

PhoenixTemp56809.tmp.txt  
SEQUENCE LISTING

<110> DSM IP Assets BV

<120> Optical resolution of a mixture of enantiomers of butynol or  
butenol

<130> 26884-WO-PCT

<150> EP08158626.5-1521

<151> 2008-06-19

<160> 10

<170> PatentIn version 3.3

<210> 1

<211> 1011

<212> DNA

<213> Staphylococcus aureus

<220>

<221> CDS

<222> (1)..(996)

<400> 1

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1				5					10					15		

aaa	aag	tta	aga	gct	tta	aaa	cct	ggt	gaa	gca	ttg	gta	caa	acg	gaa	96
Lys	Lys	Leu	Arg	Ala	Leu	Lys	Pro	Gly	Glu	Ala	Leu	Val	Gln	Thr	Glu	
		20						25					30			

tat	tgt	ggt	ggt	tgt	cat	acc	gat	tta	cat	ggt	aag	aat	gct	gat	ttt	144
Tyr	Cys	Gly	Val	Cys	His	Thr	Asp	Leu	His	Val	Lys	Asn	Ala	Asp	Phe	
		35					40					45				

ggt	gat	ggt	aca	ggc	ggt	act	tta	ggt	cat	gaa	ggt	att	ggt	aaa	gtc	192
Gly	Asp	Val	Thr	Gly	Val	Thr	Leu	Gly	His	Glu	Gly	Ile	Gly	Lys	Val	
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atc	gaa	ggt	gca	gaa	gat	gta	gaa	tca	tta	aaa	att	gga	gac	cgt	gtg	240
Ile	Glu	Val	Ala	Glu	Asp	Val	Glu	Ser	Leu	Lys	Ile	Gly	Asp	Arg	Val	
65					70					75					80	

tct	atc	gct	tgg	atg	ttc	gaa	agc	tgt	gga	aga	tgt	gaa	tat	tgt	aca	288
Ser	Ile	Ala	Trp	Met	Phe	Glu	Ser	Cys	Gly	Arg	Cys	Glu	Tyr	Cys	Thr	
			85					90						95		

aca	ggt	cgt	gaa	aca	ctt	tgc	cgt	agt	gtg	aaa	aat	gct	ggt	tat	aca	336
Thr	Gly	Arg	Glu	Thr	Leu	Cys	Arg	Ser	Val	Lys	Asn	Ala	Gly	Tyr	Thr	
			100					105					110			

gta	gat	ggt	gca	atg	gct	gaa	caa	ggt	att	ggt	act	gca	gac	tat	gct	384
Val	Asp	Gly	Ala	Met	Ala	Glu	Gln	Val	Ile	Val	Thr	Ala	Asp	Tyr	Ala	
		115					120					125				

gtg	aaa	gta	cct	gaa	aaa	tta	gat	cca	gca	gca	gcg	tct	tct	att	aca	432
Val	Lys	Val	Pro	Glu	Lys	Leu	Asp	Pro	Ala	Ala	Ala	Ser	Ser	Ile	Thr	
	130					135					140					

tgc	gca	ggt	gtg	aca	act	tat	aaa	gct	gta	aaa	gta	agt	aat	gta	aaa	480
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## PhoenixTemp56809.tmp.txt

Cys Ala Gly Val Thr Thr Tyr Lys Ala Val Lys Val Ser Asn Val Lys  
 145 150 155 160  
  
 cct ggt caa tgg tta ggt gtt ttt ggt ata ggt ggt tta ggt aac cta 528  
 Pro Gly Gln Trp Leu Gly Val Phe Gly Ile Gly Gly Leu Gly Asn Leu  
 165 170 175  
  
 gct tta caa tat gct aaa aac gtt atg ggg gct aaa att gtt gcc ttc 576  
 Ala Leu Gln Tyr Ala Lys Asn Val Met Gly Ala Lys Ile Val Ala Phe  
 180 185 190  
  
 gac att aat gat gat aaa tta gca ttc gcg aaa gaa tta ggt gca gat 624  
 Asp Ile Asn Asp Asp Lys Leu Ala Phe Ala Lys Glu Leu Gly Ala Asp  
 195 200 205  
  
 gct att att aat tct aaa gat gtt gat cca gtt gca gaa gtt atg aaa 672  
 Ala Ile Ile Asn Ser Lys Asp Val Asp Pro Val Ala Glu Val Met Lys  
 210 215 220  
  
 tta act gat aac aaa gga tta gat gca aca gtg gta act tca gtt gct 720  
 Leu Thr Asp Asn Lys Gly Leu Asp Ala Thr Val Val Thr Ser Val Ala  
 225 230 235 240  
  
 aag acg cca ttt aac caa gcg gtt gat gtt gta aaa gct ggt gca aga 768  
 Lys Thr Pro Phe Asn Gln Ala Val Asp Val Val Lys Ala Gly Ala Arg  
 245 250 255  
  
 gtt gtt gcc gtt ggt tta cct gtt gat aaa atg aac tta gat atc cca 816  
 Val Val Ala Val Gly Leu Pro Val Asp Lys Met Asn Leu Asp Ile Pro  
 260 265 270  
  
 aga tta gtg ctt gac ggt att gaa gta gta ggt tca ctt gtt ggt aca 864  
 Arg Leu Val Leu Asp Gly Ile Glu Val Val Gly Ser Leu Val Gly Thr  
 275 280 285  
  
 aga caa gac tta cgt gaa gcg ttt gaa ttt gct gct gaa aat aaa gta 912  
 Arg Gln Asp Leu Arg Glu Ala Phe Glu Phe Ala Glu Glu Asn Lys Val  
 290 295 300  
  
 aca cct aaa gtt caa tta aga aaa tta gaa gaa atc aat gat att ttt 960  
 Thr Pro Lys Val Gln Leu Arg Lys Leu Glu Glu Ile Asn Asp Ile Phe  
 305 310 315 320  
  
 gaa gaa atg gaa aag ggt act ata act ggt aga atg gttattaaat tttaa 1011  
 Glu Glu Met Glu Lys Gly Thr Ile Thr Gly Arg Met  
 325 330

&lt;210&gt; 2

&lt;211&gt; 332

&lt;212&gt; PRT

&lt;213&gt; Staphylococcus aureus

&lt;400&gt; 2

Met Arg Ala Ala Val Val Thr Lys Asp His Lys Val Ser Ile Glu Asp  
 1 5 10 15

Lys Lys Leu Arg Ala Leu Lys Pro Gly Glu Ala Leu Val Gln Thr Glu  
 20 25 30

Tyr Cys Gly Val Cys His Thr Asp Leu His Val Lys Asn Ala Asp Phe

35

40

45

Gly Asp Val Thr Gly Val Thr Leu Gly His Glu Gly Ile Gly Lys Val  
50 55 60

Ile Glu Val Ala Glu Asp Val Glu Ser Leu Lys Ile Gly Asp Arg Val  
65 70 75 80

Ser Ile Ala Trp Met Phe Glu Ser Cys Gly Arg Cys Glu Tyr Cys Thr  
85 90 95

Thr Gly Arg Glu Thr Leu Cys Arg Ser Val Lys Asn Ala Gly Tyr Thr  
100 105 110

Val Asp Gly Ala Met Ala Glu Gln Val Ile Val Thr Ala Asp Tyr Ala  
115 120 125

Val Lys Val Pro Glu Lys Leu Asp Pro Ala Ala Ala Ser Ser Ile Thr  
130 135 140

Cys Ala Gly Val Thr Thr Tyr Lys Ala Val Lys Val Ser Asn Val Lys  
145 150 155 160

Pro Gly Gln Trp Leu Gly Val Phe Gly Ile Gly Gly Leu Gly Asn Leu  
165 170 175

Ala Leu Gln Tyr Ala Lys Asn Val Met Gly Ala Lys Ile Val Ala Phe  
180 185 190

Asp Ile Asn Asp Asp Lys Leu Ala Phe Ala Lys Glu Leu Gly Ala Asp  
195 200 205

Ala Ile Ile Asn Ser Lys Asp Val Asp Pro Val Ala Glu Val Met Lys  
210 215 220

Leu Thr Asp Asn Lys Gly Leu Asp Ala Thr Val Val Thr Ser Val Ala  
225 230 235 240

Lys Thr Pro Phe Asn Gln Ala Val Asp Val Val Lys Ala Gly Ala Arg  
245 250 255

Val Val Ala Val Gly Leu Pro Val Asp Lys Met Asn Leu Asp Ile Pro  
260 265 270

Arg Leu Val Leu Asp Gly Ile Glu Val Val Gly Ser Leu Val Gly Thr  
275 280 285

Arg Gln Asp Leu Arg Glu Ala Phe Glu Phe Ala Ala Glu Asn Lys Val

290

295

300

Thr Pro Lys Val Gln Leu Arg Lys Leu Glu Glu Ile Asn Asp Ile Phe  
 305 310 315 320

Glu Glu Met Glu Lys Gly Thr Ile Thr Gly Arg Met  
 325 330

<210> 3  
 <211> 1029  
 <212> DNA  
 <213> Pseudomonas aeruginosa

<220>  
 <221> CDS  
 <222> (1)..(1029)

<400> 3  
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 Met Thr Leu Pro Gln Thr Met Lys Ala Ala Val Val His Ala Tyr Gly  
 1 5 10 15  
 gcg ccg ctg cgg atc gag gaa gtc aag gtt ccg ctg ccc ggc ccc ggg 96  
 Ala Pro Leu Arg Ile Glu Glu Val Lys Val Pro Leu Pro Gly Pro Gly  
 20 25 30  
 cag gta ctg gtg aag atc gaa gcc tcc ggc gtc tgc cac acc gac ctg 144  
 Gln Val Leu Val Lys Ile Glu Ala Ser Gly Val Cys His Thr Asp Leu  
 35 40 45  
 cat gcc gcc gag ggc gac tgg ccg gtg aag ccg ccg ttg ccg ttc att 192  
 His Ala Ala Glu Gly Asp Trp Pro Val Lys Pro Pro Leu Pro Phe Ile  
 50 55 60  
 ccc ggt cac gaa ggc gtc ggc tac gtc gcc gcg gtg ggc agc gga gtg 240  
 Pro Gly His Glu Gly Val Gly Tyr Val Ala Ala Val Gly Ser Gly Val  
 65 70 75 80  
 acc cga gtg aag gaa ggc gac ccg gtc ggc atc ccc tgg ctg tac acc 288  
 Thr Arg Val Lys Glu Gly Asp Arg Val Gly Ile Pro Trp Leu Tyr Thr  
 85 90 95  
 gcc tgc ggc tgc tgc gag cac tgc ctg acc ggc tgg gag acc ctc tgc 336  
 Ala Cys Gly Cys Cys Glu His Cys Leu Thr Gly Trp Glu Thr Leu Cys  
 100 105 110  
 gag agc cag cag aac acc ggc tac tcg gtg aac ggc ggc tat gcc gaa 384  
 Glu Ser Gln Gln Asn Thr Gly Tyr Ser Val Asn Gly Gly Tyr Ala Glu  
 115 120 125  
 tac gta ttg gcc gac ccg aac tac gtc gga att ctg ccg aaa aac gtc 432  
 Tyr Val Leu Ala Asp Pro Asn Tyr Val Gly Ile Leu Pro Lys Asn Val  
 130 135 140  
 gaa ttc gct gaa atc gcg ccg atc ctc tgc gcc ggc gtc acc gtc tac 480  
 Glu Phe Ala Glu Ile Ala Pro Ile Leu Cys Ala Gly Val Thr Val Tyr  
 145 150 155 160  
 aag ggg ctc aag cag act aac gcg cgc ccc ggc cag tgg gtg gcg atc 528  
 Lys Gly Leu Lys Gln Thr Asn Ala Arg Pro Gly Gln Trp Val Ala Ile

## PhoenixTemp56809.tmp.txt

165	170	175	
tcc ggc atc ggc ggc ctc ggc cac gtc gcc gtg cag tac gcc agg gcc			576
Ser Gly Ile Gly Gly Leu Gly His Val Ala Val Gln Tyr Ala Arg Ala			
180	185	190	
atg ggc ctg cac gtc gcc gcc atc gac atc gac gac gcc aag ctg gaa			624
Met Gly Leu His Val Ala Ala Ile Asp Ile Asp Asp Ala Lys Leu Glu			
195	200	205	
ctg gcg cgc aag ctc ggt gcc agc ctg acg gtc aac gcc cgg cag gaa			672
Leu Ala Arg Lys Leu Gly Ala Ser Leu Thr Val Asn Ala Arg Gln Glu			
210	215	220	
gac ccg gtg gag gtg ctc cag cgc gac atc ggc ggc gcc cac ggg gtg			720
Asp Pro Val Glu Val Leu Gln Arg Asp Ile Gly Gly Ala His Gly Val			
225	230	235	240
ctg gtc acc gcg gta tcc aat agc gcc ttc ggc cag gcc atc ggc atg			768
Leu Val Thr Ala Val Ser Asn Ser Ala Phe Gly Gln Ala Ile Gly Met			
245	250	255	
gcg cgc cgc ggc ggc acc atc gcc ctg gtc ggc ctg ccg ccg ggt gac			816
Ala Arg Arg Gly Gly Thr Ile Ala Leu Val Gly Leu Pro Pro Gly Asp			
260	265	270	
ttc ccg acg ccg atc ttc gac gtg gtg ctc aag ggc ctg cac atc gcc			864
Phe Pro Thr Pro Ile Phe Asp Val Val Leu Lys Gly Leu His Ile Ala			
275	280	285	
ggc tca atc gtc ggc acc cgc gcg gac ctt cag gaa gcc ctc gac ttt			912
Gly Ser Ile Val Gly Thr Arg Ala Asp Leu Gln Glu Ala Leu Asp Phe			
290	295	300	
gcc ggc gaa ggc ctg gtc aag gcg acc atc cat ccg ggc aag ctg gac			960
Ala Gly Glu Gly Leu Val Lys Ala Thr Ile His Pro Gly Lys Leu Asp			
305	310	315	320
gac atc aac cag atc ctc gac cag atg cgc gcc ggg cag atc gag ggg			1008
Asp Ile Asn Gln Ile Leu Asp Gln Met Arg Ala Gly Gln Ile Glu Gly			
325	330	335	
cgc atc gtc ctt gag atg tga			1029
Arg Ile Val Leu Glu Met			
340			

<210> 4  
 <211> 342  
 <212> PRT  
 <213> Pseudomonas aeruginosa

<400> 4

Met Thr Leu Pro Gln Thr Met Lys Ala Ala Val Val His Ala Tyr Gly	
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Ala Pro Leu Arg Ile Glu Glu Val Lys Val Pro Leu Pro Gly Pro Gly	
20 25 30	
Gln Val Leu Val Lys Ile Glu Ala Ser Gly Val Cys His Thr Asp Leu	
35 40 45	

PhoenixTemp56809.tmp.txt

His Ala Ala Glu Gly Asp Trp Pro Val Lys Pro Pro Leu Pro Phe Ile  
 50 55 60  
 Pro Gly His Glu Gly Val Gly Tyr Val Ala Ala Val Gly Ser Gly Val  
 65 70 75 80  
 Thr Arg Val Lys Glu Gly Asp Arg Val Gly Ile Pro Trp Leu Tyr Thr  
 85 90 95  
 Ala Cys Gly Cys Cys Glu His Cys Leu Thr Gly Trp Glu Thr Leu Cys  
 100 105 110  
 Glu Ser Gln Gln Asn Thr Gly Tyr Ser Val Asn Gly Gly Tyr Ala Glu  
 115 120 125  
 Tyr Val Leu Ala Asp Pro Asn Tyr Val Gly Ile Leu Pro Lys Asn Val  
 130 135 140  
 Glu Phe Ala Glu Ile Ala Pro Ile Leu Cys Ala Gly Val Thr Val Tyr  
 145 150 155 160  
 Lys Gly Leu Lys Gln Thr Asn Ala Arg Pro Gly Gln Trp Val Ala Ile  
 165 170 175  
 Ser Gly Ile Gly Gly Leu Gly His Val Ala Val Gln Tyr Ala Arg Ala  
 180 185 190  
 Met Gly Leu His Val Ala Ala Ile Asp Ile Asp Asp Ala Lys Leu Glu  
 195 200 205  
 Leu Ala Arg Lys Leu Gly Ala Ser Leu Thr Val Asn Ala Arg Gln Glu  
 210 215 220  
 Asp Pro Val Glu Val Leu Gln Arg Asp Ile Gly Gly Ala His Gly Val  
 225 230 235 240  
 Leu Val Thr Ala Val Ser Asn Ser Ala Phe Gly Gln Ala Ile Gly Met  
 245 250 255  
 Ala Arg Arg Gly Gly Thr Ile Ala Leu Val Gly Leu Pro Pro Gly Asp  
 260 265 270  
 Phe Pro Thr Pro Ile Phe Asp Val Val Leu Lys Gly Leu His Ile Ala  
 275 280 285  
 Gly Ser Ile Val Gly Thr Arg Ala Asp Leu Gln Glu Ala Leu Asp Phe  
 290 295 300

Ala Gly Glu Gly Leu Val Lys Ala Thr Ile His Pro Gly Lys Leu Asp  
305 310 315 320

Asp Ile Asn Gln Ile Leu Asp Gln Met Arg Ala Gly Gln Ile Glu Gly  
325 330 335

Arg Ile Val Leu Glu Met  
340

<210> 5  
<211> 894  
<212> DNA  
<213> Rhodopseudomonas palustris

<220>  
<221> CDS  
<222> (1)..(894)

<400> 5  
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cgg tca acg tca cac cgc agc cgc caa gcg gcg cgg att tcg gga gga 96  
Arg Ser Thr Ser His Arg Ser Arg Gln Ala Ala Arg Ile Ser Gly Gly  
20 25 30  
  
cgc att acc atg cgt ttc aac ggc aag gtc gct gtc gtc acg gca gca 144  
Arg Ile Thr Met Arg Phe Asn Gly Lys Val Ala Val Val Thr Ala Ala  
35 40 45  
  
gca tcg ggc att ggc gcc gcc acg gcc gcc cgt ctc gcg cgg gaa ggc 192  
Ala Ser Gly Ile Gly Ala Ala Thr Ala Ala Arg Leu Ala Arg Glu Gly  
50 55 60  
  
gcg tat gtc tat ctc tcg gat att gat cag gac gct ctg ggc cga cag 240  
Ala Tyr Val Tyr Leu Ser Asp Ile Asp Gln Asp Ala Leu Gly Arg Gln  
65 70 75 80  
  
gcc gaa tct ttg gtc gac gtc gct gag cgg att tcg acg gtg gtg gct 288  
Ala Glu Ser Leu Val Asp Val Ala Glu Arg Ile Ser Thr Val Val Ala  
85 90 95  
  
gat gtc acc gta ccc gag cag gtc tcg gcg cta att gac gga gcc gcg 336  
Asp Val Thr Val Pro Glu Gln Val Ser Ala Leu Ile Asp Gly Ala Ala  
100 105 110  
  
cgc gag cgg ggc cgg ctc gat atc ctg atc aac aat gcc ggc atg ggc 384  
Arg Glu Arg Gly Arg Leu Asp Ile Leu Ile Asn Asn Ala Gly Met Gly  
115 120 125  
  
gcg ttc ggc cgc atc acc gag gtg acg ccg gaa gcc tgg cac cgc gtc 432  
Ala Phe Gly Arg Ile Thr Glu Val Thr Pro Glu Ala Trp His Arg Val  
130 135 140  
  
ttc ggg atc tgc gtg gat tcg atc ttt cac gca agt cgc gcc gcg atc 480  
Phe Gly Ile Cys Val Asp Ser Ile Phe His Ala Ser Arg Ala Ala Ile  
145 150 155 160

## PhoenixTemp56809.tmp.txt

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ccg cat cta atc aag gcc cgc ggc act atc gtc aac acc gct tct atc      528
Pro His Leu Ile Lys Ala Arg Gly Thr Ile Val Asn Thr Ala Ser Ile
                      165                      170                      175

tcc ggt ctg ttc ggc gac tac ggc ttc gct gcc tac aac gcc gcg aag      576
Ser Gly Leu Phe Gly Asp Tyr Gly Phe Ala Ala Tyr Asn Ala Ala Lys
                      180                      185                      190

ggc gcg gtg atc aat ctc acc cgc aac atg gcg ctc gac tac agc cgc      624
Gly Ala Val Ile Asn Leu Thr Arg Asn Met Ala Leu Asp Tyr Ser Arg
                      195                      200                      205

gac gcc ctt cgc gtg aac gcg gtc tgc ccc gcc ctc atc gcg acg ccg      672
Asp Gly Leu Arg Val Asn Ala Val Cys Pro Gly Leu Ile Ala Thr Pro
                      210                      215                      220

ctg tcg ctg aag ctg cgc gac aac gca gcg gtg atg gcc gag tac gac      720
Leu Ser Leu Lys Leu Arg Asp Asn Ala Ala Val Met Ala Glu Tyr Asp
225                      230                      235                      240

cgg ctg atc ccg ctc ggc cgc gcc ggt tcg ccc gaa gag gtc gct gcc      768
Arg Leu Ile Pro Leu Gly Arg Ala Gly Ser Pro Glu Glu Val Ala Gly
                      245                      250                      255

gcg atc gct ttc ctc gcg tcc gac gat gcg tcc tac atc acc gcc gtc      816
Ala Ile Ala Phe Leu Ala Ser Asp Asp Ala Ser Tyr Ile Thr Gly Val
                      260                      265                      270

gcc ttc gcg gtc gat gcc ggg ctg act gcc cga acc ggg cag ccg aac      864
Ala Phe Ala Val Asp Gly Gly Leu Thr Ala Arg Thr Gly Gln Pro Asn
                      275                      280                      285

ttc ctc ggg cac ctg gcg ccc aag ccc tga      894
Phe Leu Gly His Leu Ala Pro Lys Pro
                      290                      295

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<210> 6
<211> 297
<212> PRT
<213> Rhodopseudomonas palustris

<400> 6

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Met Thr Val Arg Ala Arg Asp Leu Tyr Asn Ala Leu Tyr Gln Lys Trp
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Arg Ser Thr Ser His Arg Ser Arg Gln Ala Ala Arg Ile Ser Gly Gly
                20                      25                      30

Arg Ile Thr Met Arg Phe Asn Gly Lys Val Ala Val Val Thr Ala Ala
                35                      40                      45

Ala Ser Gly Ile Gly Ala Ala Thr Ala Ala Arg Leu Ala Arg Glu Gly
50                      55                      60

Ala Tyr Val Tyr Leu Ser Asp Ile Asp Gln Asp Ala Leu Gly Arg Gln
65                      70                      75                      80

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PhoenixTemp56809.tmp.txt

Ala Glu Ser Leu Val Asp Val Ala Glu Arg Ile Ser Thr Val Val Ala  
85 90 95

Asp Val Thr Val Pro Glu Gln Val Ser Ala Leu Ile Asp Gly Ala Ala  
100 105 110

Arg Glu Arg Gly Arg Leu Asp Ile Leu Ile Asn Asn Ala Gly Met Gly  
115 120 125

Ala Phe Gly Arg Ile Thr Glu Val Thr Pro Glu Ala Trp His Arg Val  
130 135 140

Phe Gly Ile Cys Val Asp Ser Ile Phe His Ala Ser Arg Ala Ala Ile  
145 150 155 160

Pro His Leu Ile Lys Ala Arg Gly Thr Ile Val Asn Thr Ala Ser Ile  
165 170 175

Ser Gly Leu Phe Gly Asp Tyr Gly Phe Ala Ala Tyr Asn Ala Ala Lys  
180 185 190

Gly Ala Val Ile Asn Leu Thr Arg Asn Met Ala Leu Asp Tyr Ser Arg  
195 200 205

Asp Gly Leu Arg Val Asn Ala Val Cys Pro Gly Leu Ile Ala Thr Pro  
210 215 220

Leu Ser Leu Lys Leu Arg Asp Asn Ala Ala Val Met Ala Glu Tyr Asp  
225 230 235 240

Arg Leu Ile Pro Leu Gly Arg Ala Gly Ser Pro Glu Glu Val Ala Gly  
245 250 255

Ala Ile Ala Phe Leu Ala Ser Asp Asp Ala Ser Tyr Ile Thr Gly Val  
260 265 270

Ala Phe Ala Val Asp Gly Gly Leu Thr Ala Arg Thr Gly Gln Pro Asn  
275 280 285

Phe Leu Gly His Leu Ala Pro Lys Pro  
290 295

<210> 7  
<211> 1086  
<212> DNA  
<213> Novosphingobium aromaticivorans

<220>

&lt;221&gt; CDS

&lt;222&gt; (1) .. (1086)

&lt;400&gt; 7

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Met Pro Leu Arg His Leu Thr Gly Ile Met Ala Pro Ser Ser Glu Arg	
1 5 10 15	
cgt tca gtg gta ctt cga tgg cgg agg cgc acg atg atc ccc cat ggc	96
Arg Ser Val Val Leu Arg Trp Arg Arg Thr Met Ile Pro His Gly	
20 25 30	
gaa cac tcg atg ctg gca atg cag ctc gat ggt ccc ggc aag cgg ctg	144
Glu His Ser Met Leu Ala Met Gln Leu Asp Gly Pro Gly Lys Arg Leu	
35 40 45	
cac ccc gtc gtg cgc cct ctg ccc ctt ccg ggg cgc ggc gaa gtg cgg	192
His Pro Val Val Arg Pro Leu Pro Leu Pro Gly Arg Gly Glu Val Arg	
50 55 60	
gtc aag gtg cac gcc tgc ggt gtc tgc cgc acg gac ctg cac gtt gcc	240
Val Lys Val His Ala Cys Gly Val Cys Arg Thr Asp Leu His Val Ala	
65 70 75 80	
gac ggc gac atc cac ggt ctg cta ccc atc gtg ccc ggg cac gaa gtg	288
Asp Gly Asp Ile His Gly Leu Leu Pro Ile Val Pro Gly His Glu Val	
85 90 95	
atc ggc gtt gtc gac gca ctg ggg ccg ggg gtg acg gat gtc gag ccc	336
Ile Gly Val Val Asp Ala Leu Gly Pro Gly Val Thr Asp Val Glu Pro	
100 105 110	
ggt gcg cgg gtc ggc gtc ccc tgg ctc ggc cat gcc tgt ggc acc tgc	384
Gly Ala Arg Val Gly Val Pro Trp Leu Gly His Ala Cys Gly Thr Cys	
115 120 125	
cca tat tgc gac agc ggg cgg gaa aac ctc tgc gac gcg ccg ctg ttc	432
Pro Tyr Cys Asp Ser Gly Arg Glu Asn Leu Cys Asp Ala Pro Leu Phe	
130 135 140	
acc ggc ttc acc cgc gat ggc ggc tac gct acc cac gtg atc gcc gac	480
Thr Gly Phe Thr Arg Asp Gly Gly Tyr Ala Thr His Val Ile Ala Asp	
145 150 155 160	
gcg cgc ttc tgc ttt ccc att cca gag ggt ttc gac gat ctc cac gcg	528
Ala Arg Phe Cys Phe Pro Ile Pro Glu Gly Phe Asp Asp Leu His Ala	
165 170 175	
gcg ccg ctc ctg tgc gcg ggc ctt atc ggc tat cgc gcg ctt cgg ctt	576
Ala Pro Leu Leu Cys Ala Gly Leu Ile Gly Tyr Arg Ala Leu Arg Leu	
180 185 190	
gcc ggc gat gcc cct gtc ctc ggc ttc tac ggc ttc gga gcg gcg gcg	624
Ala Gly Asp Ala Pro Val Leu Gly Phe Tyr Gly Phe Gly Ala Ala Ala	
195 200 205	
cac atc ctc gcg caa gtg gcc ctg tgg cag ggg cgc acg gtt tac gcg	672
His Ile Leu Ala Gln Val Ala Leu Trp Gln Gly Arg Thr Val Tyr Ala	
210 215 220	
ttc act cgc gat ggc gac gcg aag gcc cag gcc ttt gct cgt gac atc	720
Phe Thr Arg Asp Gly Asp Ala Lys Ala Gln Ala Phe Ala Arg Asp Ile	
225 230 235 240	

## PhoenixTemp56809.tmp.txt

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ggt tgc caa tgg gcc gga ccc tct ggc gcc gcg ccg ccg caa gcg ctc      768
Gly Cys Gln Trp Ala Gly Pro Ser Gly Ala Ala Pro Pro Gln Ala Leu
245                               250                               255

gac gca gcg atc atc ttc gcc tct gcg gga gaa ttg gtg ccc acc gcc      816
Asp Ala Ala Ile Ile Phe Ala Ser Ala Gly Glu Leu Val Pro Thr Ala
260                               265                               270

ctg cgt gcc gtg cgc aag ggc ggg cgc gtg gtc tgt gcc ggg atc cac      864
Leu Arg Ala Val Arg Lys Gly Gly Arg Val Val Cys Ala Gly Ile His
275                               280                               285

atg agc gac atc ccg gcc ttc ccc tac gcc gat ctc tgg gag gaa cgg      912
Met Ser Asp Ile Pro Ala Phe Pro Tyr Ala Asp Leu Trp Glu Glu Arg
290                               295                               300

cag atc ctc tcg gtc gcc aat ctt acc cgg cgc gat ggc gtc gaa ttc      960
Gln Ile Leu Ser Val Ala Asn Leu Thr Arg Arg Asp Gly Val Glu Phe
305                               310                               315                               320

ctg ccc ctt gca gcg cgg gca ggc gtg cgc aca cat gtc gag gcc atg      1008
Leu Pro Leu Ala Ala Arg Ala Gly Val Arg Thr His Val Glu Ala Met
325                               330                               335

ccg cta atg aag gcg aac gag gcc ctc gac cgc ctg cgc cgt ggc gac      1056
Pro Leu Met Lys Ala Asn Glu Ala Leu Asp Arg Arg Leu Arg Arg Gly Asp
340                               345                               350

gtc agc ggc gcg ctg gtg ctc gtg ccc tga      1086
Val Ser Gly Ala Leu Val Leu Val Pro
355                               360

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&lt;210&gt; 8

&lt;211&gt; 361

&lt;212&gt; PRT

&lt;213&gt; Novosphingobium aromaticivorans

&lt;400&gt; 8

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Met Pro Leu Arg His Leu Thr Gly Ile Met Ala Pro Ser Ser Glu Arg
1          5          10          15

Arg Ser Val Val Leu Arg Trp Arg Arg Thr Met Ile Pro His Gly
20          25          30

Glu His Ser Met Leu Ala Met Gln Leu Asp Gly Pro Gly Lys Arg Leu
35          40          45

His Pro Val Val Arg Pro Leu Pro Leu Pro Gly Arg Gly Glu Val Arg
50          55          60

Val Lys Val His Ala Cys Gly Val Cys Arg Thr Asp Leu His Val Ala
65          70          75          80

Asp Gly Asp Ile His Gly Leu Leu Pro Ile Val Pro Gly His Glu Val
85          90          95

```

## PhoenixTemp56809.tmp.txt

Ile Gly Val Val Asp Ala Leu Gly Pro Gly Val Thr Asp Val Glu Pro  
 100 105 110

Gly Ala Arg Val Gly Val Pro Trp Leu Gly His Ala Cys Gly Thr Cys  
 115 120 125

Pro Tyr Cys Asp Ser Gly Arg Glu Asn Leu Cys Asp Ala Pro Leu Phe  
 130 135 140

Thr Gly Phe Thr Arg Asp Gly Gly Tyr Ala Thr His Val Ile Ala Asp  
 145 150 155 160

Ala Arg Phe Cys Phe Pro Ile Pro Glu Gly Phe Asp Asp Leu His Ala  
 165 170 175

Ala Pro Leu Leu Cys Ala Gly Leu Ile Gly Tyr Arg Ala Leu Arg Leu  
 180 185 190

Ala Gly Asp Ala Pro Val Leu Gly Phe Tyr Gly Phe Gly Ala Ala Ala  
 195 200 205

His Ile Leu Ala Gln Val Ala Leu Trp Gln Gly Arg Thr Val Tyr Ala  
 210 215 220

Phe Thr Arg Asp Gly Asp Ala Lys Ala Gln Ala Phe Ala Arg Asp Ile  
 225 230 235 240

Gly Cys Gln Trp Ala Gly Pro Ser Gly Ala Ala Pro Pro Gln Ala Leu  
 245 250 255

Asp Ala Ala Ile Ile Phe Ala Ser Ala Gly Glu Leu Val Pro Thr Ala  
 260 265 270

Leu Arg Ala Val Arg Lys Gly Gly Arg Val Val Cys Ala Gly Ile His  
 275 280 285

Met Ser Asp Ile Pro Ala Phe Pro Tyr Ala Asp Leu Trp Glu Glu Arg  
 290 295 300

Gln Ile Leu Ser Val Ala Asn Leu Thr Arg Arg Asp Gly Val Glu Phe  
 305 310 315 320

Leu Pro Leu Ala Ala Arg Ala Gly Val Arg Thr His Val Glu Ala Met  
 325 330 335

Pro Leu Met Lys Ala Asn Glu Ala Leu Asp Arg Leu Arg Arg Gly Asp  
 340 345 350

Val Ser Gly Ala Leu Val Leu Val Pro  
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 <212> DNA  
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 Met Lys Ser Phe Glu Asn Lys Val Ala Ala Ile Thr Gly Ala Gly Ser  
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 ggc atc ggt cgc gcc ctg gcc gtg gag ctg ggc agg cag ggt tgt cac 96  
 Gly Ile Gly Arg Ala Leu Ala Val Glu Leu Gly Arg Gln Gly Cys His  
 20 25 30  
 ctg gcc ctg gcc gac gtc aat gcc gca gct ctc gag gaa acc cgc caa 144  
 Leu Ala Leu Ala Asp Val Asn Ala Ala Ala Leu Glu Glu Thr Arg Gln  
 35 40 45  
 ttg ctc gcc agc agc ggg gta cgc gtc tcc acc gcg gtc gtc gac gtg 192  
 Leu Leu Ala Ser Ser Gly Val Arg Val Ser Thr Ala Val Val Asp Val  
 50 55 60  
 gcc gac cgc gag cag gtg cag gcc tgg gcc gac aag gcg gcc agc gaa 240  
 Ala Asp Arg Glu Gln Val Gln Ala Trp Ala Asp Lys Ala Ala Ser Glu  
 65 70 75 80  
 cat ggc cgg gtg aac ctg att ttc aac aac gcg ggc gtc gcc cac gca 288  
 His Gly Arg Val Asn Leu Ile Phe Asn Asn Ala Gly Val Ala His Ala  
 85 90 95  
 ggt acc gtg gaa ggc agc gac tac tcg gaa tac gag tgg atc atg aac 336  
 Gly Thr Val Glu Gly Ser Asp Tyr Ser Glu Tyr Glu Trp Ile Met Asn  
 100 105 110  
 atc aac ttc tgg ggc gtg gtg aac ggc acc aag gcg ttc ctt ccg cac 384  
 Ile Asn Phe Trp Gly Val Val Asn Gly Thr Lys Ala Phe Leu Pro His  
 115 120 125  
 ctg aag gcc tcc ggc aac ggc cac gtg gtc aat gtc tcc agc gtc ttc 432  
 Leu Lys Ala Ser Gly Asn Gly His Val Val Asn Val Ser Ser Val Phe  
 130 135 140  
 ggg ctg ttc gcc cag ccc ggc atg agc gcc tac aac gcc acc aag tac 480  
 Gly Leu Phe Ala Gln Pro Gly Met Ser Ala Tyr Asn Ala Thr Lys Tyr  
 145 150 155 160  
 gcg gtg cgc ggc ttc acc gag tcg ttg cgc cag gaa ctg gac atg gag 528  
 Ala Val Arg Gly Phe Thr Glu Ser Leu Arg Gln Glu Leu Asp Met Glu  
 165 170 175  
 gac tcc ggc gtc tcc gcc agt tgc gtg cat ccc ggc ggg atc aag acc 576  
 Asp Ser Gly Val Ser Ala Ser Cys Val His Pro Gly Gly Ile Lys Thr  
 180 185 190  
 aac atc gcc aag acc gcg cga atg aac gag agc atg gcc aag gtc acc 624

## PhoenixTemp56809.tmp.txt

Asn	Ile	Ala	Lys	Thr	Ala	Arg	Met	Asn	Glu	Ser	Met	Ala	Lys	Val	Thr		
		195					200					205					
ggc	cag	gct	ccg	gac	aag	gct	cgc	gag	caa	ttc	aac	gac	cag	ttg	ctg		672
Gly	Gln	Ala	Pro	Asp	Lys	Ala	Arg	Glu	Gln	Phe	Asn	Asp	Gln	Leu	Leu		
	210					215					220						
cgg	acc	acc	ccg	gag	aag	gcc	gcc	cag	gtc	atc	ctg	cgc	ggc	gtg	cag		720
Arg	Thr	Thr	Pro	Glu	Lys	Ala	Ala	Gln	Val	Ile	Leu	Arg	Gly	Val	Gln		
	225				230					235					240		
cgc	gac	agc	cgg	cgc	atc	ctg	atc	ggc	acc	gac	gcc	cac	gcg	atc	gac		768
Arg	Asp	Ser	Arg	Arg	Ile	Leu	Ile	Gly	Thr	Asp	Ala	His	Ala	Ile	Asp		
				245					250					255			
gtg	atg	ctg	cgc	ctg	gca	cca	gtg	ctc	tac	cag	cgc	ctg	gtc	acc	gcc		816
Val	Met	Leu	Arg	Leu	Ala	Pro	Val	Leu	Tyr	Gln	Arg	Leu	Val	Thr	Ala		
			260					265					270				
agc	atg	cgc	ctg	gca	gcg	cgc	ttc	gcg	ccg	cgc	ccg	aag	agc	ccc	cag		864
Ser	Met	Arg	Leu	Ala	Ala	Arg	Phe	Ala	Pro	Arg	Pro	Lys	Ser	Pro	Gln		
		275					280					285					
ggc	gcc	cgc	gaa	gcc	agc	gag	tga										888
Gly	Ala	Arg	Glu	Ala	Ser	Glu											
	290					295											

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<400> 10

Met	Lys	Ser	Phe	Glu	Asn	Lys	Val	Ala	Ala	Ile	Thr	Gly	Ala	Gly	Ser		
1				5					10					15			

Gly	Ile	Gly	Arg	Ala	Leu	Ala	Val	Glu	Leu	Gly	Arg	Gln	Gly	Cys	His		
			20					25					30				

Leu	Ala	Leu	Ala	Asp	Val	Asn	Ala	Ala	Ala	Leu	Glu	Glu	Thr	Arg	Gln		
	35						40					45					

Leu	Leu	Ala	Ser	Ser	Gly	Val	Arg	Val	Ser	Thr	Ala	Val	Val	Asp	Val		
	50					55					60						

Ala	Asp	Arg	Glu	Gln	Val	Gln	Ala	Trp	Ala	Asp	Lys	Ala	Ala	Ser	Glu		
65					70				75						80		

His	Gly	Arg	Val	Asn	Leu	Ile	Phe	Asn	Asn	Ala	Gly	Val	Ala	His	Ala		
				85				90						95			

Gly	Thr	Val	Glu	Gly	Ser	Asp	Tyr	Ser	Glu	Tyr	Glu	Trp	Ile	Met	Asn		
		100						105					110				

Ile	Asn	Phe	Trp	Gly	Val	Val	Asn	Gly	Thr	Lys	Ala	Phe	Leu	Pro	His		
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--	--

115

120

125

Leu Lys Ala Ser Gly Asn Gly His Val Val Asn Val Ser Ser Val Phe  
 130 135 140

Gly Leu Phe Ala Gln Pro Gly Met Ser Ala Tyr Asn Ala Thr Lys Tyr  
 145 150 155 160

Ala Val Arg Gly Phe Thr Glu Ser Leu Arg Gln Glu Leu Asp Met Glu  
 165 170 175

Asp Ser Gly Val Ser Ala Ser Cys Val His Pro Gly Gly Ile Lys Thr  
 180 185 190

Asn Ile Ala Lys Thr Ala Arg Met Asn Glu Ser Met Ala Lys Val Thr  
 195 200 205

Gly Gln Ala Pro Asp Lys Ala Arg Glu Gln Phe Asn Asp Gln Leu Leu  
 210 215 220

Arg Thr Thr Pro Glu Lys Ala Ala Gln Val Ile Leu Arg Gly Val Gln  
 225 230 235 240

Arg Asp Ser Arg Arg Ile Leu Ile Gly Thr Asp Ala His Ala Ile Asp  
 245 250 255

Val Met Leu Arg Leu Ala Pro Val Leu Tyr Gln Arg Leu Val Thr Ala  
 260 265 270

Ser Met Arg Leu Ala Ala Arg Phe Ala Pro Arg Pro Lys Ser Pro Gln  
 275 280 285

Gly Ala Arg Glu Ala Ser Glu  
 290 295