สำนักงานวิทยทรัพยากร จุฬาลงกรณ์มหาวิทยาลัย

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APPENDICES

APPENDIX A

Instruments and chemical reagents

1. Instruments

- Analytical balance: Mettler Toledo model AG204, Switzerland.
- Autoclave: Tomy model SS-325, Japan.
- Centrifuges: Beckman model Avanti J25, U.S.A; Eppendorf model 5430, Germany; Sorvall model RC-5C Plus and Sorvall tabletop centrifuge model RC-5C Plus, USA.
- Circulating Water Bath: Techre model TE8 A, UK.
- Freeze Dryer: Savant model Super Modulya 233, USA.
- Freezer : Sharp model FC27 (-20°C), Japan and Deep Freezer : REVCO model ULT1790-7-V12 (-80°C), USA.
- Hot plate and stirrer: Thermolyne model Crimarec2, USA.
- Incubator: Memmert model BE500(30°C, 37°C, 45°C, 50°C, and 55°C), Germany.
- Incubator shaker: New Brunswick Scientific model innova4300, U.S.A
- Magnetic stirrer: Ika model RO-10, Malaysia.
- Microwave: Sanyo model EM-815FW, Japan.
- Oven: Memmert UE 600, Germany.
- pH Meter: Mettler Toledo model CH-8603, Switzerland.
- Pipetteman: Gilson, Villiers-Le-Bel, France.
- Precision balance: Mettler Toledo model PB3002, Switzerland.
- Shaking Water Bath: Memmert, model WB22, Germany.
- Spectrophotometer: Sherwood Scientific model259, Cambridge, UK.
- Vortex mixer: Barnstead/Thermolyne model M37610-26, Iowa, USA.

2. Chemicals

Chemicals	**Company**	**Grade**
Acetone	Merck	Analytical
L-arginine monohydrochloride	Fluka	Analytical
Bovine serum albumin	Sigma	Analytical
Chloroform	Mallinckrodt	Analytical
Copper (II) sulfate pentahydrate	Sigma	Analytical
Ethanol	Carlo Erba	Analytical
Ethylene diamine tetraacetic acid (EDTA)	Merck	Analytical
Ferric sulfate sevenhydrate	Carlo Erba	Analytical
Folin-Ciocalteu's phenol	Merck	Analytical
Hydrochloric acid	Merck	Analytical
Magnesium sulfate heptahydrate	Sigma	Analytical
Methanol	Merck	Analytical
Phenol	Carlo Erba	Analytical
Potassium hydrogen sulfate	Merck	Analytical
Di-potassium tartate	Carlo Erba	Analytical
Sodium chloride	Carlo Erba	Analytical
Tri-sodium citrate dihydrate	Merck	Analytical
Sodium dodecyl sulfate	Fluka	Analytical
Sodium hydroxide	Merck	Analytical
Sodium potassium tartate	Merck	Analytical
Trichloroacetic acid	Merck	Analytical
Trisma base	Merck	Analytical
Tyrosine	Sigma	Analytical
Carboxymethyl cellulose (CMC)	Merck	Analytical
Cellulose powder	Merck	Analytical
Magnesium sulfate	Sigma	Analytical

Potassium chloride	Merck	Analytical
Di-Ammonium sulfate	Merck	Analytical
Ferric citrate	Merck	Analytical

APPENDIX B

Culture Media

All media were dispensed and steriled in autoclave at 120° C, 15 pounds/inch pressure for 15 min except the medium for acid from carbon sources testing which were sterilized at 110° C, 10 pounds/inch pressure for 10 min.

1. C medium

Polypeptone	5	g
Yeast extract	1	g
K_2HPO_4	4	g
$MgSO_4.7H_2O$	1	g
KCl	0.2	g
$FeSO_4.7H_2O$	0.02	g
Agar	15	g
Distilled water	1000	ml

Dissolve and adjust to pH 7.0

2. Cellulose powder (CP) medium

Cellulose powder	1	g
Peptone	5	g
Yeast extract	1	g
K_2HPO_4	4	g
$MgSO_4.7H_2O$	1	g
KCl	0.2	g
$FeSO_4.7H_2O$	0.02	g
Agar	15	g
Distilled water	1000	ml

Dissolve and adjust pH to 7.0

3. Carboxymethyl cellulose (CMC) medium

CMC (Carboxymethyl cellulose)	1	g
Peptone	5	g
Yeast extract	1	g
K_2HPO_4	4	g
$MgSO_4.7H_2O$	1	g
KCl	0.2	g
$FeSO_4.7H_2O$	0.02	g
Agar	15	g
Distilled water	1000	ml

Dissolve and adjust pH to 7.0

4. Carboxymethyl cellulose (CMC-basal) medium

$(NH_4)_2SO_4$	1	g
CMC	5	g
Yeast extract	1	g
Agar	10	g
Distilled water	1000	ml

5. L-arginine agar medium

Phenol red, 1.0% aq.solution	1.0	ml
L(+)arginine monohydrochloride	10.0	g
Agar	3.0	g
C medium	1000	ml

Dissolve the solids in the C medium, adjust to pH to 7.2

6. Aesculin broth

Aesculin	1	g
Ferric citrate	0.5	g
C medium	1000	ml

Dissolve the aesculin and iron salt in the C medium, adjust pH to 7.4 and sterilized at 110 °C for 10 min.

7. Casein agar

Skim milk	10	g
C medium	1000	ml
Agar	15	g

Dissolve and adjust pH to 7.2.

8. Gelatin agar

Gelatin	10	g
C medium	1000	ml
Agar	15	g

Dissolve and adjust pH to 7.2.

9. Motility test medium

Motility medium (Difco)	20	g
Distilled water	1000	ml

Dissolve and adjust pH to 7.2

10. Simmon Citrate agar

Simon citrate agar (Difco)	24.2	g
Distilled water	1000	ml

Dissolve and adjust pH to 6.8

11. Starch agar

Starch	10	g
C medium	1000	ml
Agar	15	g

Dissolve and adjust pH to 7.2.

12. Triple sugar iron agar

Triple sugar iron agar (Difco)	60	g
Distilled water	1000	ml

Dissolve and adjust pH to 7.4.

13. Tyrosine agar

Tyrosine	50	g
C medium	1000	ml
Agar	15	g

Dissolve and adjust pH to 7.2.

14. Deoxyribonuclease (DNase) media

DNase test agar (Difco)	42	g
Distilled water	1000	ml

Adjust pH to 7.3 and heat to boiling to dissolve completely

15. Indole test

Tryptone	10	g
Meat extract	3	g
Distilled water	1000	ml

Dissolve and adjusted pH to 7.4

16. Nitrate broth

Meat extract	3	g
Peptone	10	g
KNO_3	1	g
Distilled water	1000	ml

Dissolve and adjusted pH to 7.2

17. Tween 80 agar medium

Tween 80	2	ml
C medium	1000	ml
Agar	15	g

Dissolve and adjusted pH to 7.2

18. Urea agar medium

Urea	20	g
C medium	1000	ml
Agar	15	g

Dissolve and adjusted pH to 7.2

19. MR-VP broth

MR-VP medium (Merck)	17	g
Distilled water	1000	ml

Dissolve and adjusted to pH 6.9

APPENDIXC

Reagents and Buffers

1. Reducing sugar

Standards of 0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.7, 0.8, 0.9 and 1.0 mg/ml were prepared from glucose. The reactions were carried out with the same procedure as described by Somogyi and Nelson method (1952)

2. Flagella staining

Basic fuchisin	0.5	g
Tannic acid	0.2	g
Aluminium sulfate	0.5	g

Solvent was composed of a mixture of 2.0 of 95% ethanol, 0.5 ml of glucerol, and 7.5 ml of tris(hydroxymethyl)aminomethane(tris)buffer.

3. Kovacs'reagent

ρ-dimethylaminobenzaldehyde	5	g
Amyl alcohol	75	g
Conc. HCl	25	ml

Dissolve the aldehyde in the alcohol by gently warming in a water bath (about 50-55 °C). Cool and the acid with care. Protect from light and store at 4 ^{0}C.

4. Nitrate test reagent

Solution A

0.33% sulphanilic acid in 5 N- acetic acid

Dissolve by gentle heating

Solution B

0.6% dimethyl-α-napthylaminein 5 N-acetic acid

Dissolve by gentle heating in a fume hood.

Add two drops of sulphanilic acid solution and three drops of *N,N*-dimethyl-l-naphthylamine into peptone nitrate broth inoculing with thetest microorganisms.

5. 6 N HCl

Conc. HCl	60	ml
Distiller water	60	ml

Add conc. HCl into the distilled water

6. 2 N H_2SO_4

Conc. H_2SO_4	2	ml
Distiller water	34	ml

Add conc. HCl into the distilled water

7. Ninhydrin solution

Ninhydrin	0.3	g
1-Butanol	100	ml
Glacial acetic acid	3	ml

8. Phenol : Chloroform (1:1 v/v)

Crystalline phenol was liquidified in water bath at 65^0 C and mixed with chloroform in the ratio of 1:1 (v/v). The solution was stored in a light tight bottle.

9. 0.5M EDTA (pH 8.0)

800 ml of distilled water, 186.1 g of disodium ethylenediaminetetraacetate.$2H_2O$ was added and stirred vigorously on a magnetic stirrer. The pH was adjusted to 8.0 with NaOH (20 g of NaOH pellets). The volume was adjusted to 1 litre. The solution was dispensed into aliquots and sterilized by autoclaving for 15 minutes at 15 lb/in^2.

10. 2xPBS

8 mM Na_2HPO_4

1.5 mM KH_2PO_4

137 mM NaCl

2.7 mM KCl

The 2xPBS was adjusted the pH to 7.0 with 1N NaOH or 1N HCL. The solution was sterilized by autoclaving for 15 minutes at 15 lb/in^2.

11. 10 mg/ml Salmon sperm DNA

A 10 mg of Salmon sperm DNA was dissolved in 1 ml of 10 mM TE buffer pH 7.6. Boiling for 10 minutes, immediately cooling in ice and sonication for 3 minutes.

12. 3 M Sodium acetate pH 5.2

To 800 ml of distilled water, 408.1 g of sodium acetate was added and adjusted the pH to 5.2 with glacial acetic acid. The volume was adjusted to 1 litre. The solution was sterilized by autoclaving for 15 minutes at 15 lb/in^2.

13. 10% Sodium dodecyl sulphate (SDS)

The stock solution of 10% SDS was prepared by dissolved 10 g of sodium dodecyl sulphate in 100 ml sterilized distilled water. Streilization is not required for the preparation of this stock solution.

14. 20xSSC

3 M NaCl

0.1 M Tri-sodiumcitrate

The 20xSSC was adjusted the pH to 7.0 with 1N NaOH. The solution was sterilized by autoclaving for 15 minutes at 15 lb/in^2.

15. 1 M Tris-HCl pH 8.0

The 1M Tris was prepared by dissolving 121.1 g of Tris base in 800 ml of distilled water. The pH was adjusted to the desired value by adding conc. HCL (pH 8.0, 42 ml of HCl). The solution was cooled to room temperature before making final adjustment to the desired pH. The volume of the solution was adjusted to 1 litter with with distilled water and sterilized by autoclaving.

16. RNase A solution

RNase A	20 mg
0.15 M NaCl	10 ml

Dissolve 20 mg of RNase A in 10 ml 0.15 M NaCl and heat at 95° C for 5-10 minutes. Keep RNase A solution in -20°C.

17. RNase T_1 solution

RNase T_1	80	µl
0.1 M Tris-HCl (pH 7.5)	10	ml

Mix 80 µl of RNase T_1 in 10 ml of 0.1 M Tris-HCl (pH 7.5) and heat at 95°C for 5 minutes. Keep RNase T_1 solution in -20°C.

18. Proteinase K

Proteinase K (Sigma)	4	mg
50 mM Tris-HCl (pH 7.5)	1	ml

Use freshly prepared solution.

19. Nuclease P_1 solution

Nuclease P1	0.1	mg
40 mM CH_3COONa+12 mM $ZnSO_4$ (pH5.3)	1	ml

Store at 4°C.

20. Alkaline phosphatase solution

Alkaline phosphatase	2.4	units
0.1 M Tris-HCl (pH 8.1)	1	ml

21. 0.1 M Tris-HCl buffer, pH 9

Tris	1.21 mg
Distilled water	100 ml

Adjust the pH to 9 with HCl.

22. TE buffer

10 mM Tris HCl (pH 8.0)

1 m M Na_2-EDTA (pH 8.0)

23. TE buffer + RNase A

TE buffer	960 ml
RNase A (2 mg/ml)	100 μl

24. Saline-Na_2 EDTA

0.1 M NaCl

50 mM EDTA.2Na (pH 8.0)

25. Reagents and buffers for DNA-DNA hybridization

25.1 Prehybridization solution

100xDenhardt solution	5 ml
10 mg/ml Salmon sperm DNA	1 ml
20xSSC	10 ml

Formamide	50
ml	
Distilled water	34 ml

25.2 Hybridization solution

Prehybridization solution	100 ml
Dextran sulfate	5 g

25.3 Solution I

Bovine serum albumin (Fraction V)	0.25 g
Titron X-100	50 µl
PBS	50 ml

25.4 Solution II

Streptavidin-POD	1 µl
Solution I	4 ml

25.5 Solution III

3,3',5,5'-Tetramethylbenzidine (TMB)	100 µl
(10 mg/ml in DMFO)	
0.3% H_2O_2	100 µl
0.4 M Citric acid + o.2 M Na_2HPO_4 buffer	100 µl

pH 6.2 in 10% DMFO

25.6 2 M H_2SO_4

H_2SO_4	22 ml
Distilled water	178 ml

The solution was sterilized by autoclaving.

26. Fehling's solution

Coppersulfate	34.64 g
Sodiumpotassiumtartate	173 g
Sodiumhydroxide	50 g

Solvent was composed of a mixture 500 ml of coppersulfate and 500 ml of mixture sodiumtatare and sodiumhydroxide.

APPENDIX D

Physiological and biochemical characteristics of isolates

Primers, 16S rDNA nucleotide sequences and DNA G+C contents

Physiological and biochemical characteristics of isolates

Isolate no.	Growth In (%NaCl)		Growth at pH				Growth at °C							Catalase test	Oxidase test	Anaerobic growth	Methyl red	Voges-Proskauer	DNAase	Urease	Indole production	Citrate	TSI	Nitrate reduction	Asculin	L-arginine	Dihydroxyacetone	Hydrolysis				
	3	5	5	6	8	9	10	15	20	45	50	55	60															Casein	Gelatin	Strach	L-Tyrosine	Tween 80
P5-5	-	-	+	+	+	-	-	-	+	+	+	-	-	+	+	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
P6-5	-	-	+	+	+	-	-	-	+	+	+	-	-	+	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
P1-4	+	+	+	+	+	+	-	+	+	+	-	-	-	+	+	+	-	+	-	+	-	+	+	+	+	+	-	-	-	-	-	-
P1-9	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	-	-	+	-	+	-	+	+	-	+	+	-	+	+	+	-	-
P2-1	+	+	+	+	+	-	-	-	+	+	+	+	-	+	+	+	-	+	-	+	-	+	+	-	+	+	-	+	+	-	-	-
P3-2	+	+	+	+	+	+	-	-	+	+	+	-	-	+	+	-	-	+	-	+	-	-	+	+	+	+	-	+	+	+	-	-
P5-7	+	+	+	+	+	+	-	-	+	+	+	+	-	+	+	-	-	+	-	+	-	-	+	-	+	+	-	+	-	-	-	-
P5-8	+	+	+	+	+	+	-	-	+	+	+	+	-	+	+	-	-	+	-	+	-	+	+	-	+	+	-	+	+	+	-	-
P6-6	+	+	+	+	+	+	-	-	+	+	+	+	-	+	+	-	-	-	+	+	-	+	+	+	+	+	-	+	+	+	-	-
S8-1	+	+	+	+	+	+	-	-	-	+	+	-	-	+	+	+	-	+	-	+	-	-	-	+	+	+	-	-	+	-	-	-
S10-2	+	+	+	+	+	+	-	-	+	+	+	+	-	+	+	-	-	-	-	+	-	-	-	-	+	+	-	-	+	-	-	-

Physiological and biochemical characteristics of isolates (Cont)

Isolate no.	Growth In (%NaCl)		Growth at pH				Growth at °C							Catalase test	Oxidase test	Anaerobic growth	Methyl red	Voges-Proskauer	DNAase	Urease	indole production	Citrate	TSI	Nitrate reduction	Asculin	L-arginine	Dihydroxyacetone	Hydrolysis				
	3	5	5	6	8	9	10	15	20	45	50	55	60															Casein	Gelatin	Strach	L-Tyrosine	Tween 80
P1-2	+	+	+	+	+	+	-	-	+	+	+	-	-	+	+	-	-	+	+	+	-	-	+	-	+	+	-	+	+	+	+	+
P1-3	+	+	+	+	+	+	-	+	+	+	+	-	-	+	+	-	-	+	+	+	-	-	+	+	+	+	-	+	+	+	+	-
P2-2	+	+	+	+	+	+	-	-	+	+	+	-	-	+	+	+	-	+	+	+	-	-	+	+	+	+	-	+	+	+	-	-
P6-2	+	+	+	+	+	+	-	-	+	+	+	-	-	+	+	+	-	+	+	+	-	-	+	+	+	+	-	+	+	+	-	-
P6-3	+	+	+	+	+	+	-	-	+	+	+	-	-	+	+	-	-	+	+	+	-	+	+	+	+	+	-	+	+	+	-	-
P7-4	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	+	-	+	+	+	-	+	+	-	+	+	-	+	+	+	-	-
P7-5	+	+	+	+	+	+	-	-	+	+	+	-	-	+	+	-	-	+	+	+	-	-	+	+	+	+	-	+	+	+	-	-
P7-6	+	+	+	+	+	+	-	-	+	+	+	-	-	+	+	-	-	+	+	+	-	+	+	+	+	+	-	+	+	+	-	-
P7-7	+	+	+	+	+	+	-	-	+	+	+	-	-	+	+	-	-	+	+	+	-	-	+	+	+	+	-	+	+	+	-	-
S8-4	+	+	+	+	+	+	-	-	+	+	-	-	-	+	+	-	-	+	-	+	-	-	+	+	+	+	-	-	-	-	-	-
S10-4	+	+	+	+	+	+	-	-	+	+	-	-	-	+	+	-	-	-	-	+	-	-	+	+	+	+	-	-	-	-	-	-

Physiological and biochemical characteristics of isolates (Cont)

Isolate no.	Growth In (%NaCl)		Growth at pH				Growth at °C							Catalase test	Oxidase test	Anaerobic growth	Methyl red	Voges-Proskauer	DNAase	Urease	Indole production	Citrate	TSI	Nitrate reduction	Asculin	L-arginine	Dihydroxyacetone	Hydrolysis				
	3	5	5	6	8	9	10	15	20	45	50	55	60															Casein	Gelatin	Strach	L-Tyrosine	Tween 80
P1-7	+	+	+	+	+	+	-	-	+	+	+	+	-	+	+	-	-	+	+	+	-	+	+	-	+	+	-	+	+	+	-	-
P1-11	+	+	+	+	+	+	-	-	+	+	+	+	-	+	+	+	-	+	+	+	-	+	+	-	+	+	-	+	+	+	-	-
P2-3	+	+	+	+	+	+	-	-	+	+	+	-	-	+	+	-	-	-	+	+	-	-	+	+	+	+	-	+	+	+	-	-
P4-6	+	+	+	+	+	+	-	-	+	+	+	-	-	+	+	+	-	+	+	+	-	-	+	+	+	+	-	+	+	+	-	-
P4-7	+	+	+	+	+	+	-	-	+	+	+	-	-	+	+	-	-	+	+	+	-	-	+	+	+	+	-	+	+	+	-	-
P4-11	+	+	+	+	+	+	-	-	+	+	+	-	-	+	+	-	-	+	+	+	-	-	+	+	+	+	-	+	+	+	-	-
P5-3	+	+	+	+	+	+	-	-	+	+	+	+	-	+	+	-	-	+	+	+	-	+	+	+	+	+	-	+	+	+	-	-
P5-6	+	+	+	+	+	+	-	-	+	+	+	+	-	+	+	+	-	-	+	+	-	+	+	+	+	+	-	+	+	+	-	-
P6-4	+	+	+	+	+	+	-	-	+	+	+	-	-	+	+	-	-	-	+	+	-	-	+	+	+	+	-	+	+	+	-	-
P6-9	+	+	+	+	+	+	-	-	+	+	+	-	-	+	+	-		-	+	+	-	-	+	+	+	+	-	+	+	+	-	-
P6-10	+	+	+	+	+	+	-	-	+	+	+	+	-	+	+	-	-	+	+	+	-	-	+	+	+	+	-	+	+	+	-	-

Physiological and biochemical characteristics of isolates (Cont)

Isolate no.	Growth In (%NaCl)		Growth at pH				Growth at °C							Catalase test	Oxidase test	Anaerobic growth	Methyl red	Voges-Proskauer	DNAase	Urease	Indole production	Citrate	TSI	Nitrate reduction	Asculin	L-arginine	Dihydroxyacetone	Hydrolysis				
	3	5	5	6	8	9	10	15	20	45	50	55	60															Casein	Gelatin	Strach	L-Tyrosine	Tween 80
P7-2	+	+	+	+	+	+	-	-	+	+	+	+	-	+	+	-	-	-	-	+	-	+	+	-	+	+	-	+	+	+	-	-
S10-3	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	-	-	+	-	+	-	+	+	-	+	+	-	+	+	+	-	-
P1-1	+	-	+	+	+	+	-	+	+	+	-	-	-	+	+	+	+	+	-	+	-	-	+	-	+	+	-	+	+	+	-	-
P4-1	+	-	+	+	+	+	-	+	+	+	-	-	-	+	+	+	+	+	-	+	-	-	+	-	+	+	-	+	+	+	-	-
P4-3	+	-	+	+	+	+	-	+	+	+	-	-	-	+	+	+	+	+	-	+	-	-	+	-	+	+	-	+	+	+	-	-
P4-4	+	+	+	+	+	+	-	+	+	+	-	-	-	+	+	+	+	+	-	+	-	-	+	-	+	+	-	+	+	+	-	-
P4-5	+	+	+	+	+	+	-	+	+	+	-	-	-	+	+	+	+	+	-	+	-	-	+	-	+	+	-	+	+	+	-	-
P4-9	+	+	+	+	+	+	-	+	+	+	-	-	-	+	+	+	+	-	-	+	-	-	+	-	+	+	-	+	-	+	-	-
P4-10	+	+	+	+	+	+	-	+	+	+	-	-	-	+	+	+	+	-	-	+	-	-	+	-	+	+	-	+	-	+	-	-
P5-1	+	+	+	+	+	+	-	+	+	+	-	-	-	+	+	+	+	-	-	+	-	-	+	-	+	+	-	+	+	+	-	-
S8-3	+	+	+	+	+	+	-	+	+	+	-	-	-	+	+	+	+	-	-	+	-	-	+	-	+	+	-	+	+	+	-	-

Physiological and biochemical characteristics of isolates (Cont)

Isolate no.	Growth In (%NaCl)		Growth at pH				Growth at °C							Catalase test	Oxidase test	Anaerobic growth	Methyl red	Voges-Proskauer	DNAase	Urease	Indole production	Citrate	TSI	Nitrate reduction	Asculin	L-arginine	Dihydroxyacetone	Hydrolysis				
	3	5	5	6	8	9	10	15	20	45	50	55	60															Casein	Gelatin	Strach	L-Tyrosine	Tween 80
S9-2	-	-	+	+	+	+	-	-	+	+	+	+	-	+	+	-	+	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-
S10-1	+	+	+	+	+	+	-	+	+	+	-	-	-	+	+	+	+	-	-	+	-	-	+	-	+	+	-	+	+	+	-	-
S11-1	+	+	+	+	+	+	-	+	+	+	-	-	-	+	+	+	+	-	-	+	-	-	-	-	+	+	-	+	-	+	-	-
P1-6	-	-	+	+	+	+	-	+	+	+	+	+	-	+	+	+	W	-	-	+	-	+	+	-	+	+	-	+	+	+	-	-
P1-8	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	+	-	-	-	+	-	+	+	-	+	+	-	+	+	+	-	-
P1-10	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	+	-	-	-	+	-	+	+	-	+	+	-	+	+	+	-	-
P1-12	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	-	-	-	-	+	-	+	+	-	+	+	-	+	+	+	-	-
P2-4	+	+	+	+	+	+	-	-	+	+	+	+	-	+	+	-	-	W	-	+	-	+	+	-	+	+	-	+	+	+	-	-
P2-5	+	+	+	+	+	+	-	-	+	+	+	+	+	+	+	-	-	W	-	+	-	+	+	-	+	+	-	+	+	+	-	-
P3-1	+	+	+	+	+	+	-	+	+	+	+	-	-	+	+	+	-	+	+	+	-	+	+	+	+	+	-	+	+	+	-	-
P3-4	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	-	-	-	-	+	-	+	+	+	+	+	-	+	+	+	-	-

Physiological and biochemical characteristics of isolates (Cont)

Isolate no.	Growth In (%NaCl)		Growth at pH				Growth at °C							Catalase test	Oxidase test	Anaerobic growth	Methyl red	Voges-Proskauer	DNAase	Urease	Indole production	Citrate	TSI	Nitrate reduction	Asculin	L-arginine	Dihydroxyacetone	Hydrolysis				
	3	5	5	6	8	9	10	15	20	45	50	55	60															Casein	Gelatin	Strach	L-Tyrosine	Tween 80
P3-5	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	-	-	+	+	+	-	+	+	-	+	+	-	+	+	+	-	+
P4-2	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	-	-	-	-	+	-	-	+	W	+	W	-	[illegible]	+	+	-	+
P4-12	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	-	-	+	-	+	-	+	+	-	+	+	-	+	+	+	-	-
P4-13	+	+	+	+	+	+	-	-	+	+	+	+	-	+	+	-	-	+	-	+	-	+	+	-	+	+	-	+	+	+	-	-
P5-4	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	-	-	-	+	+	-	+	+	-	+	+	-	+	+	+	-	-
P5-9	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	+	-	+	+	+	-	+	+	-	+	+	-	+	+	+	-	-
P5-10	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	-	-	+	-	+	-	-	+	-	+	+	-	+	+	+	-	-
P5-11	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	+	-	-	-	+	-	+	+	-	+	+	-	+	+	+	-	-
P5-12	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	+	-	-	-	+	-	+	+	-	+	+	-	+	+	+	-	-
P5-13	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	-	-	+	-	+	-	+	+	-	+	+	-	+	+	+	-	-
P5-14	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	+	-	+	-	+	-	+	+	-	+	+	-	+	+	+	-	-

Physiological and biochemical characteristics of isolates (Cont)

Isolate no.	Growth In (%NaCl)		Growth at pH				Growth at °C							Catalase test	Oxidase test	Anaerobic growth	Methyl red	Voges-Proskauer	DNAase	Urease	Indole production	Citrate	TSI	Nitrate reduction	Asculin	L-arginine	Dihydroxyacetone	Hydrolysis				
	3	5	5	6	8	9	10	15	20	45	50	55	60															Casein	Gelatin	Strach	L-Tyrosine	Tween 80
P6-1	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	-	-	-	+	+	-	+	+	+	+	+	-	+	+	+	-	-
P6-8	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	-	-	-	+	+	-	+	+	-	+	+	-	+	+	+	-	-
S8-2	+	+	+	+	+	+	-	-	+	+	-	-	-	+	+	+	+	+	+	+	-	-	+	-	+	+	-	+	+	+	-	-
P3-3	+	+	+	+	+	+	-	+	+	+	+	-	-	+	+	-	-	-	+	+	-	+	+	+	+	+	-	+	+	+	-	+
P4-8	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	+	-	+	+	+	-	+	+	+	+	+	-	+	+	+	-	-
P5-2	+	+	+	+	+	+	-	+	+	+	+	-	-	+	+	-	-	+	+	+	-	+	+	+	+	+	-	+	+	+	-	
P7-1	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	-	-	+	+	+	-	+	-	+	+	+	-	+	+	+	-	-
P7-3	+	+	+	+	+	+	-	-	+	+	+	+	-	+	+	+	-	+	+	+	-	+	+	+	+	+	-	+	+	+	-	+
P1-5	+	+	+	+	+	+	-	-	+	+	+	-	-	+	+	+	-	+	+	+	-	-	+	+	+	-	-	+	+	+	-	-
P6-7	+	+	+	+	+	+	-	+	+	+	+	-	-	+	+	+	+	+	-	+	-	-	+	+	+	+	-	+	+	+	-	-

Acid from carbohydrates

Isolate no.	D-Amygdalin	L-Arabinose	D-Cellubiose	D-Fructose	D-Galactose	D-Glucose	Gluconate	Glycerol	Inositol	Inulin	Lactose	D-Maltose	D-Mannitol	D-Mannose	D-Melibiose	D-Melezitose	α - Methyl - D - gluside	Raffinose	L-Rhamnose	D-Ribose	Salicin	D-Sorbitol	L-Sorbose	Sucrose	D-Trehalose	D-Xylose
P5-5	+	-	-	+	-	+	-	-	-	-	+	+	-	+	-	-	-	-	-	-	-	-	-	+	W	+
P6-5	+	-	-	+	-	+	-	-	-	-	+	+	-	+	-	-	-	-	-	W	-	-	-	+	-	-
P1-4	+	-	+	-	-	-	-	+	+	-	+	-	-	-	-	-	+	+	+	+	+	-	-	+	+	-
P1-9	+	+	+	+	-	+	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	+	+	-
P2-1	+	+	+	+	+	+	-	-	W	W	+	+	-	+	+	-	-	W	-	-	+	-	-	+	+	+
P3-2	+	+	+	+	+	+	-	-	-	+	-	-	-	+	-	-	-	+	-	-	-	-	-	+	+	+
P5-7	-	+	+	+	+	+	-	-	-	+	+	+	-	+	+	-	-	-	-	-	-	-	-	+	+	+
P5-8	+	+	+	+	+	+	-	-	-	-	+	+	-	+	+	-	-	+	-	-	+	W	-	+	+	+
P6-6	+	+	+	+	+	+	-	-	-	+	+	+	-	+	-	-	-	+	-	-	+	-	-	+	+	+
S8-1	+	+	+	+	+	+	-	-	-	+	+	+	-	+	+	-	-	-	-	-	+	-	-	+	+	+
S10-2	+	+	+	+	+	+	-	-	-	+	+	+	-	+	+	-	-	-	-	-	+	-	-	+	+	+

Acid from carbohydrates (Cont)

Isolate no.	D-Amygdalin	L-Arabinose	D-Cellubiose	D-Fructose	D-Galactose	D-Glucose	Gluconate	Glycerol	Inositol	Inulin	Lactose	D-Maltose	D-Mannitol	D-Mannose	D-Melibiose	D-Melezitose	α – Methyl – D – gluside	Raffinose	L-Rhamnose	D-Ribose	Salicin	D-Sorbitol	L-Sorbose	Sucrose	D-Trehalose	D-Xylose
P1-2	-	-	+	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	+
P1-3	-	-	+	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	+	-	+	+
P2-2	-	-	+	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-		-	-
P6-2	-	-	+	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	-	+	-	+	+
P6-3	-	-	+	+	-	+	-	-	-	-	-	+	-	+	-	-	W	-	-	-	-	-	-	+	-	-
P7-4	-	-	+	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	-
P7-5	-	-	+	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	-
P7-6	-	-	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+		-
P7-7	-	-	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	+	+	-
S8-4	-	+	+	-	+	+	-	-	-	+	+	+	-	+	+	-	-	-	-	-	+	-	+	-	+	+
S10-4	W	+	+	+	+	+	-	-	-	+	+	+	-	+	+	-	-	-	-	-	+	-	-	+	+	+

Acid from carbohydrates (Cont)

Isolate no.	D-Amygdalin	L-Arabinose	D-Cellubiose	D-Fructose	D-Galactose	D-Glucose	Gluconate	Glycerol	Inositol	Inulin	Lactose	D-Maltose	D-Mannitol	D-Mannose	D-Melibiose	D-Melezitose	α – Methyl – D – gluside	Raffinose	L-Rhamnose	D-Ribose	Salicin	D-Sorbitol	L-Sorbose	Sucrose	D-Trehalose	D-Xylose
P1-7	-	-	-	+	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-
P1-11	-	-	-	+	-	+	-	-	-		-	+	-	-	-	-	-	-	-	-	-	-	-	+	+	-
P2-3	-	-	+	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	+	-
P4-6	-	-	+	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	-	-
P4-7	-	-	+	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	+	-	-
P4-11	-	-	+	+	-	+	-	-	-	-	-	+	W	+	-	-	-	-	-	-	+	-	-	-	-	-
P5-3	-	-	+	+	-	+	-	-	-	-	-	+	W	+	-	-	-	-	-	-	+	-	-	-	-	-
P5-6	-	-	-	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	-
P6-4	-	-	+	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-
P6-9	-	-	+	+	-	+	-	-	-	-	-	+	+	+	+	-	+	+	-	-	+	-	-	-	-	-
P6-10	-	-	-	+	-	+	-	-	-		-	+	+	+	+	+	+	+	-	-	+	+	-	-	-	-

Acid from carbohydrates (Cont)

Isolate no.	D-Amygdalin	L-Arabinose	D-Cellubiose	D-Fructose	D-Galactose	D-Glucose	Gluconate	Glycerol	Inositol	Inulin	Lactose	D-Maltose	D-Mannitol	D-Mannose	D-Melibiose	D-Melezitose	α – Methyl – D – gluside	Raffinose	L-Rhamnose	D-iRibose	Salicin	D-Sorbitol	L-Sorbose	Sucrose	D-Trehalose	D-Xylose
P7-2	-	-	+	+	-	+	-	-	-	-	-	+	+	+	-	-	-	-	-	-	+	-	-	-	-	-
S10-3	-	-	+	+	-	+	-	-	-	-	-	+	W	+	-	-	-	-	-	-	+	-	-	+	+	-
P1-1	+	-	+	+	-	+	-	+	-	-	-	+	-	+	-	-	-	-	-	+	+	-	-	+	+	-
P4-1	+	-	-	+	-	+	-	+	-	-	-	+	-	+	-	-	-	-	-	+	+	-	-	+	-	-
P4-3	+	-	+	+	-	+	+	+	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	-
P4-4	+	-	+	+	-	+	+	+	-	-	-	+	-	+	-	-	-	-	-	+	+	-	-	+	+	-
P4-5	+	-	+	+	-	+	-	+	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	-	-	-
P4-9	+	-	+	+	-	+	+	+	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	-	-
P4-10	+	-	+	+	-	+	+	+	-	W	-	+	-	+	-	-	-	-	-	-	+	-	-	+	-	-
P5-1	+	-	+	+	-	+	-	+	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	-	-	-
S8-3	+	-	+	+	-	+	-	+	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	-	-

Acid from carbohydrates (Cont)

Isolate no.	D-Amygdalin	L-Arabinose	D-Cellubiose	D-Fructose	D-Galactose	D-Glucose	Gluconate	Glycerol	Inositol	Inulin	Lactose	D-Maltose	D-Mannitol	D-Mannose	D-Melibiose	D-Melezitose	α - Methyl – D – gluside	Raffinose	L-Rhamnose	D-Ribose	Salicin	D-Sorbitol	L-Sorbose	Sucrose	D-Trehalose	D-Xylose
S9-2	-	-	-	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	-
S10-1	-	-	-	+	-	+	+	-	-	-	-	+	-	-	-	-	-	-	-	+	+	-	-	+	+	-
S11-1	-	-	-	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	+	+	-	-	+	+	W
P1-6	-	-	+	+	-	+	-	-	-	-	-	+	+	+	-	-	-	-	-		+	-	-	+	+	-
P1-8	-	-	+	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	-
P1-10	-	-	-	+	-	+	-	-	-	+	-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	-
P1-12	-	-	-	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	+	+	-
P2-4	-	-	-	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	-
P2-5	-	-	-	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	-
P3-1	-	-	-	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	-
P3-4	-	-	-	+	-	+	-	-	-		-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	+

Acid from carbohydrates(Cont)

Isolate no.	D-Amygdalin	L-Arabinose	D-Cellubiose	D-Fructose	D-Galactose	D-Glucose	Gluconate	Glycerol	Inositol	Inulin	Lactose	D-Maltose	D-Mannitol	D-Mannose	D-Melibiose	D-Melezitose	α – Methyl – D – gluside	Raffinose	L-Rhamnose	D-Ribose	Salicin	D-Sorbitol	L-Sorbose	Sucrose	D-Trehalose	D-Xylose
P3-5	-	-	+	+	-	+	-	-	-	-	-	+	-	-		-	-	-	-	-	+	-	-	+	+	-
P4-2	-	-	-	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	-
P4-12	-	-	+	+	-	+	-	-	-		-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	-
P4-13	-	-	+	+	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	+	-
P5-4	-	-	+	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	-
P5-9	-	-	+	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	-
P5-10	-	-	-	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	+	+	-
P5-11	-	-	-	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	+	+	-
P5-12	-	-	-	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	-
P5-13	-	-	-	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	+	+	-
P5-14	-	-	+	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	-

Acid from carbohydrates (Cont)

Isolate no.	D-Amygdalin	L-Arabinose	D-Cellubiose	D-Fructose	D-Galactose	D-Glucose	Gluconate	Glycerol	Inositol	Inulin	Lactose	D-Maltose	D-Mannitol	D-Mannose	D-Melibiose	D-Melezitose	α – Methyl – D – gluside	Raffinose	L-Rhamnose	D-Ribose	Salicin	D-Sorbitol	L-Sorbose	Sucrose	D-Trehalose	D-Xylose
P6-1	-	-	+	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	-
P6-8	-	-	+	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	-
S8-2	-	-	-	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	-
P3-3	-	-	-	+	-	+	-	-	-	+	-	+	-	-	-	-	-	-	-	-	+	-	-	+	+	-
P4-8	-	-	-	+	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	-	-	+	-	-
P5-2	-	-	-	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	-
P7-1	-	-	-	+	-	+	-	+	-	-	-	+	-	+	+	-	-	-	-	-	+	-	-	+	+	-
P7-3	-	-	-	-	-	+	-	+	-	-	-	+	-	-	+	-	-	-	-	-	+	-	-	+	+	-
P1-5	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	-
P6-7	-	-	-	+	-	+	-	W	W	-	-	+	-	+	-	-	-	-	-	-	+	W	-	+	-	-
KCTC 3135^T	-	-	-	+	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	+	-	-	+	+	-
KCTC 3998^T	+	+	+	+	+	+	-	-	-	+	+	+	-	+	+	-	-	+	-	-	+	-	-	+	+	+

1. Primers for 16S rDNA amplification and sequencing

9F	5'-GAGTTTGATCCTGGCTCAG-3'
1541R	5'-AAGGAGGTGATCCAGCC-3'
357R	5'-CTGCTGCCTCCCGTAG-3'
802R	5'-TACCAGGGTATCTAATCCC-3'
530F	5'-GTGCCAGCAGCCGCGG-3'

2. 16S rDNA nucleotide sequences

2.1 The 16S rDNA nucleotide sequence of strain P1-5

TTTGAGTTTTGATCCTGGCTCAGGACGAACGCTGGCGGCGTGCCTAATACATGCAAGTCGAGCGGACAGATGGGAGCTTGCTCCCTGATGTAAGCGG
CGGACGGGTGAGTAACACGTGGGTAACCTGCCTGTAAGACTGGGATAACTCCGGGAAACCGGGGCTAATACCGGATGGTTGTTTGAACCGCATGGTT
CAGACATAAAAGGTGGCTTCGGCTACCACTTACAGATGGACCCGCGGCGCATTAGCTAGTTGGTGAGGTAACGGCTCACCAAGGCAACGATGCGTAG
CCGACCTGAGAGGGTGATACGGCCACACTTGGGACTGAAGACACGGCCCAGACTCCTACGGGAGGCAGCAGTAGGGAATCTTCCGCAATGGACGAA
AGTCTGACGGAGCAACCCCGCGTGAGTGATGAAGGTTTTCGGATCGTAAAGCTCTGTTGTTAGGGAAGAACAAGTGCCGTTCAAATAGGGCGGCACC
TTGACGGTACCTAACCAGAAAGCCACGGCTAACTACGTGCCAGCAGCCGCGGTAATACGTAGGTGGCAAGCGTTGTCCGGAATTATTGGGCGTAAAG
GGCTCGCAGGCGGTTTCTTAAGTCTGATGTGAAAGCCCCCGGCTCAACCGGGGAGGGTCATTGGAAACTGGGGAACTTGAGTGCAGAAGAGGAGAG
TGGAATTCCACGTGTAGCGGTGAAATGCGTAGAGATGTGGAGGAACACCAGTGGCGAAGGCGACTCTCTGGTCTGTAACTGACGCTGAGGAGCGAA
AGCGTGGGGAGCGAACAGGATTAGATACCCTGGTAGTCCACGCCGTAAACGATGAGTGCTAAGTGTTAGGGGGTTTCCGCCCCTTAGTGCTGCAGCT
AACGCATTAAGCACTCCGCCTGGGGAGTACGGTCGCAAGACTGAAACTCAAAGGAATTGACGGGGGCCCGCACAAGCGGTGGAGCATGTGGTTTAA
TTCGAAGCAACGCGAAGAACCTTACCAGGTCTTGACATCCTCTGACAATCCTAGAGATAGGACGTCCCCTTCGGGGGCAGAGTGACAGGTGGTGCAT
GGTTGTCGTCAGCTCGTGTCGTGAGATGTTGGGTTAAGTCCCGCAACGAGCGCAACCCTTGATCTTAGTTGCCAGCATTCAGTTGGGCACTCTAAGGT
GACTGCCGGTGACAAACCGGAGGAAGGTGGGGATGACGTCAAATCATCATGCCCCTTATGACCTGGGCTACACACGTGCTACAATGGACAGAACAA
AGGGCAGCGAAACCGCGAGGTTAAGCCAATCCCACAAATCTGTTCTCAGTTCGGATCGCAGTCTGCAACTCGACTGCGTGAAGCTGGAATCGCTAGT
AATCGCGGATCAGCATGCCGCGGTGAATACGTTCCCGGGCCTTGTACACACCGCCCGTCACACCACGAGAGTTTGTAACACCCGAAGTCGGTGAGGT
AACCTTTATGGAGCCAGCCGCCGAAGGTGGGACAGATGATTGGGGAAGTCGACGGA

2.2 The 16S rDNA nucleotide sequence of strain P2-1

GAAAAAAAACCGTTGAAGGGATTTTATTTAGCTTATACGGACCACTGGCGGGGCCTAAACCTACAATTCCTGCGAATTTGAGGAGAACCTTGCTCTCT
TAATGTTTAGCGGGGAACGGTTGATTTAACATGTAGAAAACTCCTCAAGACGGGATAACCCAGAAAATTGAGCTAATACCGGGATATCTCATTTCCCT
CTCCCCGCGGGAAATAAAAGACGGAGCATTTGTCACTTGCGGATGGGCTGCGGCCATTAGCTAGTTGGTGAGGTAACGCTCACCAAGGCGACAATGC
GTAGCCGACCTGAAGAGGGTGAACCGGCCACACTGGGACTGAGACACGCCCCAGAC TCCT .CGGGAGGCACCAGTAGGGAATCTTCCGCAATGGG
CGAAAGCCTGACGGAGCAACGCCCGCGTGAGTGATGAAGGTTTTCGGATCGTAAAGCTCTGTTGCCCAGGGAAGAACGTCCCGGTAGAGTAACTGCT
ACCGGAGTGACGGTACCTGAGAAGAAAAGCCCCGGCTAACTACGTGCCAGCAGCCCGCGGTAATACGTAGGGGGCAAGCGTTGTCCGGAATTATTG
GGCGTAAAGCGCGCGCAGGCGGTCATTTAAGTCTGGTGTTTAAGGCCAAGGCTCAACCTTGGTTCGCACTGGAAACTGGGTGACTTGAGTGCAGAAG
AGGAGAGTGGAATTCCACGTGTAGCGGTGAAATGCGTAGATATGTGGAGGAACACCAGTGGCGAAGGCGACTCTCTCGGCTGTAACTGACGCTGAG
GCGCGAAAGCGTGGGGAGCAAACAGGATTAGATACCCTGGTAGTCCACGCCGTAAACGATGAATGCTAGGTGTTAGGGGTTTCGATACCCTTGGTGC
CGAAGTTAACACATTAAGCATTCCGCCTGGGGAGTACGGTCGCAAGACTGAAACTCAAAGGAATTGACGGGGACCCGCACAAGCAGTGGAGTATGT
GGTTTAATTCGAAGCAACGCGAAGAACCTTACCAGGTCTTGACATCCCTCTGACCGGTATAGAGATACACCTTTCCTTCGGGACAGAGGAGACAGGT
GGTGCATGGTTGTCGAAAGCTCGTGTCGTGAGATGTTGGGTTAAGTCCCGCAACGAGCGCAACCCTTGATTTTAGTTGCCAGCACTTCGGGTGGGCAC
TCTAGAATGACTGCCGGTGACAAACCGGAGGAAGGCGGGGATGACGTCAAATCATCATGCCCCTTATGACCTGGGCTACACACGTACTACAATGGCC
AGTACAACGGGAAGCGAAGCCGCGAGGTGGAGCCAATCCTATCAAAGCTGGTCTCAGTTCGGATTGCAGGCTGCAACTCGCCTGCATGAAGTCGGAA
TTGCTAGTAATCGCGGATCAGCATGCCGCGGTGAATACGTTCCCGGGTCTTGTACACACCGCCCGTCACACCACGAGAGTTTACAACACCCGAAGTCG
GTGAGGTAACCGCAAGGAGCCAGCCGCCGAAGGTGGGGTAGATGTTGGGAAAAGTCG

2.3 The 16S rDNA nucleotide sequence of strain P2-3

CTGGCGGCGTGCCTATACATGCAAGTCGAGCGGACAGATGGGAGCTTGCTCCCTGATGTTAGCGGCGGACGGGTGAGTAACACGTGGGTAACCTGCC
TGTAAGACTGGGATAACTCCGGGAAACCGGGGCTAATACCGGATGGTTGTTTGAACCGCATGGTTCAGACATAAAAGGTGGCT
TCGGCTACCACTTACAGATGGACCCGCGGCGCATTAGCTAGTTGGTGAGGTAACGGCTCACCAAGGCACGATGCGTAGCCGACCTGAGAGGGTGATC
GGCCACACTGGGACTGAGACACGGCCCAGACTCCTACGGGAGGCAGCAGTAGGGAATCTTCCGCAATGGACGAAAGTCTGAC
GGAGCAACGCCGCGTGAGTGATGAAGGTTTTCGGATCGTAAAGCTCTGTTGTTAGGGAAGAACAAGTGCCGTTCAAATAGGGCGGCACCTTGACGGT
ACCTAACCAGAAAGCCACGGCTAACTACGTGCCAGCAGCCGCGGTAATACGTAGGTGGCAAGCGTTGTCCGGAATTATTGGGC
GTAAAGGGCTCGCAGGCGGTTTCTTAAGTCTGATGTGAAAGCCCCCGGCTCAACCGGGGAGGGTCATTGGAAACTGGGGAACTTGAGTGCAGAAGA
GGAGAGTGGAATTCCACGTGTAGCGGTGAAATGCGTAAGATGTGGAGGAACACCAGTGGCGAAGGCGACTCTCTGGTCTGTAA
CTGACGCTGAGGAGCGAAAGCGTGGGGAGCGAACAGGATTAGATACCCTGGTAGTCCACGCCGTAAACGATGAGTGCTAAGTGTTAGGGGGTTTCC
GCCCCTTATGCTGCAGCTAACGCATTAAGCACTCCGCCTGGGGAGTACGGTCGCAAGACTGAAACTCAAAGGAATTGACGGGG
GCCCGCACAACGGTGGAACATGTGGTTTAATTCAACACCCAAAACCTTACCAGGTCTGACTCCTCTGACATCTAAAAATAGAACGTCCCCTTCCGGGG
CAAATGACGGGGTGCATGTTCCCCCTCCTGTCCGAATGTTGGTAATCCCA

2.4 The 16S rDNA nucleotide sequence of strain P4-7

GATTTGAGTTTTGACCCTGGCTCAGGACGAACGCTGGCGGCGTGCCTAATACATGCAAGTCGAGCGGACAGATGGAAGCTTGCTCCCTGATGTTAGC
GGCGGACGGGTGAGTAACACGTGGGTAACCTGCCTGTAAGACTGGGATAACTCCGGGAAACCGGGGCTAATACCGGATGGTTGTTTGAACCGCATGG
TTCAGACATAAAAGGTGGCTTCGGCTACCACTTACAGATGGACCCGCGGCGCATTAGCTAGTTGGTGAGGTAACGGCTCACCAAGGCAACGATGCGT
AGCCGACCTGAGAGGGTGATACGCCCACACTGGGACTGAGACACGGCCCAGACTTCCTACGGGAGGCAGCAGTAGGGAATTCTTCCGCAATGGACG
AAAGTCTGACGGAGCAACCCCGCGTGAGTGATGAAGGTTTTCGGATTCGTAAAAGCTCTGTTGTTAGGGAAGAACAAGTGCCGTTCAAATAGGGCGG
CACCTTGACGGTACCTAACCAGAAAGCCACGGCTAACTACGTGCCAGCAGCCGCGGTAATACGTAGGTGGCAAGCGTTGTCCGGAATTATTGGGCGT
AAAGGGCTCGCAGGCGGTTTCTTAAGTCTGATGTGAAAGCCCCCGGCTCAACCGGGGAGGGTCATTGGAAACTGGGGAACTTGAGTGCAGAAGAGG
AGAGTGGAATTCCACATTGTAGCGGTAATAATGACGTAGAGATGTGGAGGAACACCAGTGGCGAAGGCGACTCTCTGGTCTGTAACTGACGCTGAGG
AAGCGAAAAGCGTGGGGAGCGAACAGGATTAGATACCCCTGGTAGTCCACGCCGTAAACGATGAGTGCTAAGTGTTAGGGGGTTTCCCCCCCTTAGT
GCTGCAGCTAACGCATTAAGCACTCCCGCCTGGGGAGTACGGTCGCAAGACTGAAACTCAAAGGAATTGACGGGGGCCCGCACAAGCGGTGGAGCA
TGTGGTTTAATTCGAAGCAACGCGAAGAACCTTACCAGGTCTTGACATCCTCTGACAATCCTAGAGATAGGACGTCCCCTTCGGGGGCAGAGTGACA
GGTGGTGCATGGTTGGCAACAGCTCCGTGTCACGTGAGATGTTGGGTTAAGTCCCGCAACGAGCGCAACCCTTGATCTTAGTTGCCAGCATTCAGTTG
GGCACTCTAAGGTGACTGCCGGTGACAAACCGGAGGAAGGTGGGGATGACGTCAAATCATCATGCCCCTTATGACCTGGGCTACACACGTGCTACAA
TGGACAGAACAAAGGGCAGCGAAACCGCGAGGTTAAGCCAATCCCACAAATCTGTTCTCAGTTCGGATCGCAGTCTGCAACTCGACTGCGTGAAGCT
GGAATCGCTAGTAATCGCGGATCAGCATGCCGCGGTGAATACGTTCCCGGGCCTTGTACACAACCGCCCGTCACACCACGAGAGTTTGTAACACCCG
AAGTCGGTGAGGTAACCTTTATGGAGCCAGCCGCAAAGGTGGGCAGATCCTTGGAAAAGTCCTCATCA

2.5 The 16S rDNA nucleotide sequence of strain P4-8

**GCAAAGAAAATTTATTTCCCCTAGTAAAATTTAAAAATTTGCCCCCCCCGGGGGAAGGTTTTTTTAACTTCTTCAGACAAAACCCGGGGGCG
TGCCTAAATACCTTCAAGTCGAGCGGACAGAGGGAGCTTTGCCTCCCTGATTTAGCGGCGGACGGGTGAGTAACACGTGGGTAACCTCCCT
GTAAGACTGGGATAACTCCGGGGAAACCCGGGGCTTAATACCGAATGTTTGTTTGAACCGCATGGTTCAGCATAAAAGGGGGTTCGGTACCA
TTACAGATGGAGCCCGCGGGCCCATTAACTTAGTTTGGTGAGGTACGGCTCACCCAAGGCAACGATGGGGTAGCCGACCCTGAGAGGGTGA
TCGCCCCACACTGGGACTGAAGACACCGGCCCCAGACTCCTACGGGAGGCAGCAGTAGGGAATCTTCCGCCAATGGACGAAAGTCTGACGG
AGCAACCCCCGCGTGGAGTGATGAAGGTTTTTCGGATCGTAAAAGCTCTGTTTGTTAGGGAAGAACAAGTGCCGTTCAAATAGGGCGGCACC
TTGACGGTACCTAACCAGAAAGCCACGGCTAACTACGTGCCAGCAGCCGCGGTAATACGTAGGTGGCAAGCGTTGTCCGGAATTATTGGGC
GTAAAGGGCTCGCAGGCGGTTTCTTAAGTCTGATGTGAAAGCCCCCGGCTCAACCGGGGAGGGTCATTGGAAACTGGGGAACTTAAGTGCA
GAAGAGGAGAGTGGAATTCCACGTGTAGCGGTGAAATGCGTAGAGATGTGGAGGAACACCAGTGGCGAAGGCGACTCTCTGGTCTGTAACT
GACGCTGAGGAGCGAAAGCGTGGGGAGCGAACCAGGATTAGATACCCTGGTAGTCCCACGCCGTAAACGATGAGTGCTAAGTGTTAGGGGG
TTTCCGCCCCTTTAGTGCTGCAGCTAACGCATTAAGCACTCCGCCTGGGGAGTACGGTCGCAAGACTGAAACTCAAAGGAATTGACGGGGGC
CCCCACAAGCGGTGGAGCATGTGGTTTAATTCGAAGCAACGCGAAGAACCTTACCAGGTCCTTGACATCCTCTGACAATCCCTAGAGATAGG
ACGTCCCCTTCCGGGGGCAGAGTGACAGGTGGTGCATGGTGGTAATCAGCTCGATGTCGTGAAGATGTTGGGTTAACGTCCCGCAACGAGC
GCAACCCTTGATTTAGTTGCCAGCATTCAGTTGGGCACTCTAAGGTGACTGCCGGTGACAAACCGGAGGAAGGTGGGGATGACGTCAAATC
ATCATGCCCCTTATGACCTGGGCTACACACGTGCTACAATGGACAGAACAAAGGGCAGCGAAACCGCGAGGTTAAGCCAATCCCACAAATCT
GTTCTCAGTTCGGATCGCAGTCTGCAACTCGACTGCGTGAAGCTGGAATCGCTAGTAATCGCGGATCAGCATGCCGCGGTGAATACGTTCCC
GGGCATGTACACACCGCCCGTCACACCACGAGAGTTTGTAACACCCGAAGTCGGTGAGGTAACCTTTATGGAGCCCAGCCCCCGAAGGTGG
CACAGAGAGGATGATTGGAAGGAAAGCCTCCATGG**

2.6 The 16S rDNA nucleotide sequence of strain P5-2

TTAGTTTTGATCCTGGCTCAGGACGAACGCTGGCGGCGTGCCTAAGATACATGCAACTCAAGCGGACAGATGGGAGCTTGCTCCCTGATGTTAGCGG
CGGACGGGTGAGTAACACGTGGGTAACCTGCCTGTAAGACTGGGATAACTCCGGGAAACCGGGGCTAATACCGGATGGTTGTTTGAACCGCATGGTT
CAAACATAAAAGGTGGCTTCGGCTACCACTTACAGATGGACCCGCGGCGCATTAGCTAGTTGGTGAGGTAACGGCTCACCAAGGCAACGATGCGTAG
CCAACCTGAGAGGGTGATAGGCCACACTGGGAATGAGACACGGCCCAAGACTCCTACGGGAGGCAGCAGTTAGGGAATCTTCCCCCAATGGACG
AAAAGTCTGACGGAGCAACGCCGCGTGAGTGATGAAGGTTTTCGGATCGTAAAAGCTCTGTTGTTAGGGAAGAACAAGTACCGTTCGAATAGGGCG
GTACCTTGACGGTACCTAACCAGAAAGCCACGGCTAACTACGTGCCAGCAGCCGCGGTAATACGTAGGTGGCAAGCGTTGTCCGGAATTATTGGGCG
TAAAGGGCTCGCAGGCGGTTTCTTAAGTCTGATGTGAAAGCCCCCGGCTCAACCGGGGAGGGTCATTGGAAACTGGGGAACTTGAGTGCAGAAAAA
GAAAGTGGAATTCCACGTGTAGCGGTGAAATGCGTAGAGATGTGGAGGAACACCAGTGGCGAAGGCGACTCTCTGGTCTGTAACTGACGCTGAGGA
GCGAAAGCGTGGGGAGCGAACAGGATTAGATACCCTGGTAGTCCCACCCCGTAAACGATGGAGTGCTAAGTGTTAGGGGGTTTCCGCCCCTTAGGGC
TGCAGCTAACGCATTAAACCACTCCCCCTGGGGGAGTACGGTCGCAAGACTGAAACTCAAAGGAATTGACGGGGGCCCGCACAAGCGGTGGAGCAT
GTGGTTTAATTCGAAGCAACGCGAAGAACCTTACCAGGTCTTGACATCCTCTGACAATCCTAGAGATAGGACGTCCCCTTCGGGGGCAGAGTGACAG
GTGGTGCATGGTTGTCGTAAGCTCGCTGTCGTGAAAATGTTGGGTTAAGTCCCGCAACGAGCGCAACCCTTGATCTTAGTTGCCAGCATTCAGTTGGG
CACTCTAAGGTGACTGCCGGTGACAAACCGGAGGAAGGTGGGGATGACGTCAAATCATCATGCCCCTTATGACCTGGGCTACACACGTGCTACAATG
GACAGAACAAAGGGCAGCGAAACCGCGAGGTTAAGCCAATCCCACAAATCTGTTCTCAGTTCGGATCGCAGTCTGCAACTCGACTGCGTGAAGCTGG
AATCGCTAGTAATCGCGGATCAGCATGCCGCGGTGAATACGTTCCCGGGCCTTGTACACACCGCCCGTCACACCACGAGAGTTTGTAACACCCGAAG
TCGGTGAGGTAACCTTTTAGGAGCCAGCCGCCGAAGGTGGGACAGATGATTGGGGTGAAGTCGTCTGGAACTTC

2.7 The 16S rDNA nucleotide sequence of strain P5-5

AACTGGCGGCGTGCCTATACATGCAAGTCGAGCGAGGTCCCTTCGGGGGCCTAGCGTCGGACGGGGTGGATAACACGGTAGGGCAACCTGGCCTCTC
AGGACCGGGGATAACTAGGGAAACTTATGCTAATACCGGATAGGTTTTTGGATCCATGATCCGAAAAGAAAAGATGGCTTCGGCTATCACTGGGAGA
TGGGCCTGCGGCGCATTAGCTAGTTGGTGGGGTAACGGCCTACCAAGGCGACATGCGTAGCCACCTGAAGGGTGACCGGCCACACTGGGACTGAACA
CGGCCCAACTCCTACGGGAGGCAGCAGTAGGGAATTTTCCACAATGGACGAAAGTCTGATGGACAACCCCGTGAACGATGAAGGTCTTCGGATTGTA
AAGTTCTGTTGTCAGGGACGAACAAGTACCGTTCGAACAGGGGGTACCTTGACGGTACCTGACGAGAAAGCCACGGCTAACTACTGCCAGCAGCCGC
GGTAATAAAAAGGGCTGGCCCTCAAGACAACGTTGTCCGGAATTTATTGGGCGTAAAGCGCGCGCAGGCGGCTATGTAAGTCTGGTGTTAAAGCCCG
GGGCTCAACCCCGGTTCGCATCGGAAACTGCAGAGCTTGAGTGCAAAAAAGGAAAGCGGTATTCCACGTTGTAGCGGTGAAATGCGTAAAGATGTG
GAGGAACACCAGTGGCGAAGGCGGCTTTCTGGTCTGTAACTGACGCTGAGGCGCGAAAACGTGGGGAGCAAACAGGATTAGATACCCTGGTAGTCC
ACGCCGTAAACGAAGAGTGCTAGGTGTTGGGGGTTTCAATACCCTCAGTGCCGCAGCTAACGCAATAAGCACTCCCCCTGGGGAGTACGCTTCCCAA
GAGTGAAACTCAAAGGAATTGACGGGGGCCCCCACAGCGGTGGAGCATGTGGTTTAATTCGAAGCAACGCGAAGAACCTTACCAGGTCTTGACATCC
CGCTGACCGCCCTAAAGATAGGGCTTCCCTTCGGGGCTAGCGGTGACAGGTGGTGCATGGTTGTAAGTCACGCTCGTGTCGTGAGATGTTGGGTTAAG
TCCCGCAACGAGCGCAACCCTTATTTCTAGTTGCCAGACATTCAGTTGGGCACTCTAGAGAGACTGCCGTCGACAAGACGGAGGAAGGCGGGGATGA
CGTCAAATCATCATGCCCCTTATGACCTGGGCTACACACGTGCTACAATGGTTGGTACAACGGGATGCTACCTCGCGAGAGGACGCCAATCTCTGAA
AACCAATCTCAGTTCGGATTGTAGGCTGCAACTCGCCTACATGAAGTCGGAATCGCTAGTAATCGCGGATCAGCATGCCCCGGTGAATACGTTCCCCG
GGCCTTGTACACACCGCCCCGTCACAACCACGGGAGTTTGCAACACCCGAAGTCGGTGAGGTAACCCGCAAGGGGCCAGCCCGCCGAAGGTGGGGT
AAATGACTGGGGTGAAGTCGTAACAAGGTAACCGTAA

2.8 The 16S rDNA nucleotide sequence of strain P6-7

TGGAAAAAGGGAGCCCGGGGGATTATTTGAGTATCGTCCTGGGCTCAAGGACGAACGCGGGCGGCGTGCCTAATACATGCAAGTTCGAGCGGACAG
ATGGGAGCTTGCTCCCCTGATGTTAGCGGCGGACGGGTGAGTAACACGTGGGTAACCTGCCTGTAAGACTGGGATAACTCCGGGAAACCGGGGCTAA
TACCGGATGGTTGTTTGAACCGCATGGTTCAAACATAAAAGGTGGCTTCGGCTACCCACTTACAGATGGACCCGCGGCGCATTAGCTAGTTGGTGAG
GTAACGGCTCACCAAGGCAACGATGCGTAGCCGACCTGAGAGGTGATCGGCCACACTGGGACTGAAGACACCGGCCCAGACTCCTACGGGAGGCAG
CAGTAGGGAATCTTCCGCAATGGACGAAAGTCTGACGGAGCAACGCCGCGTGAGTGATGAAGGTTTTCGGATCGTAAAGCTCTGTTGTTAGGGAAGA
ACAAGTACCGTTCGAATAGGGCGGTACCTTGACGGTACCTAACCAGAAAGCCACGGCTAACTACGTGCCAGCAGCCGCGGTAATACGTAGGTGGCAA
GCGTTGTCCGGAATTATTGGGCGTAAAGGGCTCGCAGGCGGTTTCTTAAGTCTGATGTGAAAGCCCCCGGCTCAACCGGGGAGGGTCATTGGAAACT
GGGGAACTTGAGTGCAGAAGAGGAGAGTGGAATTCCACGTGTAGCGGTGAAATGCGTAGAGATGTGGAGGAACACCAGTGGCGAAGGCGACTCTCT
GGTCTGTAACTGACGCTGAGGAGCGAAAGCGTGGGGAGCGAACAGGATTAGATACCCTGGTAGTCCACGCCGTAAACGATGAGTGCTAAGTGTTAG
GGGGTTTCCGCCCCTTAGTGCTGCAGCTAACGCATTAAGCACTCCGCCTGGGGAGTACGGTCGCAAGACTGAAACTCAAAGGAATTGACGGGGGCCC
GCACAAGCGGTGGAGCATGTGGTTTAATTCGAAGCAACGCGAAGAACCTTACCAGGTCTTGACATCCTCTGACAATCCTAGAGATAGGACGTCCCCT
TCGGGGGCAGAGTGACAGGTGGTGCATGGTTGTCGTCAGCTCGTGTCGTGAGATGTTGGGTTAAGTCCCGCAACGAGCGCAACCCTTGATCTTAGTTG
CCAGCATTCAGTTGGGCACTCTAAGGTGACTGCCGGTGACAAACCGGAGGAAGGTGGGGATGACGTCAAATCATCATGCCCCTTATGACCTGGGCTA
CACACGTGCTACAATGGACAGAACAAAGGGCAGCGAAACCGCGAGGTTAAGCCAATCCCACAAATCTGTTCTCAGTTCGGATCGCAGTCTGCAACTC
GACTGCGTGAAGCTGGAATCGCTAGTAATCGCGGATCAGCATGCCGCGGTGAATACGTTCCCGGGCCTTGTACACACCGCCCGTCACACCACGAGAG
TTTGTAACACCCGAAGTCGGTGAGGTAACCTTTTAGGAGCCAGCCGCCGAAGGTGGGACAGATGATTGGGAGAAGTCGTACGGA

2.9 The 16S rDNA nucleotide sequence of strain P6-8

GAGACTGTTTCGAAATTTTAACGAAATGAAAAAGGTATAAAAAGATATTTATTTATCCTGGCTCAGACGAACCGCGGCGGGGTTCCTTAATAC
CTGCCAATCGAGCGGACAGATGGGAGCTTCCTCCCCTGATTAAGCGGCGGACGGGTGAGTAACACGTGGGTACCTCTGTAAACTGGGATAA
CTCCGGAAACCGGGGCTAATACCGAATGGTTTTTAAACCGCATGGTTCAAAACAAAAAAGGTGTTTGGCTACCCACTTAACAGATGGACCCG
CGGCCCATTAACTTAGTTGGTGAGTAACGGCTCACCCAAGGCAACGATGCGTTAGCCCCCTGAGAGGTGATTCGCCCACACTGGGGATTGAA
ACACGCCCCCAGACTCCTACGGGAGGGCACCAGTAGGAATCTTCCCGCAATGGACGAAAGTCTGACGGAGCAACCCCCGCGTGAGTGATGA
AGGTTTTCGGATCGTAAAGCTTCTGTTGTTAGGGAAGAACAAGTACCGTTCGAATAGGGCGGTACCTTGACGGTACCTAACCAGAAAGCCAC
GGCTAACTACGTGCCAGCAGCCGCGGTAATACGTAGGTGGCAAGCGTTGTCCGGAATTATTGGGCGTAAAGGGCTCGCAGGCGGTTTCTTA
AGTCTGATGTGAAAGCCCCCGGCTCAACCGGGGAGGGTCATTGGAAACTGGGGAACTTGAGTGCAGAAGAGGAGAGTGGAATTCCACGTGT
AGCGGTGAAATGCGTAGAGATGTGGAGGAACACCAGTGGCGAAGGCGACTCTCTGGTCTGTAACTGACGCTGAGGAGCGAAAGCGTGGGG
AGCGAACCAGGATTAGATACCCTGGTAGTCCACGCCGTAAACGATGAGTGCTAAGTGTTAGGGGGTTTCCCGCCCCTTAGTGCTGCAGCTAA
CGCATTAACCACTCCGCCTGGGGAGTACGGTCGCAAGACTGAAACTCAAAGGAATTGACGGGGGCCCGCACAAGCGGTGGAGCATGTGGTT
TAATTCGAAGCAACGCGAAGAACCTTACCAGGTCTTGACATCCTCTGACAATCCCTAGAGATAGGACGTCCCCTTCCGGGGGCAGAGTGACA
GGTGGTGCATGGTGGTAGTCAGCTCGATGTCGAAAGATGTTGGGTTAAGTCCCGCAACGAGCGCAACCCTTGATCTTAGTTGCCAGCATTCA
GTTGGGCACTCTAAGGTGACTGCCGGTGACAAACCGGAGGAAGGTGGGGATGACGTCAAATCATCATGCCCCTTATGACCTGGGCTACACA
CGTGCTACAATGGACAGAACAAAGGGCAGCGAAACCGCGAGGTTAAGCCAATCCCACAAATCTGTTCTCAGTTCGGATCGCAGTCTGCAACT
CGACTGCGTGAAGCTGGAATCGCTAGTAATCGCGGATCAGCATGCCGCGGTGAATACGTTCCCGGGCCTTGTACACACCGCCCGTCACACC
ACGAGAGTTTGTAACACCCGAAGTCGGTGAGGTAACCTTTTAGGAGCCAGCCGCCGAAGGTGGGACAGAGAGAAGTTTGGAAGGAAGAGCC
ATCCG

2.10 The 16S rDNA nucleotide sequence of strain P7-1

TGACTGGCGGCGTGCCTAATACATGCAAGTCGAGCGGACAGATGGGAGCTTGCTCCCTGATGTTAGCGGCGGACGGGTGAGTAACACGTGGGTAACC
TGCCTGTAAGACTGGGATAACTCCGGGAAACCGGGGCTAATACCGGATGGTTGTTTGAACCGCATGGTTCAAACATAAAAGGTGGCTTCGGCTACCA
CTTACAGATGGACCCGCGGCGCATTAGCTAGTTGGTGAGGTAACGGCTCACCAAGGCAACGATGCGTAGCCGACCTGAGAGGGTGATCGGCCACACT
GGGACTGAGACACGGCCCAGACTCCTACGGGAGGCAGCAGTAGGGAATCTTCCGCAATGGACGAAAGTCTGACGGAGCAACGCCGCGTGAGTGATG
AAGGTTTTCGGATCGTAAAGCTCTGTTGTTAGGGAAGAACAAGTACCGTTCGAATAGGGCGGTACCTTGACGGTACCTAACCAGAAAGCCACGGCTA
ACTACGTGCCAGCAGCCGCGGTAATACGTAGGTGGCAAGCGTTGTCCGGAATTATTGGGCGTAAAGGGCTCGCAGGCGGTTTCTTAAGTCTGATGTG
AAAGCCCCCGGCTCAACCGGGGAGGGTCATTGGAAACTGGGGAACTTGAGTGCAGAAGAGGAGAGTGGAATTCCACGTGTAGCGGTGAAATGCGTA
GAGATGTGGAGGAACACCAGTGGCGAAGGCGACTCTCTGGTCTGTAACTGACGCTGAGGAGCGAAAGCGTGGGGAGCGAACAGGATTAGATACCCT
GGTAGTCCACGCCGTAAACGATGAGTGCTAAGTGTTAGGGGGTTTCCGCCCCTTAGTGCTGCAGCTAACGCATTAAGCACTCCGCCTGGGGAGTACG
GTCGCAAGACTGAAACTCAAAGGAATTGACGGGGGCCCACAAGCCGGTGGAGCATGTGGTTTAATTCCAAACAACCCCAAAACCTTACCAGGTCT
TGACATCCTCTGACAATCCTAAAATAGACTCCCTTCGGGGGAAAATACGGTGCATGGTTTCTTCCTCTTGTCCTGAATTTGGTTAAATCCCCC

2.11 The 16S rDNA nucleotide sequence of strain P7-3

TGGCATGATCTCCCCAAGGCCCCCCCCTTTGAGTTTTGAATCCTGGCTCAGGACGAACGCTGGCGGCGTGCCTTAATACATCCAAGTCGAGCGGACAA
AATGGGAGCTTGCTCCCTAATGTAAGCGGCGGACGGGTGAATTAACACGTGGGGTAACCTGCCTTGTAAGACTGGGATAACTCCGGGAAACCGGGGC
TAATACCGGATGGTTGTTTGAACCAACATGGTTCAAACATAAAAGGTGGCTTCGGCTACCACTTACAGATGGACCCGCGGCGCATTAGCTAGTTGGTG
AGGTAACGGCTCACCAAGGCAACGATGCGTAGCCGACCTGAAAAGGGTGATCGGCCACACTGGGACTGAGACACGGCCCAGACTCCTTACGGGAGG
CAGCAGTAGGGAATCTTTCCGCAATGGGACGAAAAGTCTGACGGAAGCAACCGCCGCGTGAGTGATGAAGGTTTTCGGATCGTAAAGCTCTGTTGTT
AGGGAAGAACCAAGTACCGTTCGAATAGGGCGGTACCTTGACGGTACCTAACCAGAAAGCCACGGCTAACTACGTGCCAGCAGCCGCGGTAATACG
TAGGTGGCAAGCGTTGTCCGGAATTATTGGGCGTAAAGGGCTCGCAGGCGGTTTCTTAAGTCTGATGTGAAAGCCCCCGGCTCAACCGGGGAGGGTC
ATTGGAAACTGGGGAACTTGAGTGCAGAAGAGGAGAGCGGAATTCCACGTGTAGTCGATGAAATGCGTAGAGATGTGGAGGAACACCAGTGGCGAA
GGCGACTCTCTGGTCTGTAAACTGACGCTGAGGAAGCGAAAGCGTGGGGGAGCGAACCAGGATTAAGATACCCTGGGTAGTCCACGCCGTAAAACG
ATGAGTGCTAAGTGTTAGGGGGTTTCCGCCCCTTTAGTGCTGCAGCTAACGCATTAAGCACTCCCCCCTGGGGAGTACGGTCGCAAGACTGAAACTCA
AAGGAATTGACGGGGGCCCGCACAAGCGGTGGAGCATGTGGTTTAATTCGAAGCAACGCGAAGAACCTTACCAGGTCTTGACATCCTCTGACAATCC
TAGAGATAGGACGTCCCCTTCGGGGGCAGAATGACAGGTGGTGCATCGTTGTCGTCAAAAGCTCCGTGATCAGTGAGATGTTGGGTTAAGTCCCGCA
ACGAGCGCAACCCTTGATCTTAGTTGCCAGCATTCAGTTGGGCACTCTAAGGTGACTGCCGGTGACAAACCGGAGGAAGGTGGGGATGACGTCAAAT
CATCATGCCCCTTATGACCTGGGCTACACACGTGCTACAATGGACAGAACAAAGGGCAGCGAAACCGCGAGGTTAAGCCAATCCCACAAATCTGTTC
TCAGTTCGGATCGCAGTCTGCAACTCGACTGCGTGAAGCTGGAATCGCTAGTAATCGCGGATCAGCATGCCGCGGTGAATACGTTCCCGGGCCTTGTA
CACACCGCCCGTCACACCACGAGAGTTTGTAACACCCGAAGTCGGTGAGGTAACCTTTTAGGAGCCGGCCGCAAAAGGTGGCATTCCCTTGGAAACG
TCTAAACA

2.12 The 16S rDNA nucleotide sequence of strain S9-2

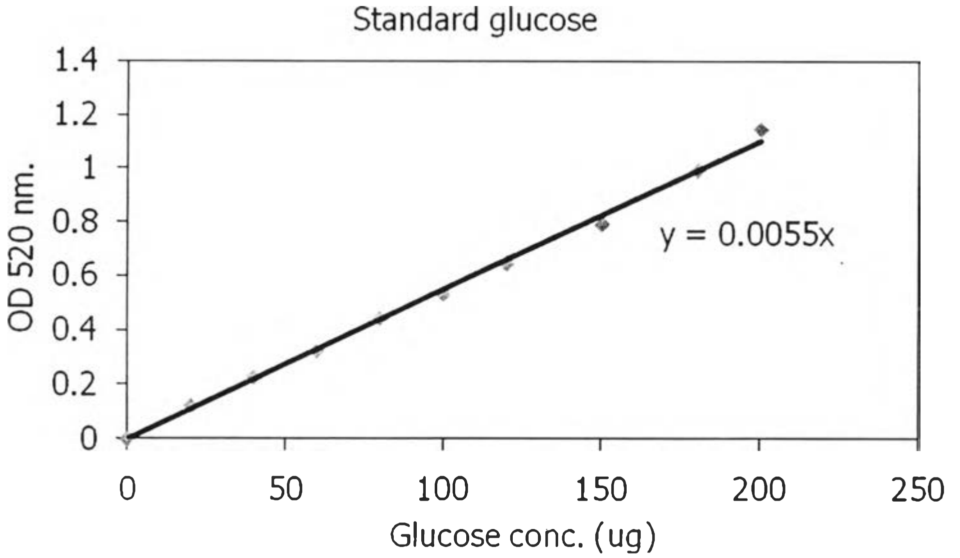
TGGTTCCTCTTTGTTATACCCAGGGCCTCCAGGACGAAACGCCGGGGGGGTCCTTAAAACATCCAAGTCCGAAGCGACAAAAGGGGAGTGCTTCCCC
TGATTTTAAGCGGCGGACGGGTTAGAAACAGTGGGTAACCTGCCCTGTAAAGACTGGGATACTCCGGGGAACCCGGGGCTAATACCGGGATGGTTGT
TTAAACCCCATGGTTCAAACATAAAAGGGGCTTCGGCTCCCACTTACAGATGGACCCGCGGCGCATAAGCTAGTGGGTGAGGTAACGGCTCACCAAG
GCGACGATGTGTAGCCGACCTGAGAGGGGATCGCCCACACTGGGACTGAGACACGGCCCAGACTCCTACGGGAGGCAGCAGTAGGGATCTTCCGCA
ATGGGACGAAAGTCTGACGGAGCAACGCCGCGTGAGTGATGAAGGTTTTCGGATCGTAAAGCTCTGTTGTTAGGGAAGAACAAGTACCGTTCGAATA
GGGCGGTACCTTGACGGTACCTAACCAGAAAGCCACGGCTAACTACGTGCCAGCAGCCGCGGTAATACGTAGGTGGCAAGCGTTGTCCGGAATTATT
GGGCGTAAAGGGCTCGCAGGCGGTTTCTTAAGTCTGATGTGAAAGCCCCCGGCTCAACCGGGGAGGGTCATTGGAAACTGGGGAACTTGAGTGCAGA
AGAGGAGAGTGGAATTCCACGTGTAGCGGTGAAATGCGTAGAGATGTGGAGGAACACCAGTGGAGAAGGCGACTCTCTGGTCTGTAACTGACGCTG
AGGAGCGAAAAGCGTGGGGAGCGAACAGGATTAGATACCCTGGTAGTCCACGCCGTAAACGATGAGTGCTAAGTGTTAGGGGGTTTCCGCCCCTTAG
TGCTGCAGCTAACGCATTAAGCACTCCGCCTGGGGAGTACGGTCGCAAGACTGAAACTCAAAGGAATTGACGGGGGCCCGCACAAGCGGTGGAGCA
TGTGGTTTAATTCGAAGCAACGCGAAGAACCTTACCAGGTCTTGACATCCTCTGACAATCCTAGAGATAGGACGTCCCCTTCGGGGGCAGAGTGACA
GGTGGTGCATGGTTGTCATCAGCTCCTGTCGTGAGATGTTGGTTAAGTCCCGCAACGAGCGCAACCTTTGATCTTAGTTGCCAGCATTCAGTTGGGCA
TTCTAAGGTGACTGCCGGTGACAACCCGGAGGAAGGTGGGGATGACGTCAAATCATCATGCCCCTTATGACCTGGGCTACACACGTGCTACAATGGA
CAGAACAAAGGGCAGCGAAACCGCGAGGTTAAGCCAATCCCACAAATCTGTTCTCAGTTCGGATCGCAGTCTGCAACTCGACTGCGTGAAGCTGGAA
TCGCTAGTAATCGCGGATCAGCATGCCGCGGTGAATACGTTCCCGGGCCTTGTACACACCGCCCGTCACACCACGAGAGTTTGTAACACCCGAAGTC
GGTGAGGTAACCTTTTAGGAGCCAGCCGCCGAAGGTGGGACAGATGATTGGGAGAAGTCGCTTCGAGA

2.13 The 16S rDNA nucleotide sequence of strain S10-4

CAACTGCGGCGTGCCTATCATGCAAGTCGAGCGGACTTGATGGAGAGCTTGCTCTCCTGATGGTTAGCGGCGGACGGGTGAGTAACACGTAGGCAAC
CTGCCTGCAAGACCGGGATAACCCACGGAAACGTGAGCTAATACCGGATATCTCATTTCCTCTCCTGAGGGGATGATGAAAGACGGAGCAATCTGTC
ACTTGCGGATGGGCCTGCGGCGCATTAGCTAGTTGGTGAGGTAACGGCTCACCAAGGCGACGATGCGTAGCCGACCTGAGAGGGTGAACGGCCACA
CTGGGACTGAGACACGGCCCAGACTCCTACGGGAGGCAGCAGTAGGGAATCTTCCGCAATGGGCGAAAGCCTGACGGAGCAACGCCGCGTGAGTGA
TGAAGGTTTTCGGATCGTAAAGCTCTGTTGCCAGGGAAGAACGTCCGGTAGAGTAACTGCTACCGGAGTGACGGTACCTGAGAAGAAAGCCCCGGCT
AACTACGTGCCAGCAGCCGCGGTNAATAAATAGGCNNNNNGCAGGCAAGCGTTGTCCGGAATTATTGGGCGTAAAGCGCGCGCAGGCGGTCATTTA
AGTCTGGTGTTTAAGGCCAAGGCTCAACCTTGGTTCGCACTGGAAACTGGGTGACTTGAGTGCAGAAGAGGAGAGTGGAATTCCACGTGTAGCGGTG
AAATGCGTAGATATGTGGAGGAACACCAGTGGCGAAGGCGACTCTCTGGGCTGTAACTGACGCTGAGGCGCGAAAGCGTGGGGAGCAAACAGGATT
AGATACCCTGGTAGTCCACGCCGTAAACGATGAATGCTAAGGTGTTAGGGGTTTCGATACCCTTGGTGCCGAAGTTAACACATTAAGCATTCCGCCTG
GGGAGTACNGGTCGCAAGACTGAAACTCAAAGGAATTGACGGGGANCCCGCACAAGCAGTGGAATATGTGGNTTTAATTCGAAGCAACCCGAAAAA
CCTTACCAGGNTCTTGACATCCCTCTGAACCGGTCTAGAGATANANNNNCCTTTCCTTCGGGACAAAGAAGACANNGGTGGTGCNATGGNTTGTCGT
NCAGCTCGTNGTCGTGAGNATGTTGGGTTAAGTCCCCCAACNNNNNNNNNNNNGAGCGCAACCCTTNNNNNNNNNCGAGTTTAGTTGCCAGCACTTC
GGGTGGGCACTCTAGAATGACTGCCGGTGACAAACCGGAGGTAAGGCGGGGATGACGTCAAATCATCATGCCCCTTATGACCTGGGCTACACACGTA
CTACAATGGCCAGTACAACGGGAAGCGAAGCCGCGAGGTGGAGCCAATCCTATCAAAGCTGGTCTCAGTTCGGATTGCAGGCTGCAACTCGCCTGCA
TGAAGTCGGAATTGCTAGTAATCGCGGATCAGCATGCCGCGGTGAATACGTTCCCGGGTCTTGTACACACCGCCCGTCACACCACGAGAGTTTACAA
CACCCGAAGTCGGTGAGGTAACCGCCCAAGGAAAGCCAAGCCGCCGAAAGGTGGGGTAGATGATTGGGGTGAAGTCGTAACAAGGTACCGTAAT

APPENDIX E

1. Standard curve of glucose



Poster presentation :

1. Thanawan Taprig , Ancharida Acharacharanya and Somboon Tanasupawat. 2005. Screening and identification of cellulase-producing bacteria from soil in NAN province. The Thai Society for Biotechnology. November 2-3, 2006 at the Montien Riversidde Hotel Bangkok, Thailand.

Biography

Miss Thanawan Taprig was born on June 20, 1983 in Bangkok, Thailand . she obtained a Bachelor of Science Degree in Microbiology from Srinakharinwirot university. Bankok, Thailand 2005.

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