

“CONTENTS”

Sl. No.	CHAPTERS	PAGE NO.
1	INTRODUCTION	1-4
2	REVIEW OF LITERATURE	5-18
	2.1 Probiotic bacteria	
	2.1.1 Probiotic Viability	
	2.2 Prebiotics	
	2.3 Encapsulation.	
	2.3.1. Techniques for microencapsulation	
	2.3.2 Extrusion technique	
	2.3.3 Emulsion technique	
	2.4 Yoghurt : Constituents and properties	
	2.4.1 Nutritional Value	
	2.4.2 Antagonistic Value	
	2.4.3 Therapeutic Value	
	2.5 General Manufacturing Procedure	
	2.6 Spray drying of yoghurt	
	2.6.1 Spray drying	
	2.6.2 Spray dryer	
	2.6.2.1 Principle	
	2.6.3 yoghurt powder	
	2.7 Response surface methodology (RSM)	
	2.8 ANOVA	

3.1 Materials**3.1.1 Research materials****3.1.3 Analysis of raw milk prior to yoghurt preparation****3.1.4 Encapsulation****3.4.1 Release / Depolymerization of bead****3.4.2 Effect of low pH****3.4.3 Effect of bile salt****3.4.4 Effect of Heat Treatment****3.5 Preparation of sweetened yoghurt.****3.5.1 Spray drying of fresh yoghurt****3.6 Analysis of product****3.6.1 Determination of moisture Content****3.6.2 Determination of pH.****3.6.3 Determination of water activity****3.6.4 Determination of syneresis****3.6.5 Determination of texture****3.6.6 Determination of Color****3.6.7 Titratable Acidity****3.6.8 Color Change (ΔE)****3.6.9 Sensory Evaluation****3.6.10 Bulk density****3.7 conversion of pump RPM into FEED RATE****3.8 Experimental Design and Statistical Analysis****3.8.1 Optimization**

4**RESULTS AND DISCUSSION****29-62****4.1 Encapsulation**

4.1.1 Microencapsulation of Cells

4.1.2 Release of Encapsulated Cells

4.1.3 Effect of Heat Treatment

4.1.4 Effect of Low pH

4.1.5 Effect of High Bile Salt Concentration

4.2 conversion of RPM of the feed pump into feed rate.

4.3 Model fitting

4.3.1 Moisture content (MC)

4.1.2 Survivability rate (SR)

4.1.3 Bulk density (BD):

4.1.4 Acidity (A_(p)):

4.1.5 Firmness (F):

4.1.6 Consistency (Con.):

4.1.7 Work of shear (WS):

4.1.8 Cohesiveness (Coh.):

4.1.9 Syneresis (SY):

4.4 Optimization**4.5 Process variables****4.6 Responses****4.5 Rehydration**

5	SUMMARY & CONCLUSION	63-65
6	BIBLIOGRAPHY	66-73
7	Appendix	

LIST OF TABLES

Sl. No.	Title	Page no.
1	Nutrition values of yoghurt	15
2	Combinations of encapsulating materials	23
3	Size of selected beds	33
4	Depolymerization	34
5	Heat treatment.	35
6	Effect of low pH	37
7	Effect of bile salt	39
8	CCRD table	46
9	Moisture content (ANOVA)	47
10	Moisture content	47
11	Surviability rate(ANOVA)	49
12	Surviability rate	49
13	Bulk density (ANOVA)	51
14	Bulk density	51
15	Acidity(ANOVA)	53
16	Acidity	53
17	Firmness(ANOVA)	55
18	Firmness	55
19	Consistency (ANOVA)	57
20	Consistency	57
21	Work of shear (ANOVA)	59
22	Work of shear	59
23	Cohesiveness (ANOVA)	61
24	Cohesiveness	61
25	Syneresis(ANOVA)	63
26	Syneresis	63
27	color	65
28	Optimized process variables	65
29	Optimized responses	66
30	Rehydration	66
31	Final product properties	67

LIST OF ABBREVIATION

1	ST	<i>Streptococcus thermophilus</i>
2	LB	<i>Lactobacillus bulgaricus</i>
3	SCFA	Short chain fatty acids
4	RSM	response surface methodology
5	GRAS	Generally Recognized as Safe
6	CFU	Colony forming unit
7	GOS	galacto-oligosaccharides
8	DRM	Digestive resistant maltodextrin
9	EPS	Microbial exopolysaccharides
10	LSD	Laboratory spray dryer
11	ANOVA	Analysis of variance
12	NCDC	National Collection of Dairy Cultures
13	SNF	Solid not fat
14	CLR	Corrected Lactometer Reading
15	A1	Sodium alginate
16	A2	Sodium alginate
17	A3	Sodium alginate
18	AC1	Sodium alginate + corn starch
19	AC2	Sodium alginate+ corn starch
10	AC3	Sodium alginate+ corn starch
11	AC4	Sodium alginate+ corn starch
12	AG1	Sodium alginate+ gaur gum
13	AG2	Sodium alginate+ gaur gum
14	AG3	Sodium alginate+ gaur gum
15	AG4	Sodium alginate+ gaur gum
16	AM1	Sodium alginate+maltodextrin (DRM)
17	AM2	Sodium alginate+maltodextrin (DRM)
18	AM3	Sodium alginate+maltodextrin (DRM)
19	AM4	Sodium alginate+maltodextrin (DRM)
20	CCRD	central composite rotatable design
21	BD	Bulk density
22	MC	Moisture content
23	SR	survival ratio
24	TA	titratable acidity

LIST OF FIGURE

Sl. No.	Content	Page no.
1	Flow diagram of encapsulation by emulsion & extrusion	12
2	Spray drying encapsulation	13
3	General Manufacturing Procedure of yoghurt	16
4	Spray drying of yoghurt	19
5	Flow chart of encapsulation	24
6	Preparation of sweetened yoghurt	26
7	Depolymerization of selected beads	34
8	Heat treatment to all the combinations of encapsulation	36
9	Heat treatment for selected combinations of encapsulation	36
10	Effect of low pH to all the combinations of encapsulation.	38
11	Effect of low pH to selected combinations of encapsulation	38
12	Effect of bile salt to all the combinations of encapsulation	40
13	Effect of bile salt to selected combinations of encapsulation	40
14	AC3 [Alginate+corn starch (2:1)]	41
15	A3 [Alginate 3%]	41
16	A2 [alginate 2%]	41
17	AM3[alginate and maltodextrin (2:1)]	41
18	AC4 [alginate and corn starch (3:1)]	42
19	AM4 [alginate and maltodextrin (3:1)]	42
20	Collected beads in CaCl_2	42
21	stored beads	42
22	conversion of RPM to feed rate	43
23	Incubation of yoghurt	44
24	free probiotic containing yoghurt powder	44
25	Encapsulated beads contain yoghurt	44
26	Encapsulated beads contain powder	44
27	final product (AC3)	44
28	final product (AM4)	44
29	MC (AB plot)	48
30	MC (BC plot)	48
31	Survivability rate (AB plot)	50
32	Survivability rate (AB plot)	50
33	Bulk density (AB plot)	52
34	Bulk density (AC plot)	52
35	Acidity (AB plot)	56

36	Acidity (AB plot)	56
37	Firmness (AB plot)	58
38	Firmness (AC plot)	58
39	Consistency (AB plot)	60
40	Consistency (AC plot)	60
41	Work of shear (AB plot)	62
42	Work of shear (AB plot)	62
43	Cohesiveness (AB plot)	64
44	Cohesiveness (AC plot)	64
45	Syneresis (AB plot)	66
46	Syneresis (BC plot)	66
47	Texture of 1:1 reconstituted powder of yoghurt	67