Table 1. Final concentration of ammonium sulphate p

		Final concentration																			
INITIAL CONCENTRATION		5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100 %
	0%	27	55	84	113	144	176	208	252	277	314	351	390	430	472	516	561	608	657	708	76
	5%		27	56	85	115	146	179	212	246	282	319	357	397	439	481	526	572	621	671	72
	10%			28	57	86	117	149	182	216	251	287	325	364	405	447	491	537	584	634	68
	15%				28	58	88	119	151	185	219	255	292	331	371	413	456	501	548	596	64
	20%					29	59	89	121	154	188	223	260	298	337	378	421	465	511	559	60
	25%						29	60	91	123	157	191	227	265	304	344	386	429	475	522	57
	30%							30	61	92	126	160	195	232	270	309	351	393	438	485	53
	35%								30	62	94	128	163	199	236	275	316	358	402	447	49
	40%									31	63	96	130	166	202	241	281	322	365	410	45
	45%										31	64	97	132	169	206	245	286	329	373	41
	50%											32	65	99	135	172	210	250	292	335	38
	55%												33	66	101	138	175	215	256	298	34
	60%													33	67	103	140	179	219	261	30
	65%														34	69	105	143	183	224	26
	70%															34	70	107	146	186	22
	75%																35	72	110	149	19
	80%																	36	73	112	15
	85%																		37	75	11
	90%																			37	76
	100%																				38

Table 2. Screening of bacteria/psychrotrophic bacteria for lipase, protease and amylase production

S.No.	Isolate no.	Enzyme production at 5ºC			Enzyme production at 28ºC		
		Lipase	Amylase	Protease	Lipase	Amylase	Protease
1.	CR1	+ve	-ve	-ve	+ve	-ve	-ve
2.	CR2	+ve	-ve	-ve	-ve	-ve	-ve
3.	CR3	-ve	-ve	-ve	+ve	+ve	+ve
4.	CR4	-ve	-ve	-ve	-ve	+ve	+ve
5.	CR 5	-ve	-ve	-ve	-ve	+ve	+ve
6.	CR 6	-ve	-ve	-ve	-ve	+ve	+ve
7.	CR 7	-ve	-ve	-ve	+ve	-ve	-ve
8.	CR 8	-ve	-ve	-ve	-ve	+ve	-ve
9.	CR 9	+ve	-ve	-ve	+ve	-ve	-ve
10.	CR 10	+ve	-ve	-ve	+ve	-ve	-ve
11.	CR 11	-ve	-ve	-ve	-ve	-ve	-ve
12.	CR 12	-ve	-ve	-ve	-ve	-ve	-ve
13.	CR 13	-ve	-ve	-ve	-ve	-ve	+ve
14.	CR 14	+ve	-ve	-ve	+ve	-ve	+ve
15.	CR 15	-ve	-ve	-ve	-ve	-ve	-ve
16.	CR 16	+ve	-ve	-ve	+ve	-ve	-ve
17.	CR17	-ve	-ve	-ve	-ve	+ve	-ve
18.	CRPB1	-ve	-ve	-ve	-ve	-ve	+ve
19.	CRPB2	-ve	-ve	-ve	-ve	-ve	-ve
20.	CRPB3	-ve	-ve	-ve	-ve	+ve	+ve
21.	CRPB4	-ve	-ve	-ve	+ve	+ve	-ve
22.	CRPB5	+ve	-ve	-ve	+ve	+ve	-ve
23.	CRPB6	-ve	-ve	-ve	+ve	+ve	+ve
24.	CRPB7	-ve	-ve	-ve	+ve	+ve	+ve

25.	*CRPB8*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*
26.	*CRPB9*	*-ve*	*-ve*	*-ve*	*-ve*	*+ve*	*+ve*
27.	*CRPB10*	*-ve*	*-ve*	*-ve*	*-ve*	*+ve*	*+ve*
28.	*CRPB11*	*-ve*	*-ve*	*-ve*	*+ve*	*-ve*	*+ve*
29.	*CRPB12*	*-ve*	*-ve*	*-ve*	*-ve*	*+ve*	*+ve*
30.	*CRPB13*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*
31.	*CRPB14*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*	*+ve*
32.	*CRPB15*	*-ve*	*-ve*	*-ve*	*-ve*	*+ve*	*+ve*
33.	*CRPB16*	*+ve*	*-ve*	*-ve*	*+ve*	*-ve*	*-ve*
34.	*CRPB17*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*
35.	*CRPB18*	*+ve*	*-ve*	*-ve*	*+ve*	*+ve*	*+ve*
36.	*CRPB19*	*+ve*	*-ve*	*-ve*	*-ve*	*-ve*	*+ve*
37.	*CRPB20*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*	*+ve*
38.	*CRPB21*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*	*+ve*
39.	*CRPB22*	*-ve*	*-ve*	*-ve*	*+ve*	*-ve*	*-ve*
40.	*CRPB23*	*-ve*	*-ve*	*-ve*	*+ve*	*-ve*	*-ve*
41.	*CRPB24*	*-ve*	*-ve*	*-ve*	*-ve*	*+ve*	*-ve*
42.	*CRPB25*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*
43.	*CRPB26*	*+ve*	*-ve*	*-ve*	*+ve*	*-ve*	*-ve*
44.	*RW1*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*
45.	*RW2*	*-ve*	*-ve*	*-ve*	*+ve*	*+ve*	*+ve*
46.	*RW3*	*-ve*	*-ve*	*-ve*	*+ve*	*+ve*	*+ve*
47.	*RW4*	*-ve*	*-ve*	*-ve*	*+ve*	*+ve*	*+ve*
48.	*RW5*	*-ve*	*-ve*	*-ve*	*-ve*	*+ve*	*+ve*
49.	*RW 6*	*-ve*	*-ve*	*-ve*	*+ve*	*-ve*	*+ve*
50.	*RW 7*	*-ve*	*-ve*	*-ve*	*+ve*	*+ve*	*+ve*
51.	*RW 8*	*+ve*	*-ve*	*-ve*	*+ve*	*+ve*	*+ve*
52.	*RW 9*	*-ve*	*-ve*	*-ve*	*-ve*	*+ve*	*+ve*
53.	*RW10*	*-ve*	*-ve*	*-ve*	*-ve*	*+ve*	*+ve*
54.	*RW11*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*	*+ve*

55.	*RW12*	*+ve*	*-ve*	*-ve*	*+ve*	*-ve*	*+ve*
56.	*RW13*	*+ve*	*-ve*	*-ve*	*+ve*	*-ve*	*-ve*
57.	*RW14*	*-ve*	*-ve*	*-ve*	*-ve*	*+ve*	*-ve*
58.	*RW15*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*
59.	*RW16*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*
60.	*RW17*	*-ve*	*-ve*	*-ve*	*+ve*	*-ve*	*-ve*
61.	*RW18*	*+ve*	*-ve*	*-ve*	*+ve*	*-ve*	*-ve*
62.	*RWPB1*	*-ve*	*-ve*	*-ve*	*-ve*	*+ve*	*+ve*
63.	*RWPB2*	*-ve*	*-ve*	*-ve*	*-ve*	*+ve*	*+ve*
64.	*RWPB3*	*-ve*	*-ve*	*-ve*	*+ve*	*-ve*	*-ve*
65.	*RWPB4*	*+ve*	*-ve*	*-ve*	*+ve*	*-ve*	*-ve*
66.	*RWPB5*	*-ve*	*-ve*	*-ve*	*+ve*	*+ve*	*+ve*
67.	*RWPB6*	*-ve*	*-ve*	*-ve*	*+ve*	*-ve*	*+ve*
68.	*RWPB7*	*-ve*	*-ve*	*-ve*	*+ve*	*-ve*	*-ve*
69.	*RWPB8*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*	*+ve*
70.	*RWPB9*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*	*+ve*
71.	*RWPB10*	*-ve*	*-ve*	*-ve*	*+ve*	*-ve*	*-ve*
72.	*RWPB11*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*
73.	*RWPB12*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*
74.	*RWPB13*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*
75.	*RWPB14*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*	*-ve*

ercentage saturation at 0 ^{o}C.

Table 3. Biochemical tests of selected isolates

Sr. No:	Cultures	Gram staining	Motility	Growth on MacConkey	Catalase	Oxidase Test	O/F test
1	CRPB16	+ve	+ ve	- ve	+ ve	+ ve	- ve
2	CR14	+ ve	+ ve	- ve	+ ve	+ ve	- ve
3	CRPB11	+ ve	+ ve	- ve	+ ve	+ ve	- ve
4	CR9	- ve	+ ve	- ve	+ ve	+ ve	- ve
5	RWPB4	- ve	- ve	+ ve	+ ve	+ ve	O
6	CRPB5	- ve	- ve	+ ve	+ ve	+ ve	- ve
7	CRPB18	+ ve	+ ve	- ve	+ ve	+ ve	- ve
8	KTPB10	- ve	+ ve	+ ve	+ ve	+ ve	- ve
9	PVPB3	+ ve	+ ve	- ve	+ ve	+ ve	- ve
10	SPB6	+ ve	+ ve	- ve	+ ve	- ve	- ve
11	SPB7	+ ve	+ ve	- ve	+ ve	- ve	- ve
12	CR1	+ ve	+ ve	- ve	+ ve	+ ve	- ve
14	CR16	- ve	- ve	- ve	- ve	- ve	O
14	CRPB26	+ ve	+ ve	- ve	+ ve	- ve	- ve
15	CR6	+ ve	+ ve	- ve	+ ve	+ ve	- ve
16	CR5	+ ve	+ ve	- ve	+ ve	+ ve	- ve
17	CR17	- ve	+ ve	+ ve	+ ve	+ ve	- ve
18	RWPB5	+ ve	- ve	- ve	- ve	+ ve	- ve
19	PVPB4	+ ve	- ve	- ve	- ve	+ ve	- ve
20	RW18	+ ve	- ve	- ve	- ve	+ ve	O

Table 4. Effect of pH on growth and lipase production of various isolates

S.No:	Samples	Time (h)	pH7	pH8	pH9	pH10
1.	CRPB16	24	0.6	0.9	0.7	1.0
		48	0.6	1.1	1.1	1.2
		72	0.6	1.2	1.3	1.6
2.	CR14	24	0.3	0.5	0.3	0.6
		48	0.4	1.0	0.7	0.9
		72	0.6	1.3	0.8	1.2
3.	CRPB11	24	0.1	0.1	0.1	-
		48	0.1	0.2	0.2	0.7
		72	0.2	0.2	1.2	1.2
4.	CR9	24	0.5	1.2	0.8	1.1
		48	1.0	1.6	1.4	1.7
		72	1.4	2.0	1.6	2.3
5.	RWPB4	24	0.9	1.1	1.0	1.2
		48	0.9	1.4	1.3	1.9
		72	1.1	1.6	1.7	2.2
6.	CRPB5	24	0.5	0.9	1.2	1.2
		48	1.4	1.5	1.6	1.7
		72	1.5	1.7	2.0	2.0
7.	CRPB18	24	0.5	0.8	0.8	-
		48	0.6	1.0	0.9	1.0
		72	0.6	1.2	1.1	1.5
8.	KTPB10	24	1.0	1.3	1.1	1.4
		48	1.0	1.7	1.5	2.0
		72	1.3	1.8	1.8	2.7

9.	PVPB3	24	0.6	-	-	-
		48	0.9	1.3	1.1	1.3
		72	0.9	1.7	1.5	2.0
10.	SPB6	24	0.6	0.7	1.1	1.2
		48	0.9	0.9	1.3	1.7
		72	0.9	1.1	1.6	2.1
11.	SPB7	24	0.7	0.8	0.9	1.1
		48	0.9	1.2	1.2	1.7
		72	0.9	1.3	1.5	2.0
12.	CR1	24	0.8	1.2	1.0	1.3
		48	1.0	1.6	1.4	2.0
		72	1.3	1.9	1.8	2.4
13.	CR16	24	1.0	1.0	1.1	-
		48	1.0	1.5	1.8	-
		72	1.1	2.0	2.1	-
14.	CRPB26	24	0.4	0.2	0.8	-
		48	0.5	0.2	1.0	-
		72	0.6	0.3	1.0	-
15.	CR6	24	0.3	0.1	-	-
		48	0.4	0.2	-	-
		72	0.4	0.2	-	-
16.	CR5	24	ND	ND	ND	ND
		48	ND	ND	ND	ND
		72	ND	ND	ND	ND
17.	CR17	24	ND	ND	ND	ND
		48	ND	ND	ND	ND
		72	ND	ND	ND	ND

18.	RWPB5	24	ND	ND	ND	ND
		48	ND	ND	ND	ND
		72	ND	ND	ND	ND
19.	PVPB4	24	ND	ND	ND	ND
		48	ND	ND	ND	ND
		72	ND	ND	ND	ND
20.	RW18	24	ND	ND	ND	ND
		48	ND	ND	ND	ND
		72	ND	ND	ND	ND

Table 5. Microbial characteristics of strain CR9

Tests	***Results***
Colony morphology	
Configuration	*L form*
Margin	*Entire*
Elevation	*Raised*
Surface	*Rough*
Density	*Opaque*
Pigments	*Orange*
Gram' reaction	*−ve*
Shape	*Rods*
Size	*Moderate*
Arrangement	*Single*
Motility	*+*
Fluorescence	*-*
Growth at temperature(^{0} C)	

5	*+*
10	*+*
20	*+*
30	*+*
37	*–*
Growth at pH	
8.0	*+*
9.0	*+*
10.0	*+*
10.5	*-*
11.0	*-*
Growth on NaCl	
2.5	*-*
5.0	*-*
7.5	*–*
Tween Hydrolysis	
Tween 20	*-*
Tween 80	*+*
Biochemical tests	
Growth on MacConkey agar	*- ve*
Indole test	*ND*
Methyl red test	*ND*
Voges proskauer test	*ND*
Citrate utilization	*+ ve*
Starch hydrolysis	*– ve*
Casein hydrolysis	*– ve*
Urea hydrolysis	*ND*
Lipid hydrolysis	*ND*
Oxidase	*+ ve*
Catalase	*+ ve*

Oxidation/fermentation (O/F)	*- ve*
Gelatin liquefaction	*- ve*
Acid production from carbohydrates	
Lactose	*+ve*
Xylose	*+ve*
Maltose	*+ve*
Fructose	*+ve*
Dextrose	*+ve*
Galactose	*+ve*
Raffinose	*+ve*
Trehalose	*+ve*
Melibiose	*+ve*
Sucrose	*+ve*
L-arabinose	*+ve*
Mannose	*+ve*
Inulin	*-ve*
Sodium gluconate	*+ve*
Glycerol	*-ve*
Salicin	*+ve*
Glucosamine	*+ve*
Dulcitol	*-ve*
Inositol	*+ve*
Sorbitol	*+ve*
Mannitol	*+ve*
Adonitol	*+ve*
α-Methyl-D-glucoside	*+ve*
Ribose	*+ve*
Rhamnose	*+ve*
Melezitose	*+ve*
Cellobiose	*+ve*

α-Methyl-D-mannoside	*+ve*
Xylitol	*+ve*
ONPG	*-ve*
Esculin	*-ve*
D-arabinose	*+ve*
Citrate	*+ve*
Malonate	*+ve*
Sorbose	*+ve*