LIST OF FIGURES

Figure	Caption	Page No
1.1	Cross section of kinnow	2
1.2	Kinnow peels	3
1.3	Structure of naringin	4
1.4	Structure of pectin	5
3.1	Calibration curve for naringin determination	24
3.2	Calibration curve for pectin determination	26
3.3	Naringin extraction process flow chart	28
3.4	Pectin extraction process	29
3.5	Setup for conditioning of resin	31
3.6	Set up for kinetic studies	34
3.7	Set up for column studies	36
3.8	Set up for simple distillation	38
4.1	Macroporous/macroreticular resin particle (schematic)	44
4.2	Concentration profile through a macroreticular resin bead	56
	(physical picture envisaged)	
5.1	Comparison of various adsorption isotherms with experimental data for	66
	adsorption of naringin on resin PA-500 from fresh KPBW for the year	
	2012 (system 1)	
5.2	Adsorption equilibrium studies with fresh KPBW on resin PA-500 (system	67
	1) in different years	
5.3	Effect of temperature on adsorption of naringin from fresh KPBW on PA-	68
	500 (system 1)	
5.4	The Van't Hoff plot of $ln(K_{a/d})$ versus 1/T for the resin PA-500 (system 1)	69
5.5	Adsorption of naringin on adsorbent PA-500 from fresh KPBW: kinetic	71
	studies, for reproducibility test (system 1)	
5.6	Kinetic studies for adsorption of naringin on the resin PA-500 from fresh	72
	KPBW for the year 2012, C_t vs t (system 1)	
5.7	Kinetic studies for adsorption of naringin on the resin PA-500 from fresh	73
	KPBW for the year 2013, C_t vs t (system 1)	

5.8	Kinetic studies for adsorption of naringin on the resin PA-500 from fresh	
	KPBW for the year 2014, C_t vs t (system 1)	74
5.9	Lagergren plot $\ln(q_e - q_t)$ vs time (t) for adsorption of naringin from fresh	75
	KPBW on resin PA-500 (year 2012) (system 1)	
5.10	Pseudo second order plot t/q vs time (t) for adsorption of naringin from	76
	fresh KPBW on resin PA-500 (year 2012)	
5.11	Bangham's plot for adsorption of naringin from fresh KPBW on resin PA-	77
	500 (year 2012)	
5.12	Elovich model plot for adsorption of naringin from fresh KPBW on resin	78
	PA-500 (year 2012)	
5.13	Weber's kinetic diffusion model plot for adsorption of naringin from fresh	79
	KPBW on resin PA-500 (year 2012)	
5.14	Boyd's Diffusivity model plot for adsorption of naringin fromfresh KPBW	80
	on resin PA-500 (year 2012)	
5.15	Adsorption of naringin on adsorbent PA-500 from fresh KPBW: Kinetic	82
	Studies, $F_n(t)$ vs $t(system 1)$	
5.16	Adsorption of naringin on adsorbent PA-500 from fresh KPBW: kinetic	87
	studies, correlation of experimental data, C_t vs t (system 1, year 2012)	
5.17	Adsorption of naringin on adsorbent PA-500 from fresh KPBW: kinetic	88
	studies, correlation of experimental data, C_t vs t (system 1, year 2013)	
5.18	Adsorption of naringin on adsorbent PA-500 from fresh KPBW: kinetic	89
	studies, correlation of experimental data, C_t vs t (system 1, year 2014)	
5.19	Comparison of naringin adsorption kinetic studies on the resin PA-500	91
	from fresh KPBW with year (system 1), C_t vs t	
5.20	Adsorption of naringin on adsorbent PA-500 from fresh KPBW (column	94
	studies): Effect of flow rate (system 1)	
5.21	Adsorption of naringin on adsorbent PA-500 from fresh KPBW (column	95
	studies): Effect of height (system 1)	
5.22	Adsorption of naringin on adsorbent PA-500 from fresh KPBW: fixed bed	97
	column study (system 1)	
5.23	Desoption equilibrium studies from naringin saturated resin PA-500 to	99
	ethanol solution (system 1)	

5.24	Desorption kinetic studies with naringin saturated resin PA-500 in ethanol:	102
	correlation of experimental data C_{td} vs t (system 1, year 2012)	
5.25	Desorption kinetic studies with naringin saturated resin PA-500 in ethanol:	103
	correlation of experimental data C_{td} vs t (system 1, year 2013)	
5.26	Desorption kinetic studies with naringin saturated resin PA-500 in ethanol:	104
	correlation of experimental data C_{td} vs t (system 1, year 2013)	
5.27	Boyd's plot for desorption of naringin from adsorbed resin PA-500 to	105
	ethanol solution (system 1)	
5.28	Comparison of desorption kinetic studies of naringin saturated resin PA-	107
	500 in ethanol with year (system 1), C_{td} vs t	
5.29	Column desorption studies from naringin saturated resin PA-500 into	109
	ethanol, C_{td} vs t (system 1)	
5.30	Photograph of Naringin sample	110
5.31	Photograph of Pectin sample	111
5.32	Adsorption equilibrium studies with fresh KPBW on resin PA-800 in	113
	different years (system 2)	
5.33	Effect of temperature on adsorption of naringin from fresh KPBW on PA-	114
	800 (system 2)	
5.34	The Van't Hoff plot of $ln(K_{a/d})$ versus $1/T$ for the resin PA-800 (system 2)	115
5.35	Adsorption of naringin on adsorbent PA-800 from fresh KPBW: kinetic	118
	studies, correlation of experimental data, C_t vs t (system 2, year 2012)	
5.36	Adsorption of naringin on adsorbent PA-800 from fresh KPBW: kinetic	119
	studies, correlation of experimental data, C_t vs t (system 2, year 2013)	
5.37	Adsorption of naringin on adsorbent PA-800 from fresh KPBW: kinetic	120
	studies, correlation of experimental data, C_t vs t (system 2, year 2014)	
5.38	Comparison of naringin adsorption kinetic studies on the resin PA-800	122
	from fresh KPBW with year (system 2), C_t vs t	
5.39	Adsorption of naringin on adsorbent PA-800 from fresh KPBW: fixed bed	123
	column study (system 2)	
5.40	Desoption equilibrium studies from naringin saturated resin PA-800 to	125
	ethanol solution (system 2)	

5.41	Desorption kinetic studies with naringin saturated resin PA-800 in ethanol:	127
	correlation of experimental data C_{td} vs t (system 2, year 2012)	
5.42	Desorption kinetic studies with naringin saturated resin PA-800 in ethanol:	128
	correlation of experimental data C_{td} vs t (system 2, year 2013)	
5.43	Desorption kinetic studies with naringin saturated resin PA-800 in ethanol:	129
	correlation of experimental data C_{td} vs t (system 2, year 2013)	
5.44	Comparison of desorption kinetic studies of naringin saturated resin PA-	131
	800 in ethanol with year (system 2), C_{td} vs t	
5.45	Column desorption studies from naringin saturated resin PA-800 into	133
	ethanol, C_{td} vs t (system 2)	
5.46	Adsorption equilibrium studies with dropped KPBW on resin PA-500 in two years (system 3)	136
5.47	Adsorption of naringin on adsorbent PA-500 from dropped KPBW: kinetic	138
	studies, correlation of experimental data, C_t vs t (system 3, year 2012)	
5.48	Adsorption of naringin on adsorbent PA-500 from dropped KPBW: kinetic	139
	studies, correlation of experimental data, C_t vs t (system 3, year 2013)	
5.49	Comparison of naringin adsorption kinetic studies on the resin PA-500	141
	from dropped KPBW with year (system 3), C_t vs t	
5.50	Adsorption of naringin on adsorbent PA-500 from dropped KPBW: fixed bed column study (system 3)	143
5.51	Desoption equilibrium studies from naringin saturated resin PA-500 to ethanol solution (system 3)	145
5.52	Desorption kinetic studies with naringin saturated resin PA-500 in ethanol:	147
	correlation of experimental data C_{td} vs t (system 3, year 2012)	
5.53	Desorption kinetic studies with naringin saturated resin PA-500 in ethanol:	148
	correlation of experimental data C_{td} vs t (system 3, year 2013)	
5.54	Comparison of desorption kinetic studies of naringin saturated resin PA-	150
	500 in ethanol with year (system 3), C_{td} vs t	
5.55	Column desorption studies from naringin saturated resin PA-500 into	152
	ethanol, C_{id} vs t (system 3)	

5.56	Adsorption equilibrium studies with dropped KPBW on resin PA-800 in	155
	two years (system 4)	
5.57	Adsorption of naringin on adsorbent PA-800 from dropped KPBW: kinetic	157
	studies, correlation of experimental data, C_t vs t (system 4, year 2012)	
5.58	Adsorption of naringin on adsorbent PA-800 from dropped KPBW: kinetic	158
	studies, correlation of experimental data, C_t vs t (system 4, year 2013)	
5.59	Comparison of naringin adsorption kinetic studies on the resin PA-800	160
	from dropped KPBW with year (system 4), C_t vs t	
5.60	Adsorption of naringin on adsorbent PA-500 from dropped KPBW: fixed	162
	bed column study (system 4)	
5.61	Desoption equilibrium studies from naringin saturated resin PA-800 to	164
	ethanol solution (system 4)	
5.62	Desorption kinetic studies with naringin saturated resin PA-800 in ethanol:	166
	correlation of experimental data C_{td} vs t (system 4, year 2012)	
5.63	Desorption kinetic studies with naringin saturated resin PA-800 in ethanol:	167
	correlation of experimental data C_{td} vs t (system 4, year 2013)	
5.64	Comparison of desorption kinetic studies of naringin saturated resin PA-	169
	800 in ethanol with year (system 4), C_{td} vs t	
5.65	Column desorption studies from naringin saturated resin PA-800 into	170
	ethanol, C_{td} vs t (system 4)	
5.66	Adsorption equilibrium studies with dry KPBW on resin PA-500 in two years (system 5)	173
5.67	Adsorption of naringin on adsorbent PA-500 from dry KPBW: kinetic	175
	studies, correlation of experimental data, C_t vs t (system 5, year 2012)	
5.68	Adsorption of naringin on adsorbent PA-500 from dry KPBW: kinetic	176
	studies, correlation of experimental data, C_t vs t (system 5, year 2013)	
5.69	Comparison of naringin adsorption kinetic studies on the resin PA-500	178
	from dry KPBW with year (system 5), C_t vs t	
5.70	Adsorption of naringin on adsorbent PA-500 from dry KPBW: fixed bed column study (system 5)	180

5.71	Desoption equilibrium studies from naringin saturated resin PA-500 to ethanol solution (system5)	182
5.72	Desorption kinetic studies with naringin saturated resin PA-500 in ethanol:	184
	correlation of experimental data C_{td} vs t (system 5, year 2012)	
5.73	Desorption kinetic studies with naringin saturated resin PA-500 in ethanol:	185
	correlation of experimental data C_{td} vs t (system 5, year 2013)	
5.74	Comparison of desorption kinetic studies of naringin saturated resin PA-	187
	500 in ethanol with year (system 5), C_{td} vs t	
5.75	Column desorption studies from naringin saturated resin PA-500 into	188
	ethanol, C_{td} vs t (system5)	
5.76	Adsorption equilibrium studies with dry KPBW on resin PA-800 in two	191
	years (system 6)	
5.77	Adsorption of naringin on adsorbent PA-800 from dry KPBW: kinetic	193
	studies, correlation of experimental data, C_t vs t (system 6, year 2012)	
5.78	Adsorption of naringin on adsorbent PA-800 from dry KPBW: kinetic	194
	studies, correlation of experimental data, C_t vs t (system 6, year 2013)	
5.79	Comparison of naringin adsorption kinetic studies on the resin PA-800	196
	from dry KPBW with year (system 6), C_t vs t	
5.80	Adsorption of naringin on adsorbent PA-800 from dry KPBW: fixed bed	197
	column study (system 6)	
5.81	Desoption equilibrium studies from naringin saturated resin PA-800 to	199
	ethanol solution (system 6)	
5.82	Desorption kinetic studies with naringin saturated resin PA-800 in ethanol:	201
	correlation of experimental data C_{td} vs t (system 6, year 2012)	
5.83	Desorption kinetic studies with naringin saturated resin PA-800 in ethanol:	202
	correlation of experimental data C_{td} vs t (system 6, year 2013)	
5.84	Comparison of desorption kinetic studies of naringin saturated resin PA-	204
	800 in ethanol with year (system 6), C_{td} vs t	
5.85	Column desorption studies from naringin saturated resin PA-800 into	205
	ethanol, C_{td} vs t (system 6)	

5.86	Adsorption equilibrium studies with fresh KPBW on regenerated resin PA-	207
	500 (system 7)	
5.87	Adsorption of naringin on regenerated resin PA-500 from fresh KPBW:	209
	kinetic studies, correlation of experimental data, C_t vs t (system 7)	
5.88	Adsorption of naringin on regenerated resin PA-500 from fresh KPBW:	211
	fixed bed column study (system 7)	
5.89	Desoption equilibrium studies from naringin saturated resin (regenerated)	212
	PA-500 to ethanol solution (system 7)	
5.90	Desorption kinetic studies with naringin saturated resin (regenerated)PA-	214
	500 in ethanol: correlation of experimental data C_{td} vs t (system 7)	
5.91	Column desorption studies from naringin saturated resin (regenerated) PA-	216
	500 into ethanol, C_{td} vs t (system 7)	
5.92	Adsorption equilibrium studies with fresh KPBW on regenerated resin PA-	217
	800 (system 8)	
5.93	Adsorption of naringin on regenerated resin PA-800 from fresh KPBW:	219
	kinetic studies, correlation of experimental data, C_t vs t (system 8)	
5.94	Adsorption of naringin on regenerated resin PA-800 from fresh KPBW:	221
	fixed bed column study (system 8)	
5.95	Desoption equilibrium studies from naringin saturated resin (regenerated)	222
	PA-800 to ethanol solution (system 8)	
5.96	Desorption kinetic studies with naringin saturated resin (regenerated)PA-	224
	800 in ethanol: correlation of experimental data C_{td} vs t (system 8)	
5.97	Column desorption studies from naringin saturated resin (regenerated) PA-	226
	800 into ethanol, C_{td} vs t (system 8)	
5.98	Adsorption of naringin on resin PA-500 and regenerated resin PA-500	228
	from fresh KPBW: a comparison of equilibrium data of system 1 with 7	
5.99	Adsorption of naringin on resin PA-800 and regenerated resin PA-800	229
	from fresh KPBW: a comparison of equilibrium data of system 2 with 8	
5.100	Adsorption of naringin on resin PA-500from fresh, dropped and dry	230
	KPBW: a comparison of equilibrium data of systems 1, 3, and 5	
5.101	Adsorption of naringin on resin PA-800from fresh, dropped and dry	231
	KPBW: a comparison of equilibrium data of systems 2, 4, and 6	

5.102	Adsorption of naringin on resins PA-500 and PA-800 from fresh KPBW: a	233
	comparison of equilibrium data of system 1 with 2	
5.103	Adsorption of naringin on resins PA-500 and PA-800 from dropped	234
	KPBW: a comparison of equilibrium data of system 3 with 4	
5.104	Adsorption of naringin on resins PA-500 and PA-800 from dry KPBW: a	235
	comparison of equilibrium data of system 5 with 6	
5.105	Adsorption of naringin on resin PA-500 and regenerated resin PA-500	237
	from fresh KPBW: a comparison of kinetic data of system 1 with 7	
5.106	Adsorption of naringin on resin PA-800 and regenerated resin PA-500	238
	from fresh KPBW: a comparison of kinetic data of system 2 with 8	
5.107	Adsorption of naringin on resin PA-500 from fresh, dropped and dry	239
	KPBW: a comparison of kinetic data, C_t vs. t of systems 1, 3, and 5	
5.108	Adsorption of naringin on resin PA-800 from fresh, dropped and dry	240
	KPBW: a comparison of kinetic data, C_t vs. t of systems 2, 4, and 6	
5.109	Adsorption of naringin on resins PA-500 and PA-800 from fresh KPBW: a	242
	comparison of kinetic data, C_t vs. t of system 1 with 2	
5.110	Adsorption of naringin on resins PA-500 and PA-800 from dropped	243
	KPBW: a comparison of kinetic data, C_t vs. t of system 3 with 4	
5.111	Adsorption of naringin on resins PA-500 and PA-800 from dry KPBW: a	244
	comparison of kinetic data, C_t vs. t of system 5 with 6	
5.112	Adsorption of naringin on resin PA-500 from fresh, dropped and dry	245
	KPBW: a comparison of fixed bed column study of systems 1, 3, and 5	
5.113	Adsorption of naringin on resin PA-800 from fresh, dropped and dry	246
	KPBW: a comparison of fixed bed column study of systems 2, 4, and 6	
5.114	Adsorption of naringin on resins PA-500 and PA-800 from fresh KPBW: a	248
	comparison of fixed bed column study of system 1 with 2	
5.115	Adsorption of naringin on resins PA-500 and PA-800 from dropped	249
	KPBW: a comparison of fixed bed column study of system 3 with 4	
5.116	Adsorption of naringin on resins PA-500 and PA-800 from dry KPBW: a	250
	comparison of fixed bed column study of system 5 with 6	

5.117	Desorption of naringin from naringin saturated resin PA-500 to ethanol: a	251
	comparison of equilibrium data (fresh, dropped and dry peels) of systems	
	1, 3, and 5	
5.118	Desorption of naringin from naringin saturated resin PA-800 to ethanol: a	252
	comparison of equilibrium data (fresh, dropped and dry peels) of systems	
	2, 4, and 6	
5.119	Desorption of naringin from naringin saturated resin PA-500 and PA-800	254
	to ethanol: a comparison of equilibrium data (fresh peels) of system 1 with	
	2	
5.120	Desorption of naringin from naringin saturated resin PA-500 and PA-800	255
	to ethanol: a comparison of equilibrium data (dropped peels) of system 3	
	with 4	
5.121	Desorption of naringin from naringin saturated resin PA-500 and PA-800	256
	to ethanol: a comparison of equilibrium data (dry peels) of system 5 with 6	
5.122	Desorption of naringin from naringin saturated resin PA-500 to ethanol: a	257
	comparison of kinetic data (fresh, dropped and dry peels), C_{td} vs. t of	
	systems 1, 3, and 5	
5.123	Desorption of naringin from naringin saturated resin PA-800 to ethanol: a	258
	comparison of kinetic data (fresh, dropped and dry peels), C_{td} vs. t of	
	systems 2, 4, and 6	
5.124	Desorption of naringin from naringin saturated resin PA-500 and PA-800	260
	to ethanol: a comparison of kinetic data (fresh peels), C_{td} vs. t of system 1	
	with 2	
5.125	Desorption of naringin from naringin saturated resin PA-500 and PA-800	261
	to ethanol: a comparison of kinetic data (dropped peels), C_{td} vs. t of	
	system 3 with 4	
5.126	Desorption of naringin from naringin saturated resin PA-500 and PA-800	262
	to ethanol: a comparison of kinetic data (dry peels), C_{td} vs. t of system 5	
	with 6	
5 127		264
5.127	Desorption of naringin from naringin saturated resin PA-500 to ethanol: a	∠04
	comparison of column data (fresh, dropped and dry peels) of systems 1, 3, and 5	
	and J	

5.128	Desorption of naringin from naringin saturated resin PA-800 to ethanol: a	265
	comparison of column data (fresh, dropped and dry peels) of systems 2, 4,	
	and 6	
5.129	Desorption of naringin from naringin saturated resin PA-500 and PA-800	266
	to ethanol: a comparison of column data (fresh peels) of system 1 with 2	
5.130	Desorption of naringin from naringin saturated resin PA-500 and PA-800	267
	to ethanol: a comparison of column data (dropped peels) of system 3 with	
	4	
5.131	Desorption of naringin from naringin saturated resin PA-500 and PA-800	268
	to ethanol: a comparison of column data (dry peels) of system 5 with 6	
5.132	FTIR analysis of Naringin	270