

Days		Viscosity	Acid Value
Day 1	R1	2.1	0.5
	R2	2.2	0.5
	R3	2	0.5
	Ave	2.1	0.5
Day 3	R1	2.3	0.4
	R2	2.1	0.4
	R3	1.9	0.4
	Ave	2.1	0.4
Day 5	R1	1.8	0.3
	R2	1.9	0.3
	R3	1.7	0.3
	Ave	1.8	0.3
ASTM Standard		1.9 – 6.0	0.0 – 0.5

APPENDIX B

Publications of This Dissertation

Hossain, ABMS and M. Mazen 2011. Bioethanol production from waste dates. Bioethanol fuel for transportation. LAP Lambart Academic publishing Co. Paperback, Germany. ISBN Pp. 41-51. (ISBN No. 978-3847332466).