APPENDIX A

QUALITY PARAMETERS OF ULTRASOUND ASSISTED JAMUN JUICE

Table A1 Yield

Run	Temperature (ºC)	Time (mins)	Yield (%)
1	10	90	77.33
2	20	102	81.56
3	30	90	80.25
4	10	30	75.33
5	20	60	81
6	20	60	81.05
7	34	60	**81.65**
8	6	60	**74.25**
9	20	60	81.05
10	20	60	81.05
11	20	60	81.05
12	20	18	79.73
13	30	30	80.1

Table A2 pH

Run	Temperature (ºC)	Time (mins)	pH
1	10	90	3
2	20	102	3
3	30	90	3
4	10	30	**3.17**
5	20	60	3.1
6	20	60	3.1
7	34	60	3.1
8	6	60	**3**
9	20	60	3.1
10	20	60	3.1
11	20	60	3.1
12	20	18	3.1
13	30	30	3.14

Table A3 Acidity

Run	Temperature (ºC)	Time (mins)	Acidity
1	10	90	0.68
2	20	102	0.77
3	30	90	**0.87**
4	10	30	0.66
5	20	60	0.82
6	20	60	0.82
7	34	60	0.83
8	6	60	0.85
9	20	60	0.83
10	20	60	0.82
11	20	60	0.82
12	20	18	**0.58**
13	30	30	0.81

Table A4 TSS

Run	Temperature (ºC)	Time (mins)	TSS (%)
1	10	90	5.8
2	20	102	5.77
3	30	90	5.5
4	10	30	5.4
5	20	60	5.86
6	20	60	5.86
7	34	60	**5.89**
8	6	60	5.8
9	20	60	5.86
10	20	60	5.86
11	20	60	5.87
12	20	18	**5.33**
13	30	30	5.4

Table A5 Total phenolic content

Run	Temperature (ºC)	Time (mins)	Total phenolic content (mg GAE/100g)
1	10	90	129.51
2	20	102	130.799
3	30	90	146.37
4	10	30	118.12
5	20	60	136
6	20	60	136.85
7	34	60	**160.56**
8	6	60	135.25
9	20	60	136.52
10	20	60	136
11	20	60	136
12	20	18	**112.049**
13	30	30	136.81

Table A6 Total anthocyanin content

Run	Temperature (ºC)	Time (mins)	Total anthocyanin content (mg/ 100 ml)
1	10	90	1038.11
2	20	102	1070.96
3	30	90	1227.37
4	10	30	990.8
5	20	60	1096.56
6	20	60	1098.56
7	34	60	**1281.92**
8	6	60	1045.91
9	20	60	1096
10	20	60	1096
11	20	60	1096
12	20	18	**988.017**
13	30	30	1179.5

Table A7 Antioxidant activity

Run	Temperature (ºC)	Time (mins)	Antioxidant activity (%)
1	10	90	95.1
2	20	102	94
3	30	90	93.98
4	10	30	93
5	20	60	95.1
6	20	60	95
7	34	60	**95.4**
8	6	60	94
9	20	60	95
10	20	60	95
11	20	60	95
12	20	18	**93**
13	30	30	95.25

APPENDIX B

ANOVA FOR ULTRASOUND ASSITED EXTARCTION OF JAMUN JUICE

Table B1 Juice Yield (%)

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	61.39	5	12.28	21.13	0.0004	significant
A-Temperature	41.20	1	41.20	70.90	< 0.0001	
B-Time	2.81	1	2.81	4.83	0.0640	
AB	0.8556	1	0.8556	1.47	0.2643	
A^2	16.52	1	16.52	28.44	0.0011	
B^2	0.2611	1	0.2611	0.4494	0.5241	
Residual	4.07	7	0.5811			
Lack of Fit	3.17	3	1.06	4.71	0.0842	not significant
Pure Error	0.8970	4	0.2242			
Cor Total	65.46	12				
Std. Dev.	0.7623		**R^2**		0.9379	
Mean	79.44		**Adjusted R^2**		0.8935	
C.V. %	0.9596		**Predicted R^2**		0.6341	
			Adeq Precision		13.4317	

Table B2 pH

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.0313	5	0.0063	5.01	0.0286	significant
A-Temperature	0.0016	1	0.0016	1.24	0.3017	
B-Time	0.0255	1	0.0255	20.41	0.0027	
AB	0.0002	1	0.0002	0.1802	0.6839	
A^2	0.0023	1	0.0023	1.83	0.2181	
B^2	0.0023	1	0.0023	1.83	0.2181	
Residual	0.0087	7	0.0012			
Lack of Fit	0.0087	3	0.0029			
Pure Error	0.0000	4	0.0000			
Cor Total	0.0400	12				
Std. Dev.	0.0353		**R^2**		0.7817	
Mean	3.08		**Adjusted R^2**		0.6258	
C.V. %	1.15		**Predicted R^2**		-0.5522	
			Adeq Precision		6.6493	

Table B3 Titratable acidity

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.0683	5	0.0137	4.45	0.0383	significant
A-Temperature	0.0121	1	0.0121	3.95	0.0871	
B-Time	0.0152	1	0.0152	4.95	0.0615	
AB	0.0004	1	0.0004	0.1302	0.7288	
A^2	0.0005	1	0.0005	0.1589	0.7021	
B^2	0.0382	1	0.0382	12.45	0.0096	
Residual	0.0215	7	0.0031			
Lack of Fit	0.0214	3	0.0071	356.96	< 0.0001	significant
Pure Error	0.0001	4	0.0000			
Cor Total	0.0898	12				
Std. Dev.	0.0554		**R^2**	0.7605		
Mean	0.7815		**Adjusted R^2**	0.5895		
C.V. %	7.09		**Predicted R^2**	-0.6980		
			Adeq Precision	7.4835		

Table B4 TSS

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.5269	5	0.1054	8.07	0.0080	significant
A-Temperature	0.0113	1	0.0113	0.8616	0.3842	
B-Time	0.1574	1	0.1574	12.06	0.0104	
AB	0.0225	1	0.0225	1.72	0.2307	
A^2	0.0521	1	0.0521	3.99	0.0860	
B^2	0.3112	1	0.3112	23.83	0.0018	
Residual	0.0914	7	0.0131			
Lack of Fit	0.0581	3	0.0194	2.33	0.2160	not significant
Pure Error	0.0333	4	0.0083			
Cor Total	0.6183	12				
Std. Dev.	0.1143		**R^2**	0.8522		
Mean	5.71		**Adjusted R^2**	0.7466		
C.V. %	2.00		**Predicted R^2**	0.2475		
			Adeq Precision	8.0046		

Table B5 Total phenolic content

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	1652.43	5	330.49	107.60	< 0.0001	significant
A-Temperature	636.24	1	636.24	207.15	< 0.0001	
B-Time	281.63	1	281.63	91.70	< 0.0001	
AB	0.8372	1	0.8372	0.2726	0.6177	
A^2	173.63	1	173.63	56.53	0.0001	
B^2	472.85	1	472.85	153.95	< 0.0001	
Residual	21.50	7	3.07			
Lack of Fit	11.58	3	3.86	1.56	0.3312	not significant
Pure Error	9.92	4	2.48			
Cor Total	1673.92	12				
Std. Dev.	1.75		**R^2**		0.9872	
Mean	134.93		**Adjusted R^2**		0.9780	
C.V. %	1.30		**Predicted R^2**		0.9415	
			Adeq Precision		39.8821	

Table B6 Total anthocyanin content

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	87311.10	5	17462.22	149.91	< 0.0001	significant
A-Temperature	63319.69	1	63319.69	543.59	< 0.0001	
B-Time	5643.42	1	5643.42	48.45	0.0002	
AB	0.0784	1	0.0784	0.0007	0.9800	
A^2	10233.41	1	10233.41	87.85	< 0.0001	
B^2	5793.66	1	5793.66	49.74	0.0002	
Residual	815.38	7	116.48			
Lack of Fit	605.06	3	201.69	3.84	0.1134	not significant
Pure Error	210.32	4	52.58			
Cor Total	88126.48	12				
Std. Dev.	10.79		**R^2**	0.9907		
Mean	1099.17		**Adjusted R^2**	0.9841		
C.V. %	0.9819		**Predicted R^2**	0.9474		
			Adeq Precision	42.0631		

Table B7 Antioxidant activity

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	8.11	5	1.62	45.56	< 0.0001	significant
A-Temperature	1.21	1	1.21	33.98	0.0006	
B-Time	0.6296	1	0.6296	17.69	0.0040	
AB	2.84	1	2.84	79.80	< 0.0001	
A^2	0.0722	1	0.0722	2.03	0.1973	
B^2	3.43	1	3.43	96.32	< 0.0001	
Residual	0.2491	7	0.0356			
Lack of Fit	0.2411	3	0.0804	40.18	0.0019	significant
Pure Error	0.0080	4	0.0020			
Cor Total	8.35	12				
Std. Dev.	0.1886		**R^2**		0.9702	
Mean	94.53		**Adjusted R^2**		0.9489	
C.V. %	0.1996		**Predicted R^2**		0.7933	
			Adeq Precision		20.7691	

APPENDIX C

QUALITY PARAMETERS OF SPRAY DRIED JAMUN JUICE POWDER

Table C1 Product Yield

Run	Temperature (°C)	Concentration (%)	Feed rate (rpm)	Product yield (%)
1	150	20	10	56.76
2	150	20	10	56.76
3	150	25	8	64.62
4	150	15	12	52.21
5	140	25	10	63.39
6	160	20	12	63.76
7	150	25	12	65.23
8	150	20	10	56.76
9	150	20	10	56.76
10	160	15	10	**46.9**
11	160	20	8	65.7
12	150	20	10	56.76
13	140	15	10	53
14	140	20	12	**67.39**
15	140	20	8	63.52
16	150	15	8	51.91
17	160	25	10	57.46

Table C2 Moisture content

Run	Temperature (°C)	Concentration (%)	Feed rate (rpm)	Moisture content (%)
1	150	20	10	4.6
2	150	20	10	4.64
3	150	25	8	4.47
4	150	15	12	4.78
5	140	25	10	**4.82**
6	160	20	12	4.5
7	150	25	12	4.59
8	150	20	10	4.5
9	150	20	10	4.6
10	160	15	10	4.54
11	160	20	8	**4.1**
12	150	20	10	4.6
13	140	15	10	4.74
14	140	20	12	4.28
15	140	20	8	4.16
16	150	15	8	4.7
17	160	25	10	4.5

Table C3 Water activity

Run	Temperature (°C)	Concentration (%)	Feed rate (rpm)	Water activity
1	150	20	10	0.298
2	150	20	10	0.298
3	150	25	8	0.339
4	150	15	12	0.321
5	140	25	10	0.327
6	160	20	12	0.283
7	150	25	12	0.332
8	150	20	10	0.298
9	150	20	10	0.298
10	160	15	10	0.302
11	160	20	8	**0.282**
12	150	20	10	0.298
13	140	15	10	0.318
14	140	20	12	0.326
15	140	20	8	**0.343**
16	150	15	8	0.325
17	160	25	10	0.298

Table C4 Bulk density

Run	Temperature (°C)	Concentration (%)	Feed rate (rpm)	Bulk density (g/cm^3)
1	150	20	10	0.392
2	150	20	10	0.386
3	150	25	8	0.352
4	150	15	12	0.382
5	140	25	10	0.391
6	160	20	12	0.381
7	150	25	12	0.36
8	150	20	10	0.392
9	150	20	10	0.392
10	160	15	10	0.367
11	160	20	8	**0.342**
12	150	20	10	**0.398**
13	140	15	10	0.378
14	140	20	12	0.362
15	140	20	8	0.351
16	150	15	8	0.362
17	160	25	10	0.352

Table C5 True density

Run	Temperature (°C)	Concentration (%)	Feed rate (rpm)	True density (g/cm^3)
1	150	20	10	0.56
2	150	20	10	0.56
3	150	25	8	0.5
4	150	15	12	0.38
5	140	25	10	0.56
6	160	20	12	0.63
7	150	25	12	0.63
8	150	20	10	0.56
9	150	20	10	0.56
10	160	15	10	0.5
11	160	20	8	0.56
12	150	20	10	0.56
13	140	15	10	0.56
14	140	20	12	0.56
15	140	20	8	0.5
16	150	15	8	**0.42**
17	160	25	10	**0.71**

Table C6 Wettability

Run	Temperature (°C)	Concentration (%)	Feed rate (rpm)	Wettability (%)
1	150	20	10	106.8
2	150	20	10	106.8
3	150	25	8	**129**
4	150	15	12	75
5	140	25	10	120
6	160	20	12	72
7	150	25	12	90
8	150	20	10	106.8
9	150	20	10	106.8
10	160	15	10	64.5
11	160	20	8	**62**
12	150	20	10	106.8
13	140	15	10	90
14	140	20	12	102
15	140	20	8	99
16	150	15	8	96
17	160	25	10	70.5

Table C7 Dispersibility

Run	Temperature (°C)	Concentration (%)	Feed rate (rpm)	Dispersibility (%)
1	150	20	10	86
2	150	20	10	86
3	150	25	8	93
4	150	15	12	94
5	140	25	10	94.56
6	160	20	12	**96**
7	150	25	12	86
8	150	20	10	86
9	150	20	10	86
10	160	15	10	93
11	160	20	8	96
12	150	20	10	86
13	140	15	10	66.97
14	140	20	12	69.24
15	140	20	8	**83.62**
16	150	15	8	89.5
17	160	25	10	96

Table C8 Solubility

Run	Temperature (°C)	Concentration (%)	Feed rate (rpm)	Solubility (%)
1	150	20	10	**96**
2	150	20	10	96
3	150	25	8	96
4	150	15	12	95.2
5	140	25	10	96
6	160	20	12	95.2
7	150	25	12	95.2
8	150	20	10	96
9	150	20	10	96
10	160	15	10	95.2
11	160	20	8	95.6
12	150	20	10	96
13	140	15	10	95.6
14	140	20	12	**94.8**
15	140	20	8	95.6
16	150	15	8	95.2
17	160	25	10	95.2

Table C9 Total anthocyanin content

Run	Temperature (°C)	Concentration (%)	Feed rate (rpm)	Total anthocyanin content (mg/100 ml)
1	150	20	10	634.558
2	150	20	10	634.558
3	150	25	8	**514.493**
4	150	15	12	**735.253**
5	140	25	10	358.191
6	160	20	12	699.795
7	150	25	12	583.793
8	150	20	10	634.558
9	150	20	10	634.558
10	160	15	10	677.58
11	160	20	8	621.978
12	150	20	10	634.558
13	140	15	10	756
14	140	20	12	701.353
15	140	20	8	581.121
16	150	15	8	609.175
17	160	25	10	652.37

Table C10 Total colour difference

Run	Temperature (°C)	Concentration (%)	Feed rate (rpm)	Total colour difference
1	150	20	10	47.0194
2	150	20	10	47.0194
3	150	25	8	51.647
4	150	15	12	43.35
5	140	25	10	**53.48**
6	160	20	12	48.17
7	150	25	12	50.2874
8	150	20	10	47.0194
9	150	20	10	47.0194
10	160	15	10	39.37
11	160	20	8	47.34
12	150	20	10	47.0194
13	140	15	10	**20.83**
14	140	20	12	48.2
15	140	20	8	49.83
16	150	15	8	34.72
17	160	25	10	50.41

APPENDIX D

ANOVA FOR SPRAY DRIED JAMUN JUICE POWDER

Table D1 Product Yield (%)

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	536.31	9	59.59	24.57	0.0002	significant
A-Temperature	22.71	1	22.71	9.36	0.0183	
B-Concentration	272.38	1	272.38	112.30	< 0.0001	
C-Feed rate	1.01	1	1.01	0.4157	0.5396	
AB	0.0072	1	0.0072	0.0030	0.9580	
AC	8.44	1	8.44	3.48	0.1044	
BC	0.0240	1	0.0240	0.0099	0.9235	
A^2	26.61	1	26.61	10.97	0.0129	
B^2	70.31	1	70.31	28.99	0.0010	
C^2	142.56	1	142.56	58.78	0.0001	
Residual	16.98	7	2.43			
Lack of Fit	16.98	3	5.66			
Pure Error	0.0000	4	0.0000			
Cor Total	553.29	16				

Std. Dev.	1.56	R^2	0.9693
Mean	58.76	Adjusted R^2	0.9299
C.V. %	2.65	Predicted R^2	0.5090
		Adeq Precision	17.5477

Table D2 Moisture Content (%)

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.5321	9	0.0591	3.83	0.0451	significant
A-Temperature	0.0162	1	0.0162	1.05	0.3395	
B-Concentration	0.0181	1	0.0181	1.17	0.3151	
C-Feed rate	0.0648	1	0.0648	4.20	0.0795	
AB	0.0036	1	0.0036	0.2335	0.6437	
AC	0.0196	1	0.0196	1.27	0.2967	
BC	0.0004	1	0.0004	0.0259	0.8766	
A^2	0.1031	1	0.1031	6.69	0.0361	
B^2	0.2010	1	0.2010	13.04	0.0086	
C^2	0.1238	1	0.1238	8.03	0.0253	
Residual	0.1079	7	0.0154			
Lack of Fit	0.0971	3	0.0324	11.89	0.0184	significant
Pure Error	0.0109	4	0.0027			
Cor Total	0.6400	16				
Std. Dev.	0.1242		R^2		0.8314	
Mean	4.54		Adjusted R^2		0.6145	
C.V. %	2.74		Predicted R^2		-1.4529	
			Adeq Precision		7.4290	

Table D3 Water activity

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.0053	9	0.0006	8.45	0.0051	significant
A-Temperature	0.0028	1	0.0028	39.79	0.0004	
B-Concentration	0.0001	1	0.0001	1.61	0.2447	
C-Feed rate	0.0001	1	0.0001	1.31	0.2906	
AB	0.0000	1	0.0000	0.6057	0.4619	
AC	0.0001	1	0.0001	1.16	0.3169	
BC	2.250E-06	1	2.250E-06	0.0323	0.8626	
A^2	0.0001	1	0.0001	0.8489	0.3875	
B^2	0.0012	1	0.0012	17.45	0.0042	
C^2	0.0009	1	0.0009	12.26	0.0100	
Residual	0.0005	7	0.0001			
Lack of Fit	0.0005	3	0.0002			
Pure Error	0.0000	4	0.0000			
Cor Total	0.0058	16				
Std. Dev.	0.0084		**R^2**		0.9157	
Mean	0.3109		**Adjusted R^2**		0.8074	
C.V. %	2.69		**Predicted R^2**		-0.3481	
			Adeq Precision		7.5522	

Table D4 Bulk density

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.0044	9	0.0005	4.98	0.0230	significant
A-Temperature	0.0002	1	0.0002	2.01	0.1988	
B-Concentration	0.0001	1	0.0001	1.46	0.2668	
C-Feed rate	0.0008	1	0.0008	7.66	0.0278	
AB	0.0002	1	0.0002	1.97	0.2028	
AC	0.0002	1	0.0002	1.97	0.2028	
BC	0.0000	1	0.0000	0.3626	0.5661	
A^2	0.0007	1	0.0007	6.63	0.0368	
B^2	0.0002	1	0.0002	2.39	0.1664	
C^2	0.0018	1	0.0018	17.82	0.0039	
Residual	0.0007	7	0.0001			
Lack of Fit	0.0006	3	0.0002	11.54	0.0194	significant
Pure Error	0.0001	4	0.0000			
Cor Total	0.0051	16				
Std. Dev.	0.0100		R^2		0.8649	
Mean	0.3729		Adjusted R^2		0.6912	
C.V. %	2.67		Predicted R^2		-0.9593	
			Adeq Precision		7.1642	

Table D5 Tapped bulk density

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.0903	9	0.0100	31.93	< 0.0001	significant
A-Temperature	0.0060	1	0.0060	19.25	0.0032	
B-Concentration	0.0364	1	0.0364	115.98	< 0.0001	
C-Feed rate	0.0060	1	0.0060	19.25	0.0032	
AB	0.0110	1	0.0110	35.08	0.0006	
AC	0.0000	1	0.0000	0.0795	0.7861	
BC	0.0072	1	0.0072	22.99	0.0020	
A^2	0.0111	1	0.0111	35.19	0.0006	
B^2	0.0035	1	0.0035	11.07	0.0126	
C^2	0.0100	1	0.0100	31.84	0.0008	
Residual	0.0022	7	0.0003			
Lack of Fit	0.0022	3	0.0007			
Pure Error	0.0000	4	0.0000			
Cor Total	0.0925	16				
Std. Dev.	0.0177		R^2		0.9762	
Mean	0.5476		Adjusted R^2		0.9456	
C.V. %	3.24		Predicted R^2		0.6195	
			Adeq Precision		24.2704	

Table D6 Wettability

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	5442.46	9	604.72	6.12	0.0131	significant
A-Temperature	2520.50	1	2520.50	25.49	0.0015	
B-Concentration	882.00	1	882.00	8.92	0.0203	
C-Feed rate	276.13	1	276.13	2.79	0.1386	
AB	144.00	1	144.00	1.46	0.2667	
AC	12.25	1	12.25	0.1239	0.7352	
BC	81.00	1	81.00	0.8192	0.3955	
A^2	1238.41	1	1238.41	12.53	0.0095	
B^2	48.67	1	48.67	0.4923	0.5056	
C^2	146.57	1	146.57	1.48	0.2629	
Residual	692.12	7	98.87			
Lack of Fit	692.12	3	230.71			
Pure Error	0.0000	4	0.0000			
Cor Total	6134.58	16				
Std. Dev.	9.94		R^2		0.8872	
Mean	94.35		Adjusted R^2		0.7421	
C.V. %	10.54		Predicted R^2		-0.8052	
			Adeq Precision		7.6871	

Table D7 Dispersibility

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	968.22	9	107.58	3.99	0.0407	significant
A-Temperature	554.61	1	554.61	20.59	0.0027	
B-Concentration	85.09	1	85.09	3.16	0.1188	
C-Feed rate	35.62	1	35.62	1.32	0.2880	
AB	151.17	1	151.17	5.61	0.0497	
AC	51.70	1	51.70	1.92	0.2085	
BC	33.06	1	33.06	1.23	0.3045	
A^2	8.12	1	8.12	0.3014	0.6001	
B^2	38.43	1	38.43	1.43	0.2712	
C^2	10.83	1	10.83	0.4020	0.5462	
Residual	188.58	7	26.94			
Lack of Fit	188.58	3	62.86			
Pure Error	0.0000	4	0.0000			
Cor Total	1156.80	16				
Std. Dev.	5.19		R^2		0.8370	
Mean	87.52		Adjusted R^2		0.6274	
C.V. %	5.93		Predicted R^2		-1.6083	
			Adeq Precision		7.2783	

Table D8 Solubility

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	2.35	9	0.2612	5.08	0.0218	significant
A-Temperature	0.0800	1	0.0800	1.56	0.2524	
B-Concentration	0.1800	1	0.1800	3.50	0.1036	
C-Feed rate	0.5000	1	0.5000	9.72	0.0169	
AB	0.0400	1	0.0400	0.7778	0.4071	
AC	0.0400	1	0.0400	0.7778	0.4071	
BC	0.1600	1	0.1600	3.11	0.1211	
A^2	0.3789	1	0.3789	7.37	0.0300	
B^2	0.1684	1	0.1684	3.27	0.1133	
C^2	0.6737	1	0.6737	13.10	0.0085	
Residual	0.3600	7	0.0514			
Lack of Fit	0.3600	3	0.1200			
Pure Error	0.0000	4	0.0000			
Cor Total	2.71	16				
Std. Dev.	0.2268		R^2		0.8672	
Mean	95.58		Adjusted R^2		0.6964	
C.V. %	0.2373		Predicted R^2		-1.1250	
			Adeq Precision		5.4619	

Table D9 Total anthocyanin content

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	1.241E+05	9	13788.92	12.37	0.0016	significant
A-Temperature	8131.82	1	8131.82	7.29	0.0306	
B-Concentration	55972.06	1	55972.06	50.21	0.0002	
C-Feed rate	19348.10	1	19348.10	17.36	0.0042	
AB	34707.50	1	34707.50	31.13	0.0008	
AC	449.76	1	449.76	0.4034	0.5455	
BC	805.94	1	805.94	0.7229	0.4233	
A^2	299.24	1	299.24	0.2684	0.6204	
B^2	4298.92	1	4298.92	3.86	0.0903	
C^2	274.45	1	274.45	0.2462	0.6350	
Residual	7803.84	7	1114.83			
Lack of Fit	7803.84	3	2601.28			
Pure Error	0.0000	4	0.0000			
Cor Total	1.319E+05	16				
Std. Dev.	33.39		**R^2**	0.9408		
Mean	627.29		**Adjusted R^2**	0.8648		
C.V. %	5.32		**Predicted R^2**	0.0534		
			Adeq Precision	13.8759		

Table D10 Total colour difference

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	865.84	9	96.20	6.89	0.0093	significant
A-Temperature	20.96	1	20.96	1.50	0.2601	
B-Concentration	570.45	1	570.45	40.86	0.0004	
C-Feed rate	5.23	1	5.23	0.3749	0.5597	
AB	116.75	1	116.75	8.36	0.0233	
AC	1.51	1	1.51	0.1084	0.7516	
BC	24.95	1	24.95	1.79	0.2231	
A^2	7.19	1	7.19	0.5148	0.4963	
B^2	92.63	1	92.63	6.63	0.0367	
C^2	30.06	1	30.06	2.15	0.1857	
Residual	97.73	7	13.96			
Lack of Fit	97.73	3	32.58			
Pure Error	0.0000	4	0.0000			
Cor Total	963.57	16				
Std. Dev.	3.74		R^2		0.8986	
Mean	45.45		Adjusted R^2		0.7682	
C.V. %	8.22		Predicted R^2		-0.6228	
			Adeq Precision		10.3209	

APPENDIX E

QUALITY EVALAUTION OF OPTIMIZED ULTRASOUND EXTRACTED JAMUN JUICE AND SPRAY DRYING

Table E1 Quality properties of optimized ultrasound extracted jamun juice

Sl. No.	Characteristics	Value ± SD	Percentage Deviation from Predicted Points
1	Yield	81.33	0.001
2	pH	3.08	-0.003
3	Acidity	0.81	-0.06
4	TSS	6	0.039
5	Total phenolic content	147.21	-0.02
6	Total anthocyanin content	1227.37	0.005
7	Antioxidant activity	94.54	-0.007

Table E2 Quality properties of optimized ultrasound extracted spray dried jamun juice powder

Sl. No.	Characteristics	Value ± SD	Percentage Deviation from Predicted Points
1	Yield	65	10.97832
2	Moisture Content	4.5	2.342506
3	Water Activity	0.269	-2.88809
4	Bulk Density	0.29	-21.6216
5	True Density	0.43	-35.4354
6	Wettability	71	-1.31899
7	Dispersibility	92	-0.66189
8	solubility	96	0.300903
9	Total anthocyanin content	690	1.45716
10	Total colour difference	46	-3.99466

APPENDIX F

Sensory score card for sensory evaluation

SENSORY SCORE CARD

Table F1 9-Point Hedonic Scale Sensory Score Card

Sample	Colour	appearance	Flavour	Taste	Overall acceptability
T1					
T2					
T3					
T4					
T5					

Hedonic scale

9 – Like Extremely

8 – Like Very Much

7 – Like Moderately

6 – Like Slightly

5 – Neither Like or Dislike

4 – Dislike Slightly

3 – Dislike Moderately

2 – Dislike Very Much

1 – Dislike Extremely

Signature of sensory panel:

Name:

Date:

APPENDIX G

Cost economics of ultrasound treated spray dried jamun juice powder

I. Fixed cost per year

Capacity of the Spray dryer = 750 ml of feed per hour

Working hour per shift = 8 hours

Number of shifts per day = 2

Total capacity of the unit per day = 12 L

Cost of the Ultrasound equipment = Rs. 80,000/-

Cost of the Spray drier (S) = Rs.12, 00,000/-

Cost of mixer = Rs. 2,000/-

Cost of sealing machine = Rs. 1,500

Life span of the unit (n)

1.Ultrasound = 10 years

2.Spray dryer = 15 years

Annual usage (A)

A) Ultrasound = 150 days

B) Spray dryer = 300 days

Interest rate (Ri) = 15%

Fixed cost $= \frac{Ri \times (1+Ri)^n}{(1+Ri)^n - 1} \times C$

A) Fixed cost of the Ultrasound unit

$= \frac{0.15 \times (1+0.15)^{10}}{(1+0.15)^{10} - 1} \times 80{,}000$

= Rs. 15940/-

B) Fixed cost of the Spray drier unit

$= \frac{0.15 \times (1+0.15)^{15}}{(1+0.15)^{15} - 1} \times 12{,}00{,}000$

=Rs. 205220.5/-

C) Fixed cost of the mixer = Rs.398/-

D) Fixed cost of the sealing machine	= Rs. 447/-
E) Fixed cost of floor area 5 m^2, water charges and installation charge	= Rs. 9000/-
Total fixed cost/ year	**=** A+B+C+D+E
	= Rs. 231005.5/-
II. Variable cost per year	
a) Repair and maintenance cost per year	2 % of initial cost of the spray dryer
i) Ultrasound	= Rs.1600/-
ii) Spray dryer	= Rs. 24000/-
iii) Blender	= Rs. 40/-
iv) Sealing machine	= Rs. 30/-
Total Repair and maintenance charge	= i+ ii+ iii+ Iv
	= Rs. 25670/-
b) Cost of energy	
i) Energy consumed by ultrasound unit	= 0.8 kwh
ii) Energy consumed by the spray dryer	= 5.8 kwh
iii) Energy consumed by miscellaneous equipment	= 0.28 kwh
Total energy consumption	= 6.88 kwh
Total energy consumption per day	= 102.68 / day
Electricity rate	= Rs. 8.00 /kwh
Cost of energy consumption/h	= No. of days× Energy/day× Rate
	= 300× 102.68× 8
	= Rs.2,46,432 /year
c) Labour cost (2 persons)	= Rs. 800/day
	= Rs.4,80,000/-
d) Cost of raw materials	

i) Quantity of jamun fruit required	= 15 Kg/day
Cost of jamun fruit	= Rs.100/Kg
	= 1500/ day
	=Rs.4,50,000 / year
ii) Quantity of maltodextrin required	= 567 kg/ year
Cost of maltodextrin	= 567×380
	= Rs. 2,15,460/year
iii) Quantity of gum arabic	= 189 kg/year
Cost of gum arabic	=189×1220
	= Rs.2,30,580/ year
Total raw material cost	= i +ii +iii
	=8,96,040/ year
Total variable cost per year	= a+ b+ c+ d
	=25670+2,46,432+480000+8,96,040
	= Rs. 16,48,142/-
Operating cost of ultrasound assisted spray dryer	= Total fixed cost + Total variable cost
	=231005.5+752102
	=9,83,107.5/ year
	= 3277/ day
	=204.8/h

Total production cost per year	= Rs.1879147/-
Total powder produced per year	=Rs.792 kg
Cost of production of one kg of jamun fruit powder	= Rs.2372/-

1. Benefit – cost ratio

Assumptions

Cost of the raw material = Rs.100

Estimated selling price = Rs.2450

Cost of raw material per year = Rs.8,96,040/ year

Actual operating cost of machine per year= Rs. 9,83,107.5/ year

Weight of powder produced per year= 2.64×300

=792 kg

Total cost of obtained powder per year (gross income) = 792×2600

= Rs. 2059200/-

Net income = Total gross income -actual processing cost

=2059200-983107.5

= Rs.1076092.5

$$\text{Benefit- cost ratio} = \frac{\textbf{Net income}}{\textbf{Actual cost of raw material per year}}$$

=1.1:1

2. Payback period

Investment required for a project payback period=
(1283500+896040+480000+2659540) + 15% of investment

= Rs.3058471/-

Net annual cash inflow= Investment required for a project-Net income

=3058471-1076092.5

= Rs.1982378.5/-

Payback period = $\frac{\textbf{Investment required for a project}}{\textbf{\textit{Net annual cash flow}}}$

=2.84 years