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APPENDICS

APPENDIX A

Instruments and chemical reagents

1. Instruments

- Analytical balance: Mettler Toledo, model AG204, Switzerland.
- Autoclave: Tomy, model Avanti J25, USA; Eppendorf, model 5430, Germany; Sorvall, 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 stirring plate: Thermolyne, model Crimarec2, USA.
- Incubator: Memmert, model BE500, Germany.
- Incubator shaker: New Brunswick Scientific, model innova 4300, USA
- Magnetic stirrer: Ika, model RO-10, Malaysia.
- Microwave: Sanyo, model EM-815FW, Japan.
- Oven: Memmert, model UE 600, Germany.
- pH Meter: Mettler Toledo, model CH-8603, Switzerland.
- Pipetteman: Gilson, France.
- Precision balance: Mettler Toledo, model PB3002, Switzerland.
- Shaking Water Bath: Memmert, model WB22, Germany.
- Spectrophotometer: Sherwood Scientific, model 1259, Cambridge, UK.
- Vortex mixer: Barnstead/Thermolyne, model M37610-26, USA.

2. Chemicals (Analytical grade)

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

APPENDIX B

Culture Media

All media were dispensed and sterilized in autoclave at 120° C, 15 pounds/inch^2 pressure for 15 min except the media for acid production from carbon source testing which were sterilized at 110° C, 10 pounds/inch^2 pressure for 10 min.

1. PY 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 (CPY) medium

Cellulose powder	10	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. Xylan (XPY) medium

Oat spelt xylan	10	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) 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

5. Carboxymethyl cellulose-basal (CMC-basal) medium

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

Dissolve and adjust pH to 7.0

6. L-arginine agar medium

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

Dissolve and adjust pH to 7.2

7. Aesculin broth

Aesculin	1	g
Ferric citrate	0.5	g
PY medium	1000	ml

Dissolve and adjust pH to 7.4. Sterilization was performed at 110 °C for 10 min.

8. Casein agar medium

Skim milk	10	g
PY medium	1000	ml
Agar	15	g

Dissolve and adjust pH to 7.2

9. Gelatin agar medium

Gelatin	10	g
PY medium	1000	ml
Agar	15	g

Dissolve and adjust pH to 7.2

10. Motility test medium

Motility medium (Difco)	20	g
Distilled water	1000	ml

Dissolve and adjust pH to 7.2

11. Simmon Citrate agar

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

Dissolve and adjust pH to 6.8

12. Starch agar medium

Starch	10	g
PY medium	1000	ml
Agar	15	g

Dissolve and adjust pH to 7.2

13. Triple sugar iron agar medium

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

Dissolve and adjust pH to 7.4

14. Tyrosine agar medium

Tyrosine	50	g
PY medium	1000	ml
Agar	15	g

Dissolve and adjust pH to 7.2

15. Deoxyribonuclease (DNase) medium

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

Adjust pH to 7.3 and heat to boiling to dissolve completely

16. Indole test medium

Tryptone	10	g
Meat extract	3	g
Distilled water	1000	ml

Dissolve and adjust pH to 7.4

17. Nitrate broth

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

Dissolve and adjust pH to 7.2

18. Tween 80 agar medium

Tween 80	2	ml
PY medium	1000	ml
Agar	15	g

Dissolve and adjust pH to 7.2

19. Urea agar medium

Urea	20	g
PY medium	1000	ml
Agar	15	g

Dissolve and adjust pH to 7.2

20. MR-VP broth

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

Dissolve and adjust pH to 6.9

APPENDIX C

Reagents and Buffers

1. Standard curve of glucose or xylose

Glucose or xylose solution (0, 20, 40, 60, 80, 100, 120, 140, 160, 180, 200 ug/ml) were prepared. The analytical reactions were carried out by a procedure described by Somogyi and Nelson (1952).

2. Flagella staining reagent

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

Dissolve in solvent composed of 95% (v/v) ethanol (2ml), glycerol(0.5 ml), and Tris(hydroxymethyl)aminomethane(Tris) buffer (7.5ml).

3. Kovac's reagent

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

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

4. Nitrate test reagent

Solution A (sulphanilic acid solution)

0.33% (w/v) sulphanilic acid in 5 N- acetic acid

Dissolve by gently heating

Solution B (N, N-dimethyl-1-naphthylamine)

0.6% (w/v) dimethyl-α-napthylaminein 5 N-acetic acid

Dissolve by gently 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, then inoculating with test microorganisms.

5. 6 N HCl

conc. HCl	60	ml
Distilled water	60	ml

Add conc. HCl into the distilled water

6. 2 N H_2SO_4

conc. H_2SO_4	2	ml
Distilled 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

Dissolve ninhydrin in butanol containing acetic acid

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

Crystalline phenol was liquified 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. 0.5 M EDTA (pH 8.0)

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

10. 2x PBS solution

8 mM Na_2HPO_4

1.5 mM KH_2PO_4

137 mM NaCl

2.7 mM KCl

The ingredient of 2x PBS is shown above. The solution pH was adjusted to 7.0 with 1N NaOH or 1N HCL, then sterilized by autoclaving at 15 lb/in^2 for 15 minutes.

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 water and sonicating 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 at 15 lb/in^2 for 15 minutes.

13. 10% Sodium dodecyl sulphate (SDS)

The solution was prepared by dissolving 10 g of sodium dodecyl sulphate in 100 ml sterile distilled water. Sterilization is not required.

14. 20x SSC

3 M NaCl

0.1 M Tri-sodium citrate

The ingredient of 20x SSC is shown above. The solution pH was adjusted to 7.0 with 1N NaOH, then sterilized by autoclaving at 15 lb/in^2 for 15 minutes

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 of 0.15 M NaCl and heat at 95° C for 5-10 minutes. Store at -20°C.

17. RNase T_1 solution

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

Add 80 µl of RNase T_1 into 10 ml of 0.1 M Tris-HCl (pH 7.5), then heat at 95°C for 5 minutes. Store at -20°C.

18. Proteinase K solution

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

Dissolve proteinase K in Tris-HCl buffer. Use freshly prepared solution.

19. Nuclease P1 solution

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

Dissolve nuclease P1 in sodium acetate containing $ZnSO_4$. Store at 4°C.

20. Alkaline phosphatase solution

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

Dissolve alkaline phosphatase in Tris-HCl buffer. Store at -20°C.

21. 0.1 M Tris-HCl buffer, pH 9

Tris	1.21 mg
Distilled water	100 ml

Dissolve Tris base in distilled water, adjust the pH to 9 with conc.HCl.

22. TE buffer (pH 8.0)

10 mM Tris HCl (pH 8.0)

1 m M Na_2-EDTA (pH 8.0)

The ingredient of TE buffer (pH 8.0) is shown above. Sterile by autoclaving at 15 lb/in^2 for 15 minutes, store at 4°C.

23. TE buffer + RNase A

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

The ingredient is shown above. Mix the ingredient together and store at 4°C.

24. Saline-Na_2 EDTA

0.1 M NaCl

50 mM EDTA.2Na (pH 8.0)

The ingredient is shown above. Mix the ingredient together, sterile by autoclaving at 15 lb/in^2 for 15 minutes. Store at room temperature.

25. Reagents and buffers for DNA-DNA hybridization

25.1 Prehybridization solution

100x Denhardt solution	5	ml
10 mg/ml Salmon sperm DNA	1	ml
Sterile 20x SSC	10	ml
Formamide	50	ml
Distilled water	34	ml

Sequentially dissolve the above ingredients in disstilled water.

25.2 Hybridization solution

Prehybridization solution	100	ml
Dextran sulfate	5	g

Dissolve dextran sulphate in prehybridization solution, store at 4°C.

25.3 Solution I

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

Dissolve Bovine serum albumin and Triton X-100 in PBS solution.

Store at 37°C.

25.4 Solution II

Streptavidin-POD	1	μl
Solution I	4	ml

Dissolve Streptavidin-POD in Solution I. Store at 4°C.

25.5 Solution III

3,3',5,5'-Tetramethylbenzidine (TMB) (10 mg/ml in DMFO)	100	μl
0.3% (v/v) H_2O_2	100	μl
0.4 M Citric acid + 0.2 M Na_2HPO_4 buffer pH 6.2 in 10% (v/v) DMFO	100	μl

Mix the above ingredient together. Store at 37°C.

25.6 2 M H_2SO_4

conc. H_2SO_4	22	ml
Distilled water	178	ml

Add conc. H_2SO_4 into distilled water. The solution was sterilized by autoclaving at 15 lb/in^2 for 15 minutes. Store at room temperature.

26. Fehling's solution

Solution I:

Copper sulfate pentahydrate	34.64 g
Distilled water	500 ml

Solution II:

Sodium potassium tartate	173 g
Sodium hydroxide	50 g

Distilled water	500 ml

Mix solution I and II together. Store at room temperature.

APPENDIX D

Physiological and biochemical characteristics of isolates,

primers, 16S rRNA gene sequences and DNA G+C contents

Physiological and biochemical characteristics of isolates.

Isolate code.	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	Hydrolysis				
	3	5	5	6	8	9	10	15	20	45	50	55	60														Casein	Gelatin	Starch	L-Tyrosine	Tween 80
PA4-1	-	-	-	+	+	+	-	w	+	+	+	-	-	+	+	+	-	+	-	+	-	-	N/N	+	+	-	-	-	+	-	-
PBS5	+	+	-	+	+	+	-	+	+	+	+	-	-	+	+	+	+	+	-	-	-	-	K/K	-	-	-	+	-	+	-	-
T4-1	+	+	-	+	+	+	-	+	+	+	+	-	-	+	+	+	+	+	-	-	-	-	A/A	+	+	-	+	-	+	-	-
T6-1	+	+	-	+	+	+	-	+	+	+	+	-	-	+	+	+	+	+	-	-	-	-	K/A	+	+	+	+	+	+	-	-
T3-3	+	+	-	+	+	+	-	+	+	+	+	-	-	+	+	+	+	-	+	+	-	-	K/A	+	+	+	+	+	+	-	-
T10-2	+	+	-	+	+	+	-	+	+	+	+	-	-	+	+	+	+	-	+	+	-	-	K/A	+	+	+	+	+	+	-	-
PBS4	+	+	W	+	+	+	-	+	+	+	+	+	-	+	+	+	+	-	-	+	-	-	A/A	+	+	+	+	+	+	+	-
PA3-3	+	+	-	+	+	+	-	+	+	+	+	+	-	+	+	-	-	+	-	-	-	-	A/A	+	+	+	+	+	+	-	-
PA3-5	+	+	-	+	+	+	-	-	+	+	+	+	-	+	+	-	-	+	-	-	-	-	K/A	+	+	+	+	+	+	-	-
PA4-3	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	+	-	+	+	-	-	-	A/A	+	+	+	-	+	-	-	-
PA4-4	+	+	-	+	+	+	-	+	+	+	+	+	-	+	+	-	+	-	+	+	-	-	K/A	+	+	+	-	+	-	-	-

Symbols: +, positive; -, negative; w, weakly positive; N,neutral; K, alkaline; A, acid

Physiological and biochemical characteristics of isolates (Cont)

Isolate code.	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	Hydrolysis				
	3	5	5	6	8	9	10	15	20	45	50	55	60														Casein	Gelatin	Starch	L-Tyrosine	Tween 80
T3-2	+	+	-	+	+	+	-	+	+	+	+	w	-	+	+	+	+	-	+	-	-	-	K/A	+	+	+	+	-	+	-	-
T6-3	+	+	-	+	+	+	-	+	+	+	+	-	-	+	+	+	+	-	+	-	-	-	K/A	+	+	+	+	-	+	-	-
N14-2	+	+	-	+	+	+	-	+	+	+	+	-	-	+	+	+	-	-	-	-	-	+	K/K	+	-	+	-	-	-	-	-
PF2-1	+	-	-	+	+	+	-	+	+	+	+	-	-	+	+	+	-	+	-	-	-	+	K/K	+	-	+	-	+	-	-	-
PD1-2	+	+	-	+	+	+	-	-	+	+	+	-	-	+	+	+	-	+	-	+	-	+	K/K	+	-	+	-	+	-	+	-
T6-4	+	+	-	+	+	+	-	+	+	+	+	-	-	+	+	+	-	-	-	-	-	-	K/K	+	+	+	-	+	-	-	-
N3-2	+	+	+	+	+	+	-	-	+	+	+	-	-	+	+	+	-	-	-	-	-	-	K/K	+	+	+	-	+	-	-	-
N12	+	-	-	+	+	-	-	+	+	+	-	-	-	+	+	+	-	+	-	-	-	-	K/N	+	+	+	+	+	-	-	-
N16-2	+	-	-	+	+	-	-	-	+	+	+	-	-	+	+	+	-	-	-	-	-	-	K/K	+	+	+	-	+	-	+	-
PA1-4	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	+	-	+	-	-	-	-	K/A	+	-	-	-	-	-	-	-
PA2-4	+	-	+	+	+	+	-	+	+	+	+	+	-	+	+	+	-	-	-	-	-	-	K/A	+	-	-	-	+	-	-	-

Symbols: +, positive; -, negative; w, weakly positive; N,neutral; K, alkaline; A, acid

Physiological and biochemical characteristics of isolates (Cont)

Isolate code.	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	Hydrolysis				
	3	5	5	6	8	9	10	15	20	45	50	55	60														Casein	Gelatin	Starch	L-Tyrosine	Tween 80
PA4-2	+	+	+	+	+	+	-	+	+	+	+	-	-	+	+	+	-	+	-	-	-	-	K/A	+	-	-	-	-	-	-	-
PB11	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	+	+	+	-	-	-	+	K/A , gas[+]	+	+	+	-	-	-	-	-
PBH2	+	+	+	+	+	+	-	-	+	+	+	-	-	+	+	+	+	+	-	-	-	+	K/K	+	-	+	-	-	-	+	-
PBH4	+	+	+	+	+	+	-	-	+	+	+	+	-	+	+	+	+	+	+	+	-	+	K/A	+	+	+	-	-	-	-	-
PBS3	+	+	+	+	+	+	-	-	+	+	+	+	-	+	+	+	+	+	+	+	-	+	K/A	+	+	+	-	-	-	-	-
PT4-2	-	-	+	+	+	+	-	+	+	+	+	-	-	-	-	+	-	+	-	-	-	-	N/N	+	+	-	-	+	+	-	-
PN8-3	-	-	+	+	+	-	-	+	+	+	+	-	-	+	-	+	-	+	-	+	-	-	N/N	+	+	-	-	+	+	-	-
PN12-2	-	-	-	+	+	-	-	+	+	+	+	-	-	+	-	+	-	+	-	-	-	-	N/N	+	+	-	-	-	+	-	-
PN12-3	-	-	-	+	+	-	-	+	+	+	+	-	-	+	-	+	-	+	-	-	-	-	N/N	+	+	-	-	-	+	-	-
PT6-2	+	-	+	+	+	+	-	+	+	+	+	-	-	+	-	+	-	+	-	+	-	-	N/N	+	+	-	-	+	+	-	-
PT6-3	-	-	+	+	+	+	-	+	+	+	+	+	-	+	-	+	-	+	-	+	-	-	N/N	+	+	-	+	+	+	-	-

Symbols: +, positive; -, negative; w, weakly positive; N,neutral; K, alkaline; A, acid

Physiological and biochemical characteristics of isolates (Cont)

Isolate code.	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	Hydrolysis				
	3	5	5	6	8	9	10	15	20	45	50	55	60														Casein	Gelatin	Starch	L-Tyrosine	Tween 80
PN13-1	+	-	-	-	+	+	-	-	+	+	+	-	-	+	+	+	-	+	-	-	-	-	N/N	+	+	-	-	+	+	-	-
N5-3	-	-	+	+	+	-	-	-	+	+	+	-	-	+	+	+	-	+	-	+	-	+	K/N, gas*	+	+	+	-	+	-	-	-
T3-2X	-	-	+	+	+	-	-	-	+	+	+	-	-	+	-	+	-	+	-	+	-	-	A/A	+	+	-	-	-	+	-	-
PT2-3	-	-	-	+	+	-	-	-	+	+	+	-	-	+	-	-	-	+	-	-	-	-	N/N	+	+	-	-	+	+	-	-
PN8-2	+	+	+	+	+	+	-	-	+	+	+	+	-	+	+	+	+	+	-	+	-	+	K/A	+	+	+	+	-	+	-	-
PN1-2	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	+	-	+	-	+	-	+	K/N, H_2S*	+	-	+	+	+	-	+	-
TT2-2X	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	+	-	+	-	+	-	+	K/N	+	-	+	-	+	-	+	+
T8-1X	+	+	+	+	+	-	-	+	+	+	+	-	-	+	+	+	-	+	-	-	-	-	K/N	+	-	+	-	-	-	-	+
PN8-1	-	-	-	+	+	-	-	+	+	+	+	-	-	+	+	+	-	+	-	-	-	+	K/N	+	-	+	+	-	-	-	-
PN9-3	+	-	+	+	+	+	-	+	+	+	+	-	-	+	-	-	-	+	-	-	-	+	K/N	-	-	+	-	+	-	+	+
PN20-1	+	+	+	+	+	+	-	+	+	+	-	-	-	+	-	-	-	+	-	-	-	+	A/A	-	-	+	-	+	-	-	-

Symbols: +, positive; -, negative; w, weakly positive; N,neutral; K, alkaline; A, acid

Physiological and biochemical characteristics of isolates (Cont)

Isolate code.	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	Hydrolysis				
	3	5	5	6	8	9	10	15	20	45	50	55	60														Casein	Gelatin	Starch	L-Tyrosine	Tween 80
PT1-1	-	-	-	+	+	-	-	+	+	+	+	+	-	+	+	+	-	+	-	+	-	-	K/N	+	+	-	-	+	+	-	-
PT1-2	+	+	+	+	+	+	-	+	+	+	+	+	-	+	-	-	-	+	-	+	-	-	A/A	-	+	+	-	-	+	-	-
PT2-4	+	+	+	+	+	+	-	+	+	+	+	-	-	+	-	-	-	+	-	+	-	-	A/A	-	+	+	-	-	+	-	-
PT6-4	+	+	+	+	+	+	-	+	+	+	+	+	-	+	+	-	-	+	-	+	-	-	A/A	+	+	+	-	-	+	-	-
PN16-5	+	+	+	+	+	+	-	+	+	+	+	-	-	+	+	+	-	+	-	+	-	-	A/A	+	+	+	-	+	-	+	-
N5-1X	+	+	+	+	+	+	-	+	+	+	+	-	-	+	+	+	+	+	+	+	-	+	A/A	+	+	+	-	+	+	-	-
N9-2	+	+	+	+	+	+	-	w	+	+	+	w	-	+	+	+	+	+	-	+	+	-	A/A	+	-	+	-	-	-	-	-

Symbols: +, positive; -, negative; w, weakly positive; N,neutral; K, alkaline; A, acid

Acid production from carbohydrates

Isolate code.	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 – glucoside	Raffinose	L-Rhamnose	D-Ribose	Salicin	D-Sorbitol	L-Sorbose	Sucrose	D-Trehalose	D-Xylose
PA4-1	-	w	+	-	w	w	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	w	-	w	-	+
PBS5	-	w	+	+	-	+	-	-	-	-	w	-	-	+	-	-	-	-	+	-	+	-	-	+	-	+
T4-1	-	-	+	+	-	+	-	+	-	-	-	-	+	+	-	-	-	-	-	-	+	-	-	+	+	-
T6-1	-	-	+	+	-	+	-	+	-	-	-	-	+	+	-	-	-	-	-	-	+	-	-	+	+	-
T3-3	-	+	-	+	+	+	-	w	-	-	w	+	+	-	w	+	-	+	-	w	-	-	-	+	+	w
T10-2	+	+	-	+	-	+	-	+	-	-	+	+	+	-	+	+	-	+	-	w	-	-	-	+	+	-
PBS4	+	+	-	+	-	+	-	+	-	-	+	+	+	-	+	+	-	+	-	+	-	-	-	+	w	-
PA3-3	-	-	-	-	-	-	-	-	-	-	-	-	w	-	-	-	-	-	-	-	-	-	-	-	-	-
PA3-5	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
PA4-3	-	+	+	+	+	+	+	+	-	-	-	+	+	+	-	-	+	-	-	+	+	+	-	+	+	+
PA4-4	-	+	-	+	+	+	-	+	-	-	+	+	+	-	+	+	-	+	-	+	-	-	-	+	+	+

Symbols: +, positive; -, negative; w, weakly positive

Acid production from carbohydrates (Cont)

Isolate code.	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 – glucoside	Raffinose	L-Rhamnose	D-Ribose	Salicin	D-Sorbitol	L-Sorbose	Sucrose	D-Trehalose	D-Xylose
T3-2	-	-	+	+	-	+	-	w	-	-	-	+	-	-	-	-	-	-	-	+	+	-	-	+	+	-
T6-3	+	-	+	+	-	+	w	w	-	-	-	+	w	+	-	+	-	-	-	-	w	-	-	+	+	-
N14-2	+	-	+	+	-	+	-	w	-	-	-	+	+	+	-	+	-	-	-	-	+	-	-	+	+	-
PF2-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PD1-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T6-4	+	-	+	+	-	+	-	-	-	-	-	+	+	+	-	+	-	-	-	-	+	-	-	+	+	-
N3-2	+	-	+	+	-	+	-	w	-	-	-	+	+	+	-	+	-	-	-	-	+	-	-	+	+	-
N12	+	-	-	-	-	-	-	+	-	-	+	+	-	-	-	-	+	-	-	+	+	+	+	-	-	+
N16-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PA1-4	+	-	+	+	-	+	-	+	-	-	-	+	+	+	-	+	-	-	-	-	+	-	-	+	+	-
PA2-4	W	-	+	-	-	+	-	-	-	-	-	-	-	+	-	+	-	-	-	-	+	-	-	+	+	-

Symbols: +, positive; -, negative; w, weakly positive

Acid production from carbohydrates (Cont)

Isolate code.	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 – glucoside	Raffinose	L-Rhamnose	D-Ribose	Salicin	D-Sorbitol	L-Sorbose	Sucrose	D-Trehalose	D-Xylose
PA4-2	+	-	+	+	-	+	-	+	-	-	-	+	+	+	-	+	-	-	-	-	+	-	-	+	+	-
PB11	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	+	-	-	+	+	-	-	-	-	+
PBH2	-	-	-	-	+	w	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
PBH4	+	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	+	-	-	+	-	-	-	-	-	+
PBS3	+	-	-	-	-	-	-	+	w	-	+	+	-	-	-	-	+	-	-	+	+	+	+	-	-	+
PT4-2	+	+	+	+	+	+	-	+	-	-	+	+	+	+	+	-	w	+	+	+	w	-	+	+	+	+
PN8-3	+	+	+	+	+	+	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+
PN12-2	+	+	+	+	+	+	-	+	-	-	+	+	+	+	+	-	-	w	+	+	-	-	-	+	+	-
PN12-3	w	w	+	w	w	w	-	+	-	-	+	+	+	w	+	-	-	w	-	+	+	-	-	+	+	+
PT6-2	+	+	+	+	+	+	-	w	-	-	+	+	+	+	+	+	+	+	+	+	+	-	w	+	+	+
PT6-3	+	+	+	+	+	+	-	w	-	-	+	+	+	+	+	+	+	+	+	+	+	-	w	+	+	+

Symbols: +, positive; -, negative; w, weakly positive

Acid production from carbohydrates (Cont)

Isolate code.	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 – glucoside	Raffinose	L-Rhamnose	D-iRibose	Salicin	D-Sorbitol	L-Sorbose	Sucrose	D-Trehalose	D-Xylose
PN13-1	+	+	+	w	+	+	+	w	w	w	+	+	+	+	+	+	w	+	w	w	w	+	-	+	w	+
N5-3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T3-2X	+	+	-	w	+	-	-	+	-	+	+	+	+	+	+	-	w	w	-	+	w	-	-	+	w	+
PT2-3	-	w	w	w	w	-	-	-	-	-	+	+	+	w	+	w	-	w	w	w	-	-	-	-	+	-
PN8-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PN1-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TT2-2X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T8-1X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PN8-1	w	-	w	w	-	-	-	+	-	-	w	w	+	-	w	w	-	-	w	w	-	-	-	-	w	-
PN9-3	-	-	-	-	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
PN20-1	-	-	-	-	+	-	-	-	-	-	-	-	-	+	-	-	w	-	-	-	-	-	-	-	-	-

Symbols: +, positive; -, negative; w, weakly positive

Acid production 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 - glucoside	Raffinose	L-Rhamnose	D-Ribose	Salicin	D-Sorbitol	L-Sorbose	Sucrose	D-Trehalose	D-Xylose
PT1-1	-	-	+	-	+	+	-	-	-	+	+	+	+	+	+	w	-	+	+	w	-	-	-	-	+	w
PT1-2	+	-	+	+	+	+	-	+	+	+	+	+	+	+	+	+	-	+	+	-	-	+	+	+	-	-
PT2-4	+	-	+	+	+	+	-	+	+	+	+	+	+	+	+	+	-	+	+	-	+	+	-	+	-	-
PT6-4	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	+
PN16-5	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N5-1X	+	-	+	+	+	+	-	+	+	+	+	+	+	+	+	+	-	+	+	-	-	+	+	+	-	-
N9-2	-	+	-	+	+	+	+	+	-	-	+	+	+	+	+	-	-	-	+	+	+	+	-	-	+	+

Symbols: +, positive; -, negative; w, weakly positive

1. Primers for 16S rRNA gene amplification and sequencing

9F	5'-GAGTTTGATCCTGGCTCAG-3'
357R	5'-CTGCTGCCTCCCGTAG-3'
802R	5'-TACCAGGGTATCTAATCCC-3'
1115R	5'-AGGGTTGCGCTCGTTG-'3
1541R	5'-AAGGAGGTGATCCAGCC-3'

2. 16S rRNA gene sequences

2.1 Strain PA4-1 (1080 bp)

TTTTAGTTTAAGTCCCTGGCTCAGGACGAACGCTGGCGGCGTGCCTAATACATGCAAGTCGAGCGGATCTTCAAGGGAGCTTGCTTCCTGAGAAG
GTTTAGCGGCGGGACGGGGTGAGTAACACGTAGGCAACCTGCCCTCAAGACCGGGATAACATTCGGAAACGAATGCTAAGACCGGATACGCCAA
GGAGGAGGCATCTTCTTCTTGGGAAACACGGCGCAAGCTGTGGCTTGAGGATGGGCCTGCGGCGCATTAGCTAGTTGGCGGGGTAACGGCCCACC
AAGGCGACGATGCGTAGCCGACCTGAGAGGGTGAACGGCCACACCTGGGGATTGAGACACGGCCCAGACTCCTACGGGAGGCAGCAGTAGGGA
ATCTTCCACAATGGGCGCCAAGCCTGATGGAGCAACGCCGCGTGAGTGAGGAAGCCCTTCGGGTCGTAAAGCTCTGTTGCCAGGGAAGAATAAG
AGCCAGTTAACTGCTGGTTCGATGACGGTACCTGAGAAGAAAGCCCCGGCTAACTACGTGCCAGCAGCCGCGGTAATACGTAGGGGGCAAGCGTT
GTCCGGAATTATTGGGCGTAAAGCGCGCGCAGGCGGTTTCTTAAGTCTGGTGTTTAAGTGCGGGGCTCAACCCCGTGACGCACTGGAAACTGGGA
GACTTGAGTGCAGAAGAGGAGAGCGGAATTCCACGTGTAGCGGTGAAATGCGTAGAGATGTGGAGGAACACCAGTGGCGAAGGCGGCTCTCTGG
ACTGTAACTGACGCTGAGGCGCGAAAGCGTGGGGAGCAAACAGGATTAGATACCCTGGTAGTCCACGCCGTAAACGATGAGTGCTAGGTGTTGG
GGGGGTCCACCCCTCGGTGCCGAAGTTAACACATTAAGCACTCCGCCTGGGGAGTACGGTCGCAAGACTGAAACTCAAAGGAATTGACGGGGAC
CCGCACAAGCAGTGGAGTATGTGGTTTAATTCGAAGCAACGCGAAGAACCTTACCAGGTCTTGACATCCCTCTGAATCGTTAGAGATAGGCCGGC
CTTCGGGACAGAGGAGACAGGTGGTGCATGGTACGTCAGCCC

2.2 Strain PBS5 (1493 bp)

ATTAGTTTGTCCTGGCTCAGGACGAACGCTGGCGGCGTGCCTAATACATGCAAGTCGAGCGAATCAATAGGAGCTTGCTCCTGTTGGTTAGCGGC
GGACGGGTGAGTAACACGTGGGCAACCTGCCTGTAAGACTGGGATAACACCGGGAAACCGGTGCTAATACCGGATAATTCTTTCCCTCTCATGAG
GGAAAATTGAAAGTCGGTTTTCGGCTGACACTTAACAGATGGGCCCGCGGCGCATTAAGCTAGTTGGTGAGGTAACGGCTCACCAAGGCGACCGA
TGCGTTAGCCGACCTGAGAGGAAATCGGCCCCACTGGGATTGAGACCCGGCCCATTCCTACGGGAGGCAGCAGTAGGAATTTCCCATGGGACGAA
ATCTGATGGAGCAACGCCGCGTGAGCGAGAAGCCTTTCGGGTCGTAAACTCTGTTGTTAGGGAAGAACAAGTACCGGAGTAACTGCCGGTACCTT
GACGGTACCTAACCAGAAAGCCACGGCTAACTACGTGCCAGCAGCCGCGGTAATACGTAGGTGGCAAGCGTTGTCCGGAATTATTGGGCGTAAA
GCGCGCGCAGGCGTCCTTTAAGTCTGATGTGAAAGCCCACGGCTCAACCCGTGGAGGGTCATTGGAAACTGGGGGACTTGAGTGCAGAAGAGGA
AAGCGGAATTCCACGTGAACCGGTGAAATGCGGAGAGATGTGGAGGAACACCAGGGGCGAAGGCGGCTTTTCTGGTCTGTAAACTGACGCTGAG
GCGCGAAAGCGTGGGGAGCAAACAGGATTAGATACCCTGGTAGTCCACGCCGTAAACGATGAGTGCTAAGTGTTAGAGGGTTTCCGCCCTTTTAG
TGCTGCAGCTAACGCATTAAGCACTCCGCCTGGGGAGTACGGCCGCAAGGCTGAAACTCAAAGGAATTGACGGGGGCCCGCACAAGCGGTGGAG
CATGTGGTTTAATTCGAAGCAAACGCGAAGAACCTTACCAGGTCTTGACATCCTCTGACACTCCTAGAGATAGGACGTTCCCCTTCGGGGGACAG
AGTGACAGGTGGTGCATGGTTGTCGTCAGCTCGTGTCGTGAGATGTTGGGTTAAGTCCCGCAACGAGCGCAACCCTTGATCTTAGTTGCCAGCATT
CAGTTGGGCACTCTAAGGTGACTGCCGGTGACAAACCGGAGGAAGGTGGGGATGACGTCAAATCATCATGCCCCTTATGACCTGGGCTACACACG
TGCTACAATGGATGGTACAAAGGGCTGCAAAACCGCAAGGTCTAGCCAATCCCATAAAACCATTCTCAGTTCGGATTGTAGGCTGCAACTCGCCT
ACATGAAGCCGGAATCGCTAGTAATCGCGGATCAGCATGCCGCGGTGAATACGTTCCCGGGCCTTGTACACACCGCCCGTCACACCACGAGAGTT
TGTAACACCCGAAGTCGGTGGGGTAACCGTAAGGAGCCAGCCGCCTAAGGTGGGACAGATGAGGGTGAAGT

2.3 Strain T3-3 (1204 bp)

TCCGGGGTTCGAAAAACCTTCTGTTTTTTTAGGGGAAAGAAACCAAGTTCCGGGAGGAAACCGCCTCCTAACCCTTTGACGGTCCCCAACCCAAG
AAAAAGCCCCCGGGCCTAAACTAACCGTGGCCCAAGCACCCGCGGTTAATCCGTAAGGGTGGCAAGCCGTTAATTCCCGGAAATTTATTTGGGCC
GTAAAACCGCGCGCCAGGCGGTTTTTTAAGTTTGATGTTGAAAAGCCCCCACGGCTCAACCGTGGAGGTTCATTGGAAACTGGGGAACTTGAGTG
CAGAAGAGAAAAGCGGAATTCCCACGTGTAAGCGGTGAAATGCGTAGAGATGTGGAGGAACACCAGTGCGAAGGCGGCTTTTTGGTCCTGTAAC
TGACGCTGAGGCGCGAAAGCGTGGGGAGCAAACCGGATTAGATCCCTGGTAGTCCCACGCCCGTAAACGATGAGTGCTAAGTGTTAGAGGGTTTC
CGCCCTTTTAGTGCCCGCCAGCCTAACCGCCAATTAAAGCCCTCCCCCCCTGGGGGAGAACCGGTTCCCCAAAGACCTGAAAACCTCCAAAAAGG
AATTTGAACGGGGGGCCCCGCACAAAGCCGGGTGGAGCATTGTGGTTTAAATTTCGAAAGCCAACCGCGAAGAACCCTTATCCCAGGTTCTTGGA
ACCATCCTCTGGACAACTCTAAAAGATAAGAGCGTTTTCCCCCCTTCGGGGGACAGAGTGACAGGGTGGGTGCATGGTTTGTCCGTCCACCTCGTG
TCGTGAAGATTGGTTGGGTTAAAGTCCCCGCAAACGAGCCGCAACCCTTGATCTTAGTTGCCCAGCATTTAGTTGGGCACTCTAAGGTGCTGCCCG
GTGACAAACCGGAGGAAGGTGGGGATGACGTCAAAATCATCATGCCCCTTATGACCTGGGCTAAACACGTGCTACAATGGATGGTACAAAGGGC
TGCAAGACCGCGAGGTCAACCAATCCCATAAACCATTCTCAGTTCGGATTGTAGGCTGCAACTCGCCTACATGAAGCTGGAATCGCTAGTAATCG
CGGATCAGCATGCCGCGGTGAATACGTTCCCGGGCCTTGTACACACCGCCCGTCACACCACGAGAGTTTGTAACACCCGAAGTCGGTGGAGTAAC
CGTAAGGAGCTAGCCGCCTAAGGTGGGACAGATGATTGGGGTGAAGACGTAACAAGGGAACCGC

2.4 Strain T3-2 (1167 bp)

TTTCCGGGGTCCGGAAAAACTTCTTTTTTTAAGGGAAAGACCAGTCCTAAGTTAGAAAAGCCTGGGCCCTTTGAACCTTCCCTAAACCCAGAAAA
AGCCGCGGCTAAACTACGGCCAAGCAGCCCGCGTTAATACGTAGGTGGGCAAGCGTTATCCCGGAATTATTGGGCGTAAAGCGGCGCGCAGGTG
GTTTCTTAAAGTCTGATGTGAAAGCCCACGGCTCAACCGTGGAGGGTCCATTGGAACTGGGAGACTTGAGTGCAGAAGAGGAAAGTGGAATTCCA
TGTGTAGCGGTGAAATGCGTAGAGATATGGAGGAACCCCAGTGGCGAAGGCGACTTTCTGGTCTGTAACTGACACTGAGGCGCGAAAGCGTGGG
GAGCAAACAGGATTAGATACCCTGGTAGTCCACGCCGTAAACGATGAGTGCTAAGTGTTAGAGGTTTCCCCCCCTTTAAGGTGCCTGGAAAGGTT
AACCCGCATTAAGCACTCCCCCCCTTGGGGGAGTTACCGCCCCCAAAGGCCTTGAAACCCTCCAAAGGAATTTGACCGGGGGGCCCCGCACAAGC
GGTGGGAGCATGGTGGTTTTAATTCCGGAAAGCAACCGCGAAAGAACCCTTACCCAGGTCTTTGACATCCCTCCTGAAAAACCCCAAGAGATAGG
GCTTCCTCCTTTCCGGGGAGCAGAAGTTGACCAGGGTGGGTGCATTGGTTTGTCCGTCCAGCCTCCTTGTCGTGAGATGTTTGGGGTTAAATCCCC
GCAAACGAGCGCAACCCTTGATTCTTAAGTTGCCATCAATTAATGGGGCCTCTAAGGGACTGCCCGGTGAAAAACCGAGGAAGGTGGGGATGCTC
AAATCTCATGCCCCTTATGACCTGGGCTACACACGTGCTACAATGGACGTACAAAGAGCTGCAAGACCCGAGGTGGAGCTATTCTCATAAAACCG
TTCTCAGTTCGGATTGTAGGCTGCAACTCGCCAATGAAAGCGGAATCGCAGTAATCCGCGGATCACAGCCGCGGTGAATACGTTCCCGGGCTTGT
ACACACCGCCCGTCACACACGAGAGTTTGTAACACCCGAAGTCGGTGGGGTAACCCTTTTTGGAGCCAGCCGCCTAAGGTGGGACAGATGATTGG
GGTGAAAACGTAACCCTGGGACCCCCC

2.5 Strain N14-2 (803 bp)

ATCCTTAGTTTGATCCTGGCTCAGATTGACGCTGGCGGCAGGCCTAACACATGCAAGTCGAGCGGATGAAGAGGCTTGCTCTCTGATTTAGCTGGC
GGACGGGGGAGTAATGCCCCTAGGGAAATTCTGCCTGGTTAGGTGGGGGATAACCGTCCCCGGAAAACGGGGGCCGCCTAATACCGCATACGT
CCCTACCCGGGGAAAAAAGCAGGGGGGACCTTCGGGGCCTTGCGTCTTATCCAGATGAAGCCCTAAGGTCGGATTTAGCCCTAGTTTGGTGAGGT
AAAATGGGCTCACCCAAGGCGACGATCCCGTAACTGGTCTGAGAGGATGATCCAGTCCACCACTGGGAACTTGAAACACGGTCCAACTCCTAGGG
AGGCAGCGTGGGGGAAATATGGCAATGGGGAAAGCCTGATCCAGCCATGCCGCGTGTGTGAAGAAGGTCTTCGGATTGTAAAAGCACTTTAAGTT
GGGAGGAAGGGCAAGTAAGTTAATCCCTTGCTGTTTTGACGTTTCCGACAGAATAAAGCACCGGCTAACTTCGTGCCAGCAGCCGCGGTAATACG
AAGGGTGCAAGCGTTAATCCGGAATTACTGGGCGTAAAGCGCGCGTAGGTGGTTCGTTAAGTTGGATGTGAAAGCCCCGGGCTCAACCTGGGAAC
TGCATCCAAAACTGGCGAGCTAGAGTACGGTAGAGGGTGGTGGAATTTCCTGTGTAGCGGTGAAATGCGTAGATATAGGAAGGAACACCAGTGG
CGAAGGCGACCACCTGGACTGATACTGAATGAGTCAAGACTCCC

2.6 Strain T6-4 (800 bp)

TCCCCCCTAGTTTGTCCTGGCTCAGATTGAACGCTGGCGGCAGGCCTAACACATGCAAGTCGAGCGGATGAAGGGAGCTTGCTCTCTGATTCAGCG
GCCGGACGGGTGAAGTAATGCCCTTAGGAAATCTGGCCCCCGGTAAATGGGGGGGATAACGTTCCCGAAAGGGAACCGCTAAATACCCGGCAT
ACGTCCCTACCGGGGAGAAAGCGGGGGATCTTCGGACCTCGCGTTTATCGGATGACGCCTAAGGTCCGGATTTAGCCAAGTTTGGTGGGGTAAAA
GGCCTACCCAAAGGCGACCGATCCCGTAACCTGGTCTGAGAGGGATGATCAGTCCACACTGGAACTGGAGACCCCGGTCCAGACTCCCTACGGGA
GGCAGCAGTGGGGAATATTTGACATGGGTAAGCCTGATCCAGCCATCCCGCGTGTGTGAAGAAGGTCCTTCGGATTGTAAAGCCTTTAAGTTGG
GGAGGGAAGGGCAGTAAGTTAATCCCCTTGCTGTTTGACGTTACCCAACAGAATAAGCACCGGGCAACTTCGTCCAGCAGCCGCGGTAATACGAA
AGGGTGCAAGCGTAATCGGAATTACCTGGGCGTAAAGCGCGCTAGGTGGTTTGGTAAGATGGATGTGAAATCCCCCGGGCTCAACCTGGGACGCA
TCCATAACTGCCTGACTAGAGTACGGTAGAGGGTGGTGGAATTTCCTGTGTAGCGGTGAAATGCGTAGATATAGGAAGGAACACCAGTGGCGAA
GGCGACCACCTGGACTGATACTGGAATGAGTCGGACCCCCC

2.7 Strain PT4-2 (1510 bp)

AATCCTTAGTTTGGTCCTGGCTCAGGACGAACCCGGGCGGCGTGCCTAATACATGCAAGTCGAGCGGATCTTCTCAAGTAGCTTGCTACTTGAGAA
GGTTAGCGGCGGACGGGTGAGTAACACGTAGGCAACCTGCCCATAAGACCGGGATAACATTCGGAAACGAATGCTAAGACCGGATACGCAGAGT
GGGGCATCTTCACTTTGGGAAACACGGTGCAAGCTGTGGCTTATGGATGGCCTGACGCCCCATTAGCTAGTTGGCGGGGAAACGGCCTACCAAGG
CGACGATGCGTAGCCGACCTGAGAGGGTGAACGGCCACCACTGGGACTGAGACACGGCCCAGACTCCTACGGGAGGCAGCAGTAGGGAATCTTC
CACAATGGGCGCAAGCCTGATGGAGCAACGCCGCGTGAGTGAGGAAGGCTTTCGGGTCGTAAAGCTCTGTTGCCAGGGAAGAATAAGGGCGAGG
TCACTACTCGTCCGATGACGGTACCTGAGAAGAAAGCCCCGGCTAACTACGTGCCAGCAGCCGCGGTAATACGTAGGGGGCCAAACGTTGTCCGG
AATTATTGGGCCTAAAAGCGCGCCCAGGCGGTTTCTTAAGTCTGGTGTTTAAGTGCGGGGCTCAACCCCGTGTCGCATCGGAAACTGGGAGACTT
GAGTGCAGAAGAGGAGAGCGGAATTCCACGTGTAGCGGTGAAATGCGTAGAGATGTGGAGGAACACCAGTGGCGAAGGCGGATCTCTGGACTGT
AACTGACGCTGAGGCGCGAAAGCGTGGGGAGCAAACAGGATTAGATACCCTGGTAGTCCACGCCGTAAACGATGAGTGCTAGGTGTTGGGGGGG
TCCACCCCTCGGTGCCGAAGTTAACACATTTAAGCACTCTCGCCTGGGGAGTACGGTCGCAAGACTGAAACTCAAAGGAATTGACGGGGACCCGC
ACAACCAGGGGAGTATGTGGTTTAATTCGAAGCAACGCGGAAAAAACCTTACCCAGGTCTGGACATCCCTCTGACCGTCCAAGAAAAAGGGCTTC
CCTTCGGGGCAGAGGAGACAGGTGATGCATGGTTGTCGTCGAACTCGTGTCGTGAGATGTTGGGTTAAGTCCCGCAACGAGCGCAACCCTTGAAT
TTAGTTGCCAGCACGTAAGGGTGGGCACTCTAGATTGACTGCCGGTGACAAACCGGAGGAAGGCGGGGATGACGTCAAATCATCATGCCCCTTAT
GACCTGGGCTACACACGTACTACAATGGCCGGTACAACGGGCTGCGAAGGAGCGATCCGGAGCTAATCCTATAAAGCCGGTCTCAGTTCGGATTG
CAGGCTGCAACTCGCCTGCATGAAGTCGGAATTGCTAGTAATCGCGGATCAGCATGCCGCGGTGAATACGTTCCCGGGTCTTGTACACACCGCCC
GTCACACCACGAGAGTTTACAACACCCGAAGCCGGTGGGGTAACCGCAAGGAGCCAGCCGTCGAAGGTGGGAAGATGATTCTAGAGAGT

2.8 Strain PN8-3 (1491 bp)

AGTTTGAGTTCCTGGCTCAGGACGAACGCGGCGGGTGCCTAAACATGCAAGTCGAGCGGTTTCAAGGGAGTTTGCCTCCCGAGAAGGTTAACGGC
GGACGGGTGTACCAGTAGGCAACCTGCCCCTCAAGCCGGGATAACATTTGGGAAACGAATTTTAAGACCCGGATACCCAAGGAAGGAGGCTCTTT
TTTCTTGGAAACCAGGGGCCAACTTGTGGCTTTGAAGAAAGGCCCTGACGGCCCCTTTAACATATTGGCCGGGGTAAGGCCCCCAGGCGACGATG
CGTAGCCGACCTGAGAGGGGGAACGCCCACACTGGGACTGAGACACGGCCCCAGACTCCTACGGGAGGCAGCAGTAGGGAATCTTCCACAATGG
GCGCAAGCCTGATGGAGCAACGCCGCGTGAGTGAGGAAGGCCTTCGGGTCGTAAAAGCTCTGTTCCCAGGGAAGAATAAGAGCCAGTTAACTGC
TGTTCGATGACGGTACCTGAGAAGAAAGCCCCGGCTAACTACGTGCCAGCAGCCGCGGTAAAACGTAGGGGCCAAGCGTTGTCCGGAATTATTGG
GGGTAAAGCGCGCGCAGCGGTTTTCTTAAGTCTGGTGTTTAAGTGCGGGGCTCAACCCCGTGACGCACTGGAAACTGGGAGACTTGAGTGCAGAA
GAGGAGAGCGGAATTCCACGTGTAGCGGTGAAATGCGTAGAGATGTGGAGGAACACCAGTGGCGAAGGCGGCTCTCTGGACTGTAAACTGACGC
TGAGGCGCGAAAGCGTGGGGGAGCAAACAGGATTAGATACCCTGGTAAGTCCACCCCGTAAACAATGAGTGCTAGGTGTTGGGGGGGTCCCACC
CCCTCGGTGCCGAAGTTAACACATTAACCACTCCCCCTGGGGAGTACGGTCGCAAGACTGAAACTCAAAGGAATTGGACGGGGACCCGCACAAG
CAGTGGAGTAATGGGGTTTAATTCGAAGCAAAGCGAAGAACCCTTACCAGGGTCTTGACATCCCTCTCGAATACAGTTAGAGAAAGCGTAGGCCT
TCGGGACAGAGGAGACAGGTAGTGCATGGTCCTGTCGTCAGACTTCGTGTCGTGAGATGTTGGGTTAAGTCCCGCAACGAGCGCAACCCTTGATC
TTAGTTGCCAGCACTTCGGGTGGGCACTCTAAGGTGACTGCCGGTGACAAACCGGAGGAAGGTGGGGATGACGTCAAATCATCATGCCCCTTATG
ACCTGGGCTACACACGTACTACAATGGCCGGTACAACGGGCAGCGAAGGAGCGATCTGGAGCCAATCCTATAAAGCCGGTCTCAGTTCGGATTGC
AGGCTGCAACTCGCCTGCATGAAGTCGGAATTGCTAGTAATCGCGGAACAGCATGCCGCGGTGAATACGTTCCCGGGTCTTGTACACACCGCCCG
TCACACCACGAGAGTTTACAACACCCGAAGCCGGTGGGGTAACCGCAAGGACCACCTCCCATTTGGAAGAT

2.9 Strain PN12-3 (1505 bp)

GGGGGGGGAATTTTTGTTTTTTCCCTGCCCGACCACCCATTCCCTAAAACATAAATTCAAAGATTTTTTTAAAAAACCTTTCTCCTAAAAAGTTAAC
CCCCCACCTTAATTAACCTTTAGGCAACGGTCCCCATAAACCGGGGAAACCTTGGGAAAGGAATGCTAAAGACCGGATACGCAAAATGGGGGCA
TCTCATTTTTGGAAAACACGGGGCCAAGCTGTGGCTTATGGATGGCCTGGGGCGCATAAGCTAGTTGGTGGGGTAACGGCCTACCAAGGCGACGA
TGGTAGCCGACCTGAGAGGGTGAACGGCCACACTGGGACTGAGACACGGCCCAGACTCCTACGGGAGGCAGCAGTAGGGAATCTTTCCACAATG
GGCGCAAGCCTGATGGAGCAACGCCGCGTGAGTGAGGAAGGCTTTCGGGTCGTAAAGCTCTGTTCCCAGGGAAGAATAAGGGCGAGGTAACTAC
TCGTCCGATGACGGTACCTGAGAAGAAAGCCCCGGCTAACTACGTGCCAGCAGCCGCGGTAATAAGTTAGGGGCCAAACGTTGTTCCGGAATTAT
TTGGGCGTAAAAGCGCGCGCAGGCGGTTTCTTAATTCTGGTGTTTAAGTGCGGGGCTCAACCCCGTGTCGCATCGGAAACTGGGAGACTTGAGTG
CAGAAGAGGAGAGCGGAATTCCACGTGTAGCGGTGAAATGCGTAGAGATGTGGAGGAACACCAGTGGCGAAGGCGGCTCTCTGGACTGTAACTG
ACGCTGAGGCGCGAAAGCGTGGGGAGCAAACAGGATTAGATACCCTGGTAGTCCACGCCGTAAACGATGAGTGCTAGGTGTTGGGGGGGTCCAC
CCCTCGGTGCCGAAGTTAACACATTAAGCACTCCGCCTGGGGAGTACGGTCGCAAGACTGAAACTCAAAGGAATTGACGGGGACCCCCACAAGC
AGTGGAGTAAATGGTTTAATTCGAAGCAACGCGAAAAACCTTACCAGGGTCTTGGACATCCCTCTGACCGTCCAAGAGATAGGGCTTCCCTTCGG
GGCAGAGGAGACAGGTAGTGCATGGTCTGTCGTCAGCTCGTGTCGTGAGATGTTGGGTTAAGTCCCGCAACGAGCGCAACCCTTGAATTTAGTTG
CCAGCACGTAAGGGTGGGCACTCTAGATTGACTGCCGGTGACAAACCGGAGGAAGGCGGGGATGACGTCAAATCATCATGCCCCTTATGACCTGG
GCTACACACGTACTACAATGGCCGGTACAACGGGCTGCGAAGGAGCGATCCGGAGCCAATCCTATAAAGCCGGTCTCAGTTCGGATTGGAGGCTG
CAACTCGCCTCCATGAAGTCGGAATTGCTAGTAATCGCGGATCAGCATGCCGCGGTGAATACGTTCCCGGGTCTTGTACACACCGCCCGTCACACC
ACGAGAGTTTACAACACCCGAAGCCGGTGGGGTAACCGCAAGGAGCCAGCCGTCGAAGTGGGAAGATGATTCCTTGGAGAGTA

2.10 Strain PT6-2 (1508 bp)

GTGAGTTTGAACCCTGGCTCAGGACGAACGCCGGCGGCGTGCCTAATACATTGCAAGTCGAGCGGATCTTCAAGGGAGCTTGCTCCCGAGAAGGT
TAGCGGCGGACGGGTGAGTAACACGTTAGGCAACCTGCCCTCAAGACCGGGATAACATTCGGAAACGAATGCTAAGACCGGATACGCAAGGAGG
AGGCATCTTCTTCTTGGGAAACACGGCGCAACTGTGGCTTGAGGATGGGCCTGCGGCCCTTAATTAGTGGGCGGGTAACGGCCCACCAAGGCGAC
GATGCGTAGCCGACCTGAGAGGGTGAACGGCCACCACTGGGACTGAGACACGGCCCAGACTCCTACGGGAGGCAGCAGTAGGGAATCTTCCACA
ATGGGCGCAAGCCTGATGGAGCAACGCCGCGTGAGTGAGGAAGCCTTTCGGGTCGTAAAGCTCTGTTCCCAGGGAAGAATAAGAGCCAGTTAAC
TGCTGGTTCGATGACGGTACCTGAGAAGAAAGCCCCGGCTAACTACGTGCCAGCAGCCGCGGTAAAACGTAGGGGGCAAGCGTTGTTCCGAAATT
ATTGGGGTAAAGCGCGCGCAGGCGGTTTCTTAAGTCTGGTGTTTAAGTGCGGGGCTCAACCCCGTGACGCACTGGAAACTGGGAGACTTGAGTGC
AGAAGAGGAGAGCGGAATTCCACGTGTAGCGGTGAAATGCGTAGAGATGTGGAGGAACACCAGTGGCGAAGGCGGCTCTCTGGACTGTAACTGA
CGCTGAGGCGCGAAAGCGTGGGGAGCAAACAGGATTAGATACCCTGGTAGTCCACGCCGTAAACGATGAGTGCTAGGTGTTGGGGGGGTCCACC
CCTCGGTGCCGAAGTTAAACACATTAAGCACTCCGCCTGGGGAGTACGGTCCGCAAGACTTGAAACTCAAAGGAATTGACGGGGACCCGCACCA
AGCAGGGGAGTATGTGGGTTTAATTTCGAAGCAACGCGGAAGAACCTTACCAGGTTCTGGACATCCCTTCTGAATACGTAAGAGATAGCGTAGGC
CTTCGGGACAGAGGAGACAGGTGATGCATGGTTGTCGTCAGACTCGTGTCGTGAGATGTTGGGTTAAGTCCCGCAACGAGCGCAACCCTTGATCT
TAGTTGCCAGCACTTCGGGTGGGCACTCTAAGGTGACTGCCGGTGACAAACCGGAGGAAGGTGGGGATGACGTCAAATCATCATGCCCCTTATGA
CCTGGGCTACACACGTACTACAATGGCCGGTACAACGGGCAGCGAAGGAGCGATCTGGAGCCAATCCTATAAAGCCGGTCTCAGTTCGGATTGCA
GGCTGCAACTCGCCTGCATGAAGTCGGAATTGCTAGTAATCGCGGATCAGCATGCCGCGGTGAATACGTTCCCGGGTCTTGTACACACCGCCCGTC
ACACCACGAGAGTTTACAACACCCGAAGCCGGTGGGGTAACCGCAAGGAGCCAGCCGTCGAAGGTGGGAAGATGATTCTTAGAGAGTT

2.11 Strain PN13-1 (1468 bp)

TTTAGGTTTGAAAACCTGGCTCAGGACGAACCGCTGGCGGCGTGCCTAATACATGGCAAGTCGAAGCGGACTTTAACTTTCGGGCAAAGTTAGCG
GCGGACGGGTGAGTAACACGTGGGTAACCCTGCCCCATAAGACTTGGGATAACATTCGGAAACGAATGCTAATACCGGATACGCGAATCGGTCG
CATGATCGAATCGGGAAAGGCGGAGCATTTGCCCTTTATGGAGGGACCCGCGGCGCATAACTTAGTTGGGTGGGTAACGGCTCACCAAGGCGACG
ATGCGTAGCCGACCTGAGAGGGTGATCGTCCACACTGGGACTGAGACACGGCCCAGACTCCTACGGGAGGCAGCAGTAGGGAATCTTCCGCAAT
GGACGAAAGTCTGACGGAGCAACGCCCCCTGAGTGATAAAGGTTTTCGGATCGTAAAAGCTTCTGTTGCCAGGGAAGAACGCTTGCGAGAGTAAC
TGCTCGCAAGGTGACGGTACCTGAAGAAGAAAGCCCCGGCTAAATTACGTGCCAGCAGCCCCGGGTAAAACGTTAGGGGCCAAACGTTGTCTCG
GAATTTATTGGGCGTAAAAGCGCCCCCCAGGCGCCTTGTAAGTCTGTCGTTTAAACTCGGAGCTCAACTTCGAGTCGCGATGGAAACTGCAAAGC
TTGAGTGCAGAAGAGGAAAGTGGAATTCCACGTGTAGCGGTGAAATGCGTAGAGATGTGGAGGAACACCAGTGGCGAAGGCGCTTTCTGGGCTG
TAACTGACGCTGAGGCGCGAAAGCGTGGGGAACAAACAGGATTAGATACCCTGGTAGTCCACCCCGTAAACGATGAATGCTAGGTGTTAGGGGT
TTCGATACCCTTGGTGCCGAAGTTAACACATTAAGCATTCCCCCTGGGGAGTACGGTCCGCAAGACTGAAACTCAAAGGAATTGACGGGGACCCG
CACCAAGCCAGTGGAGTATGTGGTTTAATTCGGAAGCAACCCGGAAAAACCTTACCCAGGTCTTGACATCCCTCTTGACCGCCCAAGAGAAAGGG
CTTTCCTTCGGGACAGAGGAGATCAGGTGGAAGCATGGTTGTCGTCAGACTCGTGTCGTGAGATGTTGGGTTAAGTCCCGCAACGAGCGCAACCC
TTGATCTTAGTTGCCAGCACTTTGGGTGGGCACTCTAGGATGACTGCCGGTGACAAACCGGAGGAAGGTGGGGATGACGTCAAATCATCATGCCC
CTTATGACCTGGGCTACACACGTACTACAATGGCCGATACAACGGGAAGCGAAACCGCGAGGTGGAGCCTTGAGTTCGATCTGGTCTACAGTTAA
TCGACTCAACTCAGTACCAATCGCAATTGTAGGAATCATAGCACGATGGGTAATCGTTCCCGGCCGAGTCAGGCGGGCACCACAGGTGTTCCTGT
CCTGGGGTACGAAAGCCCCCCCAGGTGGAAGATGATCCCTTTGGAGAT

2.12 Strain T3-2X (1509 bp)

GATTTAGTTAATGTCCCTGGCTCAGGACGAACGCCGGCGGCGTGCCTTAATACATGCAAGTCGAGCCGGACTTTGCCTTTCGGGTAAAGTAAGCG
GCGGACGGGTGAGTAACACGTGGGTAACCCTCCCCCATAAGACTGGGATAACATTCGGAAACGAATGCTAATACCGGATACGCGAAGCGGTCGC
ATGATCGAATCGGGAAAGGCGGAGCAATTTACCACTTATGGATGGACCCGCGGCCCATTAGTTAGTTGGTGGGGTAACGGCTCACCAAGGCGACG
ATGCGTAGCCGACCTGAGAGGATGATCGGCCACCACTGGGATGAGACACGGCCCAGACTCCTACGGGAGGCAGCAGTAGGGATCTTCCCGCAAT
GGACGAAAGTCTGACGGAGCAACGCCGCCTAAGAGATAAAGGTTTTCGGATCGTAAAAGCTCTGTTGCCAGGGAAGAACGCTTGCGAGAGTAAC
TGCTCGCAAGGTGACGGTACCTGAGAAGAAAGCCCCGGCTAACTACGTGCCAGCAGCCGCGGTAATACGTAGGGGGCAAGCGTTGTCCGGAATT
ATTGGGCGTAAAGCGCGCGCAGGCGGCCTTGTAAGTCTGTCGTTTAAACTCGGAGCTCAACTTCGAGTCGCGATGGAAACTGCAAAGCTTGAGTG
CAGAAGAGGAAAGTGGAATTCCACGTGTAGCGGTGAAATGCGTAGAGATGTGGAGGAACACCAGTGGCGAAGGCGACTTTCTGGGCTGTAACTG
ACGCGTGAGGCCGCGAAAAGCGTGGGGACCAAACAGGATAAAGATACCCTGGTAGTCCACCCCGGTAAACGATGAATGCTAGGTGTTAGGGGTT
TCGATACCCTTGGGTGCCGAAGTTAACACATTAAAGCATTCCGCCTGGGGAGTACGGTCGCAAGACTGAAACTCAAAGGAATTGACGGGGACCCG
CACAAGCAGTGGAGTATGTGGTTTAATTTGAAGCAACGCGAAGAACCTTACCAGGTCTTGACATCCCTCTGACCGTCCCTAGAGATAGGGCTTTCC
TTCGGGACAGAGGAGACAGGTGGTGCATGGTTGTACGTCAGCTCGTGTCGTGAGATGTTGGGTTAAGTCCCGCAACGAGCGCAACCCTTGATCTT
AGTTGCCAGCACTTGGGGTGGCCACTCTAGGATGACTGCCGGGTGACAAACCGGAGGAAGGTGGGGATGACGTCAAATCATCATGCCCCTTATGA
CCTGGGCTACACACGTACTACAATGGCCGATACAACGGGAAGCGAAACCGCGAGGTGGAGCCAATCCTATCAAAGTCGGTCTCAGTTCGGATTGC
AGGCTGCAACTCGCCTGCATGAAGTCGGAATTGCTAGTAATCGCGGATCAGCATGCCGCGGTGAATACGTTCCCGGGTCTTGTACACACCGCCCG
TCACACCACGAGAGTTTACAACACCCGAAGCCGGTGGGGTAACCGCAAGGAGCCAGCCGTCGAAGGTGGGGTAGATGATGGGTGAAGTC

2.13 Strain PT2-3 (1331 bp)

AGGTTGGGAAAGGGGAGCAATTTTTTCCTTATGGAAGGGACCTTGCGGCCGCTTAAGTATTTGGGGAGGAAACGGCTTCCCCCAAGGCGACGATG
GCGTAACCCGCTAGAGGGTGATTCGCCCCCCTGGGGATTGAGACACGGCCCCAGATCTTACGGGAGCAGCAGTTAGGGAATTTCCCCCAATGGAC
GAAAGTCTGACGGAAGCAACGCCGCGTGAGTGATGAAAGTTTTCGGGTCGTAAAGTCTGTTGCCAGGGAAGAACGCTAGAGAGAGTAACTGCTC
TTTAGGTGACGGTACCTGAGAAGAAAGCCCCGGCTAACTACGTGCCAGCAGCCGCGGTAATACGTAGGGGGCAAGCGTTGTCCGGAATTATTGGG
CGTAAAGCGCGCGCAGGCGGTTGATTAAGTCTGGTGTTTAAGGCTATGGCTCAACCATAGTTCGCCACTGGAAACTGGTTGACTTGAGTGCAAAA
GAGGAAAAGTGGAATTCCACGGGTAAGCGGGGAAATGCCGAAGAGATGGGGAGGAACCACCAGTGGGCGAAGGCGACCTTTCTGGGCTGTAAA
CCTGACGCTGAAGGCGCGAAAAGCGTGGGGGAGCAAACAGGATAAAATACCCTGGTAGTCCACGCCGTAAAACGATGAATGCTAGGTGTTAGGG
GGTTTCGAATACCCTTGGGTGCCGAAAGTTAACACATTTAAGCATTCCGCCTGGGGAGTACGGTCGCAAGACTGAAACTCAAAGGAATTGACGGG
GACCCGCACAAGCCAGTGGAGTATGTGGTTTAATTCGAAGCAACGCGAAGAACCTTACCAGGTCTTGACATGCCTCTGACCGCTCTAGAGATAGA
GCTTCTCTTCGGAGCAGGGGACACAGGTGGTGCATGGTTGTAACGTCAGCCCGTGTCGTGAGATGTTGGGTTAAGTCCCGCAACGAGCGCAACCC
CTAAATGTTAGTTGCCAGCAGGTAAAGCTGGGCACTCTTAACGTGACTGCCGGTGACAACCCGGAGGAAGGTGGGGATGACGTCAAATCATCATG
CCCCTTATGACCTGGGCTACACACGTACTACAATGGCCAGTACAACGGGAAGCGAAGTCGCGAGATGGAGCCAATCCTCAAAAGCTGGTCTCAGT
TCGGATTGCAGGCTGCAACTCGCCTGCATGAAGTCGGAATTGCTAGTAATCGCGGATCAGCATGCCGCGGTGAATACGTTCCCGGGTCTTGTACAC
ACCGCCCGTCACACCACGAGAGTTTACAACACCCGAAGCCGGTGGGGTAACCCGCAAGGGAGCCAGCCGTCGAAGGTGGGGTAGTGAGGAAAGT
GAAGT

2.14 Strain PN8-2 (1524 bp)

TTAGTTTGTCCTGGCTCAGGACGAACGCTGGCGGCGTGCCTAATACATGCAAGTCGAGCGGACAGATGGGAGCTTGCTCCCTGATGTTAGCGGCG
GACGGGTGAGTAACACGTGGGTAACCTGCCTGTAAGACTGGGATAACTCCGGGAAACCGGGGCTAATACCGGATGGTTGTTTGAACCGCATGGTT
CAAACCAAAAAAGGTGGCTTCGGCTACCACTTACAGATAGGACCCGCGGCGCATTAAGCTTAGTTGGTGAGGTAACGGCTTCACCAAGGCAACGA
TGCGTAGCCCGACCTTGAGAGGGTGATCGGCCCCACTGGGATTGAGACACGGCCCAGATCCTTACGGAGGCAGCAGTAGGGAATTTTCCCCAAT
GGACGAAAGTCTTGACGGAGCAACCCCGCGTGAGTGATGAAGGTTTTCGGATCGTAAAAGCTCTGTTGTTAGGGAAGAACAAGTACCCGTTCGAA
TAGGGCGTACCTTGACGGTACCTAACCCAGAAAGCCACGGCTAACTACGTGCCAGCAGCCGCGGTAATACGTAGGTGGCAAGCGTTGTCCGGAAT
TATTGGGCGTAAAGGGCTCGCAGGCGGTTTCTTAAGTCTGATGTGAAAGCCCCCGGCTCAACCGGGGAGGGTCATTGGAAACTTGGGGAACTTGA
GTGCAGAAGAGGAGAGTGGAATTCCACCGTGTAGCGGTGAAATTGCGTAGAGATTGTGGAGGAACACCAGTGGGCGAAGGCGACTCTCTTGGTC
TGTAACTGACCGCTGAGGAGCGAAAGCGTGGGGAGCGAACCAGGATTAAGATACCCTGGTAGTCCACCCCGTAAACGATGAGTGCTAAGTGTTA
GGGGGTTTCCCCCCCTTAAGTGCTGCAGCTAACCGCATTAAGCACTTCCGCCTGGGGAGTACGGTCGCCAAGACTGAAACTCAAAGGAATTGAC
CGGGGGCCCGCACAAGCGGTGGAGCATGTGGTTTAATTCGAAAGCAACGCGAAGAACCTTACCAGGTCTTGACATCCTCCTGACAATCCTAGAG
ATAGGACGTCCCCTTCGGGGGCAGAGTGACAGGTGGTGCATGGGTGTCGTCAGCTCGTGTCGTGAGATGTTGGGTTAAGTCCCCGCAACGAGCGC
AACCCTTGATCTTAGTTGCCAGCATTCAGTTGGGCACTATAAGGTGACTGCCGGTGACAAACCGGAGGAAGGTGGGGATGACGTCAAATCATCAT
GCCCCTTATGACCTGGGCTACACACGTGCTACAATGGACAGAACAAAGGGCAGCGAAACCGCGAGGTTAAGCCAATCCCACAAATCTGTTCTCAG
TTCGGATCGCAGTCTGCAACTCGACTGCGTGAAGCTGGAATCGCTAGTAATCGCGGATCAGCATGCCGCGGTGAATACGTTCCCGGGCCTTGTAC
ACACCGCCCGTCACACCACGAGAGTTTGTAACACCCGAAGTCGGTGAGGTAACCTTTTAGGAGCCAGCCGCCGAAGGTGGGACAGATGAGGAGG
TGAAGTC

2.15 Strain PN1-2 (1083 bp)

GTGCTAGTTAAGAAAAGCACCCAACTTAGTTTGTCCTGGCTCAGATTGAACGCTGGCGGCAGGCCTAACACATGCAAGTCGAGCGGATGAAGGGA
GCTTGCTCCTGGATTCAGCGGCGGACGGGTGAGTAATGCCTAGGAATCTGCCTGGTAGTGGGGGATAACGTCCGGAAACGGGCGCTAATACCGCA
TACGTCCTGAGGGAGAAAGTGGGGGATCTTCGGACCTCCACGCTATTCAGATGAGCCTAGGTCGGATTAGCTAGTTGGTGGGGTAAAGGCCTACC
AAGGGACGATCCGTAAACTGGTCCCTGAGAGGAAAATCAGTCCCACCTGGAACTGAACACGTTCCAATTCCTCCGGGGCACATTGGGGATTTTGA
CCAAAGGTTAAAATGAATCCCAGCCATCCCCCGTGTGTGAAAGAAGGTTTTCGGTTTGTAAAGCCCTTTTAATTGGGAGGAAGGGCAGTAAGTT
AATACCTTGCTGTTTTTGACGTTACCAACAGAATAAGCACCGGCTAACTTCGTGCCAGCAGCCGCGTAATACGAAGGGTGCAAGCGTTAATCGGA
ATTACTGGGCGTAAACCGCGCGTAGGTGGTTCCAGCAAGTTGGATGTGAAATCCCCGGGCTCCAACCTGGGAACTGCATCCAAAACTACTGAGCT
AGAGTACGGTAGAGGGTGGTGGAATTTCCTGTGTAGCGGTGAAATGCGTAGATATAGGAAGGAACACCAGTGGCGAAGGCGACCACCTGGACTG
ATACTGACACTGAGGTGCGAAAGCGTGGGGAGCAAACAGGATTAGATACCCTGGTAGTCCACGCCGTAAACGATGTCGACTAGCCGTTGGGATCC
TTGAGATCTTAGTGGCGCAGCTAACGCGATAAGTCGACCGCCTGGGGAGTACGGCCGCAAGGTTAAAACTCAAATGAATTGACGGGGGCCCGCA
CAAGCGGTGGAGCATGTGGTTTAATTCGAAGCAACGCGAAGAACCTTACCTGGCCTTGACATGCTGAGAACTTTCCAGAGATGGATTGGTGCCTT
CGGGAACTCAGACACAGGTGCTGCATGGGAAACTCAGCCC

2.16 Strain PN9-3 (1563 bp)

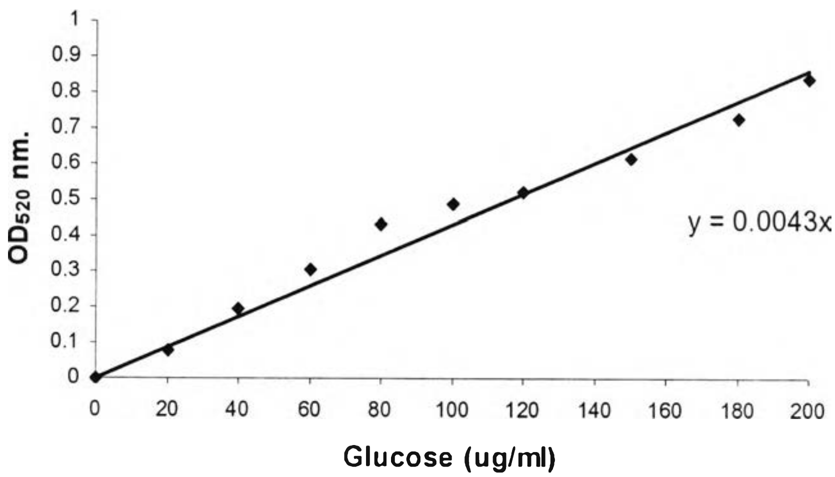
TGAGAGGTGATTTGAGTTATGTCCTGGCTCAGATTGAACGCTGGCGGCAGGCTTAACACATGCAAGTCGAGCGGGGGAAGGTAGCATTGCTACTG
GACCTAGGCGGGCGGACGGGTGAGTAAATGCTTAAGGAATCTCCCCTATTAGGTGGGGGACAAACATTCTCCGAAAGGGATGCTAATTACC
GCATACGTCCCTACGGGAGAAAGCAGGGGGATCTTCGGACCCTTGCGCTAATAGATGAGCCTAAAGTCGGGATAAGCTAGTTGGGTGGGGTAAA
GGCCTACCAAGGCGACGATCTGGAGCGGGTACTGAGAGGATGATCTCGCCAAAACTCGGAGACCGAGACACGGCCCAGACTCCTACGGGAGGCA
GCAGTGGGGAATATTGGACAATGGGGGGAACCCTGATCCAGCCATGCCGCGTGTTGTGAAGAAGGCCTTAATGGGTTGTAAAAGCACTTTTAAG
CGAGGAGGAGGCTACTCTAGTTTAATACCTAGGGATAGTGGACGTTACTCGCAGAATAAGCACCGGCTAACTCTGTGCCAGCAGCCGCGGTAATA
CAGAGGGTGCGAGCGTTAATCGGATTTACTGGGCGTAAAGCGTGCGTAGGCGGCTTATTAAGTCGGATGTGAAATCCCCGAGCTTAACTTGGGAA
TTGCATTCGATACTGGTGAGCTAGAGTATGGGAGAGGATGGTAGAATTCCAGGTGTAGCGGTGAAATGCGTAGAGATCTGGAGGAATACCGATG
GCGAAGGCAGCCATCTGGCCTAATACTTCGGAATTCGCTTGAGGTACGAAAGCATGGGGAGCAAACAGGATTAGATACCCTGGTAGTCCATGCCG
TAAACGATGTCTAACTAGCCGTTGGGGCCCTTTGGAGGGCTTTAGTGGCCGCAAGCTAACGCGATAAAGTAGACCGCCTTGGGGGAGTACGGTTC
GCAAGACTAAAATCTCAAATGAATTGACGGGGGGCCCCGCACAAGCGGTGGAGCATGTGGTTTAATTCGATGCAACGCGAAGAACCTTACCTGGC
CTTGACATACTAGAAACTTTCCAGAGATGGATTGGTGCCTTCGGGAATCTAGATACAGGTGCTGCATGGCTGTCGTCAGCTAGTGTCCTGAGATGG
TTGGGTTAAGTCCCGCAACGAGCGCAACCCTTTTCCTTACTTGCCAGCATTTCGGATGGGAACTTTAAGGATACTGCCAGTGACAAACTGGAGGAA
GGCGGGGACGACGTCAAGTCATCATGGCCCTTACGGCCAGGGCTACACACGTGCTACAATGGTCGGTACAAAGGGTTGCTACACAGCGATGTGAT
GCTAATCTCAAAAAGCCGATCGTAGTCCGGATTGGAGTCTGCAACTCGACTCCATGAAGTCGGAATCGCTAGTAATCGCGGATCAGAATGCCGCG
GTGAATACGTTCCCGGGCCTTGTACACACCGCCCGTCACACCATGGGAGTTTGTTGCACCAGAAGTAGCTAGCCTAACTGCAAAGAGGGCGGTTA
CCACGGTGTGGCCGATGACTGGGGGAAGAAATTTGAGTTGACCGG

2.17 Strain N9-2 (691 bp)

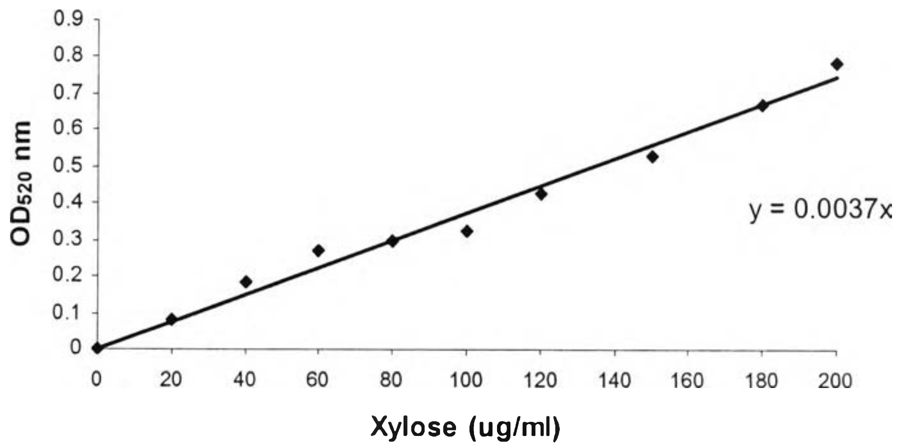
TCCTCTACGCTTACCGTAAGTCTTCGTCCAGGGGGCCGCCTTCGCCACCGGTATTCCTCCAGTATCTCTACGCATTTCACCGCTACACCTGGAATTC
TACCCCCCTCTACGAGACTCAAGCTTGCCAGTATCAGATGCAGTTCCCAGGTTGAGCCCGGGGATTTCACATCTGACTTAACAAACCGCCTGCGTG
CGCTTTACGCCCAGTAATTCCGATTAACGCTTGCACCCTCCGTATTACCGCGGCTGCTGGCACGGAGTTAGCCGGTGCTTCTTCTGCGGGTAACGTC
AATGAGCAAAGGTATTAACTTTACTCCCTTCCTCCCCGCTGAAAGTACTTTACAACCCGAAGGCCTTCTTCATACACGCGGCATGGCTGCATCAGG
CTTGCGCCCATTGTGCAATATTCCCCACTGCTGCCTCCCGTAGGAGTCTGGACCGTGTCTCAGTTCCAGTGTGGCTGGTCATCCTCTCAGACCAGCT
AGGGATCGTCGCCTAGGTGAGCCGTTACCCCACCTACTAGCTAATCCCATCTGGGCACATCCGATGGCAAGAGGCCCGAAGGTCCCCCTCTTTGGT
CTTGCGACGTTATGCGGTATTAGCTACCGTTTCCAGTATTATCCCCCCTCCCATCAGGGAGTTTCCCCAGAAATTTTACTCACCCGTCCGCCAATTC
CGTCAGCAAAAAAAA

APPENDIX E

1. Standard curve of glucose



2. Standard curve of xylose



BIOGRAPHY

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