

Sequence-Listing

@@@@@@@@@@@@@@@@SEQUENCE LISTING

<110> Hayashibara Co., Ltd.

<120> Process for producing a particulate composition comprising crystalline alpha, alpha-trehalose di-hydrate

<130> WO1243

<160> 13

<210> 1

<211> 682

<212> PRT

<213> Paenibacillus illinoisensis

<400> 1

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Asp Thr Ala Val Thr Asn Lys Gln Asn Phe Ser Thr Asp Val Ile Tyr
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Gln Val Phe Thr Asp Arg Phe Leu Asp Gly Asn Pro Ser Asn Asn Pro
      20      25      30
Thr Gly Ala Ala Phe Asp Gly Thr Cys Ser Asn Leu Lys Leu Tyr Cys
      35      40      45
Gly Gly Asp Trp Gln Gly Leu Ile Asn Lys Ile Asn Asp Asn Tyr Phe
      50      55      60
Ser Asp Leu Gly Val Thr Ala Leu Trp Ile Ser Gln Pro Val Glu Asn
      65      70      75      80
Ile Phe Ala Thr Ile Asn Tyr Ser Gly Val Thr Asn Thr Ala Tyr His
      85      90      95
Gly Tyr Trp Ala Arg Asp Phe Lys Lys Thr Asn Pro Tyr Phe Gly Thr
      100      105      110
Met Thr Asp Phe Gln Asn Leu Val Thr Ser Ala His Ala Lys Gly Ile
      115      120      125
Lys Ile Ile Ile Asp Phe Ala Pro Asn His Thr Phe Pro Ala Met Glu
      130      135      140
Thr Asp Thr Ser Phe Ala Glu Asn Gly Lys Leu Tyr Asp Asn Gly Ser
      145      150      155      160
Leu Val Gly Gly Tyr Thr Asn Asp Thr Asn Gly Tyr Phe His His Asn
      165      170      175
Gly Gly Ser Asp Phe Ser Thr Leu Glu Asn Gly Ile Tyr Lys Asn Leu
      180      185      190
Tyr Asp Leu Ala Asp Leu Asn His Asn Asn Ser Thr Ile Asp Thr Tyr
      195      200      205
Phe Lys Asp Ala Ile Lys Leu Trp Leu Asp Met Gly Val Asp Gly Ile
      210      215      220
Arg Val Asp Ala Val Lys His Met Pro Gln Gly Trp Gln Lys Asn Trp
      225      230      235      240
Met Ser Ser Ile Tyr Ala His Lys Pro Val Phe Thr Phe Gly Glu Trp
      245      250      255
Phe Leu Gly Ser Ala Ala Ser Asp Ala Asp Asn Thr Asp Phe Ala Asn
      260      265      270
Glu Ser Gly Met Ser Leu Leu Asp Phe Arg Phe Asn Ser Ala Val Arg
      275      280      285
Asn Val Phe Arg Asp Asn Thr Ser Asn Met Tyr Ala Leu Asp Ser Met
      290      295      300
Leu Thr Ala Thr Ala Ala Asp Tyr Asn Gln Val Asn Asp Gln Val Thr
      305      310      315      320
Phe Ile Asp Asn His Asp Met Asp Arg Phe Lys Thr Ser Ala Val Asn
      325      330      335
Asn Arg Arg Leu Glu Gln Ala Leu Ala Phe Thr Leu Thr Ser Arg Gly
      340      345      350
Val Pro Ala Ile Tyr Tyr Gly Thr Glu Gln Tyr Leu Thr Gly Asn Gly
      355      360      365
Asp Pro Asp Asn Arg Gly Lys Met Pro Ser Phe Ser Lys Ser Thr Thr
      370      375      380
Ala Phe Ser Val Ile Ser Lys Leu Ala Pro Leu Arg Lys Ser Asn Pro
      385      390      395      400
Ala Ile Ala Tyr Gly Ser Thr Gln Gln Arg Trp Ile Asn Asn Asp Val

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Sequence-Listing

Tyr Ile Tyr Glu 405 Lys Phe Gly Lys 410 Ser Val Ala Val Val 415
 420 Arg Thr Thr Pro Thr Ser Ile Thr Asn Leu Asn Thr Ser
 Asn Arg Asn Leu 435 Thr Thr 440 Thr Ser Ile Thr Asn Leu 445
 Leu Pro Ser Gly Thr Tyr Thr Asp Val Leu Gly Gly Val Leu Asn Gly
 450 Asn Asn Ile Thr Ser Ser 455 Gly Gly Asn Ile Ser Ser Phe Thr Leu Ala
 465 Ala Gly Ala Thr Ala Val Trp Gln Tyr Thr Ala Ser Glu Thr Thr Pro
 Thr Ile Gly His Val Gly Pro Val Met 490 Gly Lys Pro Gly Asn Val Val
 500 Thr Ile Asp Gly Arg Gly Phe Gly 505 Ser Thr Lys Gly Thr Val Tyr Phe
 515 Gly Thr Thr Ala Val Thr Gly Ser Ala Ile Thr Ser Trp Glu Asp Thr
 530 Gln Ile Lys Val Thr Ile Pro Pro Val Ala Gly Gly Asp Tyr Ala Val
 545 Lys Val Ala Ala Asn Gly Val Asn Ser Asn Ala Tyr Asn Asp Phe Thr
 565 Ile Leu Ser Gly Asp Gln Val Ser Val Arg Phe Val Ile Asn Asn Ala
 580 Thr Thr Ala Leu Gly Glu Asn Ile Tyr Leu Thr Gly Asn Val Ser Glu
 595 Leu Gly Asn Trp Thr Thr Gly Ala Ala Ser Ile Gly Pro Ala Phe Asn
 610 Gln Val Ile His Ala Tyr Pro Thr Trp Tyr Tyr Asp Val Ser Val Pro
 625 Ala Gly Lys Gln Leu Glu Phe Lys Phe Phe Lys Lys Asn Gly Ala Thr
 645 Ile Thr Trp Glu Gly Gly Ser Asn His 650 Phe Thr Thr Thr Pro Thr Ser
 660 Gly Thr Ala Thr Val Thr Val Asn Trp Gln 670
 675

<210> 2

<211> 683

<212> PRT

<213> Paenibacillus pabuli

<400> 2

Asp Thr Ala Val Thr Asn Lys Gln Asn Phe Ser Thr Asp Val Ile Tyr
 1 5 10 15
 Gln Val Phe Thr Asp Arg Phe Leu Asp Gly Asn Pro Ser Asn Asn Pro
 20 25 30
 Thr Gly Ala Ala Tyr Asp Ser Ser Cys Thr Asn Leu Lys Leu Tyr Cys
 35 40 45
 Gly Gly Asp Trp Gln Gly Leu Val Asn Lys Ile Asn Asp Asn Tyr Phe
 50 55 60
 Thr Asp Leu Gly Ile Thr Ala Leu Trp Ile Ser Gln Pro Val Glu Asn
 65 70 75 80
 Ile Tyr Ser Leu Ile Asn Tyr Ser Gly Val Asn Asn Ser Ala Tyr His
 85 90 95
 Gly Tyr Trp Ala Arg Asp Phe Lys Lys Thr Asn Pro Ala Phe Gly Thr
 100 105 110
 Met Thr Asp Phe Gln Asn Leu Ile Asn Thr Ala His Ala Lys Gly Ile
 115 120 125
 Lys Val Ile Ile Asp Phe Ala Pro Asn His Thr Ser Pro Ala Met Glu
 130 135 140
 Thr Asp Thr Ser Phe Ala Glu Asn Gly Lys Leu Tyr Asn Asn Gly Thr
 145 150 155 160
 Leu Leu Gly Gly Tyr Thr Asn Asp Thr Asn Lys Phe Phe His His Asn
 165 170 175
 Gly Gly Ser Asp Phe Ser Ser Leu Glu Asn Gly Ile Tyr Lys Asn Leu
 180 185 190
 Tyr Asp Leu Ala Asp Leu Asn His Asn Asn Ser Thr Ile Asp Thr Tyr
 195 200 205

Sequence-Listing

Phe Lys Asp Ala Ile Lys Leu Trp Leu Asp Met Gly Ile Asp Gly Ile
 210 215 220
 Arg Val Asp Ala Val Lys His Met Pro Met Gly Trp Gln Lys Asn Trp
 225 230 235 240
 Met Ser Ser Ile Tyr Gly Tyr Lys Pro Val Phe Thr Phe Gly Glu Trp
 245 250 255
 Phe Leu Gly Ser Ser Ala Ser Asp Ala Asp Asn Thr Asn Phe Ala Asn
 260 265 270
 Gln Ser Gly Met Ser Leu Leu Asp Phe Arg Phe Asn Asn Glu Val Arg
 275 280 285
 Asn Val Phe Arg Asp Asn Thr Ser Thr Met Val Ala Leu Asp Ser Met
 290 295 300
 Ile Thr Ser Thr Ala Ala Asp Tyr Ala Gln Val Asn Asp Gln Val Thr
 305 310 315 320
 Phe Ile Asp Asn His Asp Met Asp Arg Phe Lys Thr Ser Ala Val Asn
 325 330 335
 Asn Arg Arg Leu Glu Gln Ala Leu Ala Phe Thr Leu Thr Ser Arg Gly
 340 345 350
 Val Pro Ala Ile Tyr Tyr Gly Thr Glu Gln Tyr Leu Thr Gly Asn Gly
 355 360 365
 Asp Pro Asp Asn Arg Ala Lys Met Pro Ser Phe Ser Lys Thr Thr Thr
 370 375 380
 Ala Phe Asn Val Ile Ser Lys Leu Ala Pro Leu Arg Lys Thr Asn Pro
 385 390 395 400
 Ala Ile Ala Tyr Gly Thr Thr Gln Gln Arg Trp Ile Asn Asn Asp Val
 405 410 415
 Tyr Val Tyr Glu Arg Lys Phe Gly Asn Asn Val Ala Val Val Ala Val
 420 425 430
 Asn Arg Asn Leu Ser Thr Pro Thr Ser Ile Ser Gly Leu Thr Thr Ser
 435 440 445
 Leu Pro Ser Gly Thr Tyr Asn Asp Val Leu Ala Gly Ala Leu Ser Gly
 450 455 460
 Asn Asn Ile Thr Ser Thr Gly Gly Asn Val Ala Asn Phe Thr Leu Ala
 465 470 475 480
 Ala Gly Ala Thr Ala Val Trp Gln Tyr Thr Ala Asn Thr Thr Thr Pro
 485 490 495
 Thr Ile Gly His Val Gly Pro Thr Met Gly Lys Ala Gly Asn Thr Val
 500 505 510
 Thr Ile Asp Gly Arg Gly Phe Gly Thr Thr Lys Gly Thr Val Tyr Phe
 515 520 525
 Gly Thr Thr Ala Val Thr Gly Ser Ala Ile Thr Ser Trp Glu Asp Thr
 530 535 540
 Gln Ile Lys Val Thr Ile Pro Ala Val Ala Ala Asn Tyr Ala Val
 545 550 555 560
 Lys Val Ala Ala Gly Gly Val Asn Ser Asn Thr Tyr Asn Asn Phe Thr
 565 570 575
 Ile Leu Ser Gly Asn Gln Val Ser Val Arg Phe Val Ile Asn Asn Ala
 580 585 590
 Ser Thr Thr Leu Gly Gln Asn Leu Tyr Leu Thr Gly Asn Val Ala Glu
 595 600 605
 Leu Gly Asn Trp Ser Thr Gly Pro Leu Ala Ile Gly Pro Ala Phe Asn
 610 615 620
 Gln Val Ile Tyr Ser Tyr Pro Thr Trp Tyr Tyr Asp Val Ser Val Pro
 625 630 635 640
 Ala Gly Thr Asn Leu Glu Phe Lys Phe Phe Lys Lys Asn Gly Ser Thr
 645 650 655
 Ile Thr Trp Glu Asn Gly Asn Asn His Thr Phe Thr Thr Pro Thr Ser
 660 665 670
 Gly Thr Ala Thr Val Thr Val Asp Trp Gln Pro
 675 680

<210> 3

<211> 682

<212> PRT

<213> Paenibacillus amylolyticus

<400> 3

Asp Thr Ala Val Thr Asn Lys Gln Asn Phe Ser Thr Asp Val Ile Tyr

Sequence-Listing

1				5				10					15				
Gln	Ile	Phe	Thr	Asp	Arg	Phe	Leu	Asp	Gly	Asn	Pro	Ser	Asn	Asn	Pro		
			20					25					30				
Thr	Gly	Ala	Ala	Tyr	Asp	Ala	Thr	Cys	Ser	Asn	Leu	Lys	Leu	Tyr	Cys		
		35					40					45					
Gly	Gly	Asp	Trp	Gln	Gly	Leu	Ile	Asn	Lys	Ile	Asn	Asp	Asn	Tyr	Phe		
	50					55					60						
Ser	Asp	Leu	Gly	Val	Thr	Ala	Leu	Trp	Ile	Ser	Gln	Pro	Val	Glu	Asn		
65					70					75					80		
Ile	Phe	Ala	Thr	Ile	Asn	Tyr	Gly	Gly	Val	Ile	Asn	Thr	Ala	Tyr	His		
				85					90					95			
Gly	Tyr	Trp	Ala	Arg	Asp	Phe	Lys	Lys	Thr	Asn	Pro	Tyr	Phe	Gly	Thr		
			100					105					110				
Met	Ala	Asp	Phe	Gln	Asn	Leu	Ile	Thr	Thr	Ala	His	Ala	Lys	Gly	Ile		
		115					120					125					
Lys	Ile	Val	Ile	Asp	Phe	Ala	Pro	Asn	His	Thr	Ser	Pro	Ala	Met	Glu		
	130					135					140						
Thr	Asp	Thr	Ser	Phe	Ala	Glu	Asn	Gly	Lys	Leu	Tyr	Asp	Asn	Gly	Asn		
145					150					155					160		
Leu	Val	Gly	Gly	Tyr	Thr	Asn	Asp	Thr	Asn	Gly	Tyr	Phe	His	His	Asn		
				165					170					175			
Gly	Gly	Ser	Asp	Phe	Ser	Ser	Leu	Glu	Asn	Gly	Ile	Tyr	Lys	Asn	Leu		
			180					185					190				
Tyr	Asp	Leu	Ala	Asp	Leu	Asn	His	Asn	Asn	Ser	Thr	Ile	Asp	Gln	Tyr		
		195					200					205					
Phe	Lys	Asp	Ala	Ile	Lys	Leu	Trp	Leu	Asp	Met	Gly	Val	Asp	Gly	Ile		
	210					215					220						
Arg	Val	Asp	Ala	Val	Lys	His	Met	Pro	Leu	Gly	Trp	Gln	Lys	Ser	Trp		
225					230					235					240		
Met	Ser	Ser	Ile	Tyr	Ala	His	Lys	Pro	Val	Phe	Thr	Phe	Gly	Glu	Trp		
				245					250					255			
Phe	Leu	Gly	Ser	Ala	Ala	Ser	Asp	Ala	Asp	Asn	Thr	Glu	Phe	Ala	Asn		
			260					265					270				
Glu	Ser	Gly	Met	Ser	Leu	Leu	Asp	Phe	Arg	Phe	Asn	Ser	Ala	Val	Arg		
		275					280					285					
Asp	Val	Phe	Arg	Asp	Asn	Thr	Ser	Asn	Met	Tyr	Ala	Leu	Asp	Ser	Met		
	290					295					300						
Ile	Thr	Gly	Thr	Ala	Ala	Asp	Tyr	Asn	Gln	Val	Asn	Asp	Gln	Val	Thr		
305					310					315					320		
Phe	Ile	Asp	Asn	His	Asp	Met	Asp	Arg	Phe	Lys	Thr	Ser	Ala	Val	Asn		
				325					330					335			
Asn	Arg	Arg	Leu	Glu	Gln	Ala	Leu	Ala	Phe	Thr	Leu	Thr	Ser	Arg	Gly		
			340					345					350				
Val	Pro	Ala	Ile	Tyr	Tyr	Gly	Thr	Glu	Gln	Tyr	Leu	Thr	Gly	Asn	Gly		
		355					360					365					
Asp	Pro	Asp	Asn	Arg	Ala	Lys	Met	Pro	Ser	Phe	Ser	Lys	Thr	Thr	Thr		
	370					375					380						
Ala	Phe	Asn	Val	Ile	Ser	Lys	Leu	Ala	Pro	Leu	Arg	Lys	Ser	Asn	Pro		
385					390					395					400		
Ala	Ile	Ala	Tyr	Gly	Ser	Thr	Gln	Gln	Arg	Trp	Ile	Asn	Asn	Asp	Val		
				405					410					415			
Tyr	Val	Tyr	Glu	Arg	Lys	Phe	Gly	Lys	Ser	Val	Ala	Val	Val	Ala	Val		
			420					425					430				
Asn	Arg	Asn	Leu	Ser	Thr	Pro	Ala	Ser	Ile	Ala	Asn	Leu	Ser	Thr	Ser		
		435					440					445					
Leu	Pro	Thr	Gly	Asn	Tyr	Thr	Asp	Val	Leu	Gly	Gly	Ala	Leu	Asn	Gly		
	450					455					460						
Ser	Asn	Ile	Thr	Ser	Thr	Asn	Gly	Asn	Val	Ser	Ser	Phe	Thr	Leu	Ala		
465					470					475					480		
Ala	Gly	Ala	Thr	Ala	Val	Trp	Gln	Tyr	Thr	Thr	Ser	Glu	Thr	Thr	Pro		
				485					490					495			
Thr	Ile	Gly	His	Val	Gly	Pro	Val	Met	Gly	Lys	Pro	Gly	Asn	Val	Val		
			500					505					510				
Thr	Ile	Ser	Gly	Arg	Gly	Phe	Gly	Ser	Thr	Lys	Gly	Thr	Val	Tyr	Phe		
	515					520						525					
Gly	Thr	Thr	Ala	Val	Thr	Gly	Ala	Ala	Ile	Thr	Ser	Trp	Glu	Asp	Thr		
	530					535					540						
Gln	Ile	Lys	Val	Thr	Ile	Pro	Ala	Val	Ala	Ala	Gly	Asn	Tyr	Ala	Val		

Sequence-Listing

545	Lys	Val	Ala	Ala	Asn	Gly	Val	Asn	Ser	Asn	Ala	Tyr	Asn	Asn	Phe	Thr	560
					565					570						575	
	Ile	Leu	Thr	Gly	Asp	Gln	Val	Thr	Val	Arg	Phe	Val	Ile	Asn	Asn	Ala	
				580					585					590			
	Ser	Thr	Thr	Leu	Gly	Gln	Asn	Ile	Tyr	Leu	Thr	Gly	Asn	Val	Ala	Glu	
				595				600					605				
	Leu	Gly	Asn	Trp	Ser	Thr	Gly	Thr	Thr	Ala	Ile	Gly	Pro	Ala	Phe	Asn	
		610					615					620					
	Gln	Val	Ile	His	Ala	Tyr	Pro	Thr	Trp	Tyr	Tyr	Asp	Val	Ser	Val	Pro	
		625				630					635					640	
	Ala	Gly	Lys	Gln	Leu	Glu	Phe	Lys	Phe	Phe	Lys	Lys	Asn	Gly	Ala	Thr	
					645					650					655		
	Ile	Thr	Trp	Glu	Gly	Gly	Ser	Asn	His	Thr	Phe	Thr	Thr	Pro	Thr	Ser	
			660						665					670			
	Gly	Thr	Ala	Thr	Val	Asn	Val	Asn	Trp	Gln							
			675					680									

<210> 4
 <211> 680
 <212> PRT
 <213> Geobacillus stearothermophilus

<400> 4	Ala	Gly	Asn	Leu	Asn	Lys	Val	Asn	Phe	Thr	Ser	Asp	Val	Val	Tyr	Gln
					5					10					15	
	Ile	Val	Val	Asp	Arg	Phe	Val	Asp	Gly	Asn	Thr	Ser	Asn	Asn	Pro	Ser
				20					25					30		
	Gly	Ala	Leu	Phe	Ser	Ser	Gly	Cys	Thr	Asn	Leu	Arg	Lys	Tyr	Cys	Gly
			35					40					45			
	Gly	Asp	Trp	Gln	Gly	Ile	Ile	Asn	Lys	Ile	Asn	Asp	Gly	Tyr	Leu	Thr
		50					55					60				
	Asp	Met	Gly	Val	Thr	Ala	Ile	Trp	Ile	Ser	Gln	Pro	Val	Glu	Asn	Val
		65				70					75				80	
	Phe	Ser	Val	Met	Asn	Asp	Ala	Ser	Gly	Ser	Ala	Ser	Tyr	His	Gly	Tyr
				85						90					95	
	Trp	Ala	Arg	Asp	Phe	Lys	Lys	Pro	Asn	Pro	Phe	Phe	Gly	Thr	Leu	Ser
			100						105					110		
	Asp	Phe	Gln	Arg	Leu	Val	Asp	Ala	Ala	His	Ala	Lys	Gly	Ile	Lys	Val
			115					120					125			
	Ile	Ile	Asp	Phe	Ala	Pro	Asn	His	Thr	Ser	Pro	Ala	Ser	Glu	Thr	Asn
		130					135					140				
	Pro	Ser	Tyr	Met	Glu	Asn	Gly	Arg	Leu	Tyr	Asp	Asn	Gly	Thr	Leu	Leu
		145			150						155				160	
	Gly	Gly	Tyr	Thr	Asn	Asp	Ala	Asn	Met	Tyr	Phe	His	His	Asn	Gly	Gly
				165						170					175	
	Thr	Thr	Phe	Ser	Ser	Leu	Glu	Asp	Gly	Ile	Tyr	Arg	Asn	Leu	Phe	Asp
			180						185					190		
	Leu	Ala	Asp	Leu	Asn	His	Gln	Asn	Pro	Val	Ile	Asp	Arg	Tyr	Leu	Lys
			195					200					205			
	Asp	Ala	Val	Lys	Met	Trp	Ile	Asp	Met	Gly	Ile	Asp	Gly	Ile	Arg	Met
		210					215					220				
	Asp	Ala	Val	Lys	His	Met	Pro	Phe	Gly	Trp	Gln	Lys	Ser	Leu	Met	Asp
		225			230					235					240	
	Glu	Ile	Asp	Asn	Tyr	Arg	Pro	Val	Phe	Thr	Phe	Gly	Glu	Trp	Phe	Leu
				245						250					255	
	Ser	Glu	Asn	Glu	Val	Asp	Ala	Asn	Asn	His	Tyr	Phe	Ala	Asn	Glu	Ser
			260					265						270		
	Gly	Met	Ser	Leu	Leu	Asp	Phe	Arg	Phe	Gly	Gln	Lys	Leu	Arg	Gln	Val
		275						280					285			
	Leu	Arg	Asn	Asn	Ser	Asp	Asn	Trp	Tyr	Gly	Phe	Asn	Gln	Met	Ile	Gln
		290					295					300				
	Asp	Thr	Ala	Ser	Ala	Tyr	Asp	Glu	Val	Leu	Asp	Gln	Val	Thr	Phe	Ile
		305				310					315				320	
	Asp	Asn	His	Asp	Met	Asp	Arg	Phe	Met	Ile	Asp	Gly	Gly	Asp	Pro	Arg
				325						330					335	
	Lys	Val	Asp	Met	Ala	Leu	Ala	Val	Leu	Leu	Thr	Ser	Arg	Gly	Val	Pro
			340						345					350		

Sequence-Listing

Asn	Ile	Tyr	Tyr	Gly	Thr	Glu	Gln	Tyr	Met	Thr	Gly	Asn	Gly	Asp	Pro
		355					360					365			
Asn	Asn	Arg	Lys	Met	Met	Ser	Ser	Phe	Asn	Lys	Asn	Thr	Arg	Ala	Tyr
	370					375					380				
Gln	Val	Ile	Gln	Lys	Leu	Ser	Ser	Leu	Arg	Arg	Asn	Asn	Pro	Ala	Leu
	385				390					395					400
Ala	Tyr	Gly	Asp	Thr	Glu	Gln	Arg	Trp	Ile	Asn	Gly	Asp	Val	Tyr	Val
			405						410					415	
Tyr	Glu	Arg	Gln	Phe	Gly	Lys	Asp	Val	Val	Leu	Val	Ala	Val	Asn	Arg
			420					425					430		
Ser	Ser	Ser	Ser	Asn	Tyr	Ser	Ile	Thr	Gly	Leu	Phe	Thr	Ala	Leu	Pro
		435					440					445			
Ala	Gly	Thr	Tyr	Thr	Asp	Gln	Leu	Gly	Gly	Leu	Leu	Asp	Gly	Asn	Thr
	450					455					460				
Ile	Gln	Val	Gly	Ser	Asn	Gly	Ser	Val	Asn	Ala	Phe	Asp	Leu	Gly	Pro
	465				470					475					480
Gly	Glu	Val	Gly	Val	Trp	Ala	Tyr	Ser	Ala	Thr	Glu	Ser	Thr	Pro	Ile
			485						490					495	
Ile	Gly	His	Val	Gly	Pro	Met	Met	Gly	Gln	Val	Gly	His	Gln	Val	Thr
			500					505					510		
Ile	Asp	Gly	Glu	Gly	Phe	Gly	Thr	Asn	Thr	Gly	Thr	Val	Lys	Phe	Gly
		515					520					525			
Thr	Thr	Ala	Ala	Asn	Val	Val	Ser	Trp	Ser	Asn	Asn	Gln	Ile	Val	Val
	530					535					540				
Ala	Val	Pro	Asn	Val	Ser	Pro	Gly	Lys	Tyr	Asn	Ile	Thr	Val	Gln	Ser
	545				550					555					560
Ser	Ser	Gly	Gln	Thr	Ser	Ala	Ala	Tyr	Asp	Asn	Phe	Glu	Val	Leu	Thr
				565					570					575	
Asn	Asp	Gln	Val	Ser	Val	Arg	Phe	Val	Val	Asn	Asn	Ala	Thr	Thr	Asn
			580					585					590		
Leu	Gly	Gln	Asn	Ile	Tyr	Ile	Val	Gly	Asn	Val	Tyr	Glu	Leu	Gly	Asn
		595					600					605			
Trp	Asp	Thr	Ser	Lys	Ala	Ile	Gly	Pro	Met	Phe	Asn	Gln	Val	Val	Tyr
	610					615					620				
Ser	Tyr	Pro	Thr	Trp	Tyr	Ile	Asp	Val	Ser	Val	Pro	Glu	Gly	Lys	Thr
	625				630					635					640
Ile	Glu	Phe	Lys	Phe	Ile	Lys	Lys	Asp	Ser	Gln	Gly	Asn	Val	Thr	Trp
				645					650					655	
Glu	Ser	Gly	Ser	Asn	His	Val	Tyr	Thr	Thr	Pro	Thr	Asn	Thr	Thr	Gly
			660					665					670		
Lys	Ile	Ile	Val	Asp	Trp	Gln	Asn								
		675					680								

<210> 5

<211> 686

<212> PRT

<213> Bacillus macerans

<400> 5

Ser	Pro	Asp	Thr	Ser	Val	Asn	Asn	Lys	Leu	Asn	Phe	Ser	Thr	Asp	Thr
1				5					10					15	
Val	Tyr	Gln	Ile	Val	Thr	Asp	Arg	Phe	Val	Asp	Gly	Asn	Ser	Ala	Asn
			20					25					30		
His	Pro	Thr	Gly	Ala	Ala	Phe	Ser	Ser	Asp	His	Ser	Asn	Leu	Lys	Leu
		35					40					45			
Tyr	Phe	Gly	Gly	Asp	Trp	Gln	Gly	Ile	Thr	Asn	Lys	Ile	Asn	Asp	Gly
	50					55					60				
Tyr	Leu	Thr	Gly	Met	Gly	Ile	Thr	Ala	Leu	Trp	Ile	Ser	Gln	Pro	Val
	65				70					75				80	
Glu	Asn	Ile	Thr	Ala	Val	Ile	Lys	Tyr	Ser	Gly	Val	Asn	Asn	Thr	Ala
				85					90					95	
Tyr	His	Gly	Tyr	Trp	Pro	Arg	Asp	Phe	Lys	Lys	Thr	Asn	Ala	Ala	Phe
			100					105					110		
Gly	Ser	Phe	Thr	Asp	Phe	Ser	Asn	Leu	Ile	Ala	Ala	Ala	His	Ser	His
		115					120					125			
Asn	Ile	Lys	Val	Val	Met	Asp	Phe	Ala	Pro	Asn	His	Thr	Asn	Pro	Ala
	130					135					140				
Ser	Ser	Thr	Asp	Pro	Ser	Phe	Ala	Glu	Asn	Gly	Ala	Leu	Tyr	Asn	Asn

Sequence-Listing

145					150	Sequence				155	E155				160
Gly	Thr	Leu	Leu	Gly 165	Lys	Tyr	Ser	Asn	Asp 170	Thr	Ala	Gly	Leu	Phe 175	His
His	Asn	Gly	Gly 180	Thr	Asp	Phe	Ser	Thr 185	Thr	Glu	Ser	Gly	Ile 190	Tyr	Lys
Asn	Leu	Tyr 195	Asp	Leu	Ala	Asp	Ile 200	Asn	Gln	Asn	Asn	Asn 205	Thr	Ile	Asp
Ser	Tyr 210	Leu	Lys	Glu	Ser	Ile 215	Gln	Leu	Trp	Leu	Asn 220	Leu	Gly	Val	Asp
Gly 225	Ile	Arg	Phe	Asp	Ala 230	Val	Lys	His	Met	Pro 235	Gln	Gly	Trp	Gln	Lys 240
Ser	Tyr	Val	Ser	Ser 245	Ile	Tyr	Ser	Ser	Ala 250	Asn	Pro	Val	Phe	Thr 255	Phe
Gly	Glu	Trp	Phe 260	Leu	Gly	Pro	Asp	Glu 265	Met	Thr	Gln	Asp	Asn 270	Ile	Asn
Phe	Ala	Asn 275	Gln	Ser	Gly	Met	His 280	Leu	Leu	Asp	Phe	Ala 285	Phe	Ala	Gln
Glu	Ile 290	Arg	Glu	Val	Phe	Arg 295	Asp	Lys	Ser	Glu	Thr 300	Met	Thr	Asp	Leu
Asn 305	Ser	Val	Ile	Ser	Ser 310	Thr	Gly	Ser	Ser	Tyr 315	Asn	Tyr	Ile	Asn	Asn 320
Met	Val	Thr	Phe 325	Ile	Asp	Asn	His	Asp	Met 330	Asp	Arg	Phe	Gln	Gln 335	Ala
Gly	Ala	Ser	Thr 340	Arg	Pro	Thr	Glu	Gln 345	Ala	Leu	Ala	Val	Thr 350	Leu	Thr
Ser	Arg	Gly 355	Val	Pro	Ala	Ile	Tyr 360	Tyr	Gly	Thr	Glu	Gln 365	Tyr	Met	Thr
Gly	Asn 370	Gly	Asp	Pro	Asn	Asn 375	Arg	Gly	Met	Met	Thr 380	Gly	Phe	Asp	Thr
Asn 385	Lys	Thr	Ala	Tyr	Lys 390	Val	Ile	Lys	Ala	Leu 395	Ala	Pro	Leu	Arg	Lys 400
Ser	Asn	Pro	Ala	Leu 405	Ala	Tyr	Gly	Ser	Thr 410	Thr	Gln	Arg	Trp	Val 415	Asn
Ser	Asp	Val	Tyr 420	Val	Tyr	Glu	Arg	Lys 425	Phe	Gly	Ser	Asn	Val 430	Ala	Leu
Val	Ala	Val 435	Asn	Arg	Ser	Ser	Thr 440	Thr	Ala	Tyr	Pro	Ile 445	Ser	Gly	Ala
Leu	Thr 450	Ala	Leu	Pro	Asn	Gly 455	Thr	Tyr	Thr	Asp	Val 460	Leu	Gly	Gly	Leu
Leu 465	Asn	Gly	Asn	Ser	Ile 470	Thr	Val	Asn	Gly	Gly 475	Thr	Val	Ser	Asn	Phe 480
Thr	Leu	Ala	Ala	Gly 485	Gly	Thr	Ala	Val	Trp 490	Gln	Tyr	Thr	Thr	Thr 495	Glu
Ser	Ser	Pro	Ile 500	Ile	Gly	Asn	Val	Gly 505	Pro	Thr	Met	Gly	Lys 510	Pro	Gly
Asn	Thr	Ile 515	Thr	Ile	Asp	Gly	Arg 520	Gly	Phe	Gly	Thr	Thr 525	Lys	Asn	Lys
Val	Thr 530	Phe	Gly	Thr	Thr	Ala 535	Val	Thr	Gly	Ala	Asn 540	Ile	Val	Ser	Trp
Glu 545	Asp	Thr	Glu	Ile	Lys 550	Val	Lys	Val	Pro	Asn 555	Val	Ala	Ala	Gly	Asn 560
Thr	Ala	Val	Thr	Val 565	Thr	Asn	Ala	Ala	Gly 570	Thr	Thr	Ser	Ala	Ala 575	Phe
Asn	Asn	Phe	Asn 580	Val	Leu	Thr	Ala	Asp 585	Gln	Val	Thr	Val	Arg 590	Phe	Lys
Val	Asn	Asn 595	Ala	Thr	Thr	Ala	Leu 600	Gly	Gln	Asn	Val	Tyr 605	Leu	Thr	Gly
Asn	Val 610	Ala	Glu	Leu	Gly	Asn 615	Trp	Thr	Ala	Ala	Asn 620	Ala	Ile	Gly	Pro
Met 625	Tyr	Asn	Gln	Val	Glu 630	Ala	Ser	Tyr	Pro	Thr 635	Trp	Tyr	Phe	Asp	Val 640
Ser	Val	Pro	Ala	Asn 645	Thr	Ala	Leu	Gln	Phe 650	Lys	Phe	Ile	Lys	Val 655	Asn
Gly	Ser	Thr	Val 660	Thr	Trp	Glu	Gly	Gly 665	Asn	Asn	His	Thr	Phe 670	Thr	Ser
Pro	Ser	Ser 675	Gly	Val	Ala	Thr	Val 680	Thr	Val	Asp	Trp	Gln 685	Asn		

Sequence-Listing

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 <211> 681
 <212> PRT
 <213> Thermoanaerobacter thermosulfurigenes

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 35 40 45
 Tyr Phe Gly Gly Asp Trp Gln Gly Ile Ile Asn Lys Ile Asn Asp Gly
 50 55 60
 Tyr Leu Thr Gly Met Gly Ile Thr Ala Ile Trp Ile Ser Gln Pro Val
 65 70 75 80
 Glu Asn Ile Tyr Ala Val Leu Pro Asp Ser Thr Phe Gly Gly Ser Thr
 85 90 95
 Ser Tyr His Gly Tyr Trp Ala Arg Asp Phe Lys Lys Pro Asn Pro Phe
 100 105 110
 Phe Gly Ser Phe Thr Asp Phe Gln Leu Ile Ala Thr Ala His Ala
 115 120 125
 His Asn Ile Lys Val Ile Ile Asp Phe Ala Pro Asn His Thr Ser Pro
 130 135 140
 Ala Ser Glu Thr Asp Pro Thr Tyr Gly Glu Asn Gly Arg Leu Tyr Asp
 145 150 155 160
 Asn Gly Val Leu Leu Gly Gly Tyr Thr Asn Asp Thr Asn Gly Tyr Phe
 165 170 175
 His His Tyr Gly Gly Thr Asn Phe Ser Ser Tyr Glu Asp Gly Ile Tyr
 180 185 190
 Arg Asn Leu Phe Asp Leu Ala Asp Leu Asp Gln Gln Asn Ser Thr Ile
 195 200 205
 Asp Ser Tyr Leu Lys Ala Ala Ile Lys Leu Trp Leu Asp Met Gly Ile
 210 215 220
 Asp Gly Ile Arg Met Asp Ala Val Lys His Met Ala Phe Gly Trp Gln
 225 230 235 240
 Lys Asn Phe Met Asp Ser Ile Leu Ser Tyr Arg Pro Val Phe Thr Phe
 245 250 255
 Gly Glu Trp Tyr Leu Gly Thr Asn Glu Val Asp Pro Asn Asn Thr Tyr
 260 265 270
 Phe Ala Asn Glu Ser Gly Met Ser Leu Leu Asp Phe Arg Phe Ala Gln
 275 280 285
 Lys Val Arg Gln Val Phe Arg Asp Asn Thr Asp Thr Met Tyr Gly Leu
 290 295 300
 Asp Ser Met Ile Gln Ser Thr Ala Ala Asp Tyr Asn Phe Ile Asn Asp
 305 310 315 320
 Met Val Thr Phe Ile Asp Asn His Asp Met Asp Arg Phe Tyr Thr Gly
 325 330 335
 Gly Ser Thr Arg Pro Val Glu Gln Ala Leu Ala Phe Thr Leu Thr Ser
 340 345 350
 Arg Gly Val Pro Ala Ile Tyr Tyr Gly Thr Glu Gln Tyr Met Thr Gly
 355 360 365
 Asn Gly Asp Pro Tyr Asn Arg Ala Met Met Thr Ser Phe Asp Thr Thr
 370 375 380
 Thr Thr Ala Tyr Asn Val Ile Lys Lys Leu Ala Pro Leu Arg Lys Ser
 385 390 395 400
 Asn Pro Ala Ile Ala Tyr Gly Thr Gln Lys Gln Arg Trp Ile Asn Asn
 405 410 415
 Asp Val Tyr Ile Tyr Glu Arg Gln Phe Gly Asn Asn Val Ala Leu Val
 420 425 430
 Ala Ile Asn Arg Asn Leu Ser Thr Ser Tyr Tyr Ile Thr Gly Leu Tyr
 435 440 445
 Thr Ala Leu Pro Ala Gly Thr Tyr Ser Asp Met Leu Gly Gly Leu Leu
 450 455 460
 Asn Gly Ser Ser Ile Thr Val Ser Ser Asn Gly Ser Val Thr Pro Phe
 465 470 475 480
 Thr Leu Ala Pro Gly Glu Val Ala Val Trp Gln Tyr Val Ser Thr Thr
 485 490 495

Sequence-Listing

Asn Pro Pro Leu Ile Gly His Val Gly Pro Thr Met Thr Lys Ala Gly
 500 505 510
 Gln Thr Ile Thr Ile Asp Gly Arg Gly Phe Gly Thr Thr Ala Gly Gln
 515 520 525
 Val Leu Phe Gly Thr Thr Pro Ala Thr Ile Val Ser Trp Glu Asp Thr
 530 535 540
 Glu Val Lys Val Lys Val Pro Ala Leu Thr Pro Gly Lys Tyr Asn Ile
 545 550 555 560
 Thr Leu Lys Thr Ala Ser Gly Val Thr Ser Asn Ser Tyr Asn Asn Ile
 565 570 575
 Asn Val Leu Thr Gly Asn Gln Val Cys Val Arg Phe Val Val Asn Asn
 580 585 590
 Ala Thr Thr Val Trp Gly Glu Asn Val Tyr Leu Thr Gly Asn Val Ala
 595 600 605
 Glu Leu Gly Asn Trp Asp Thr Ser Lys Ala Ile Gly Pro Met Phe Asn
 610 615 620
 Gln Val Val Tyr Gln Tyr Pro Thr Trp Tyr Tyr Asp Val Ser Val Pro
 625 630 635 640
 Ala Gly Thr Thr Ile Glu Phe Ile Lys Lys Asn Gly Ser Thr Val Thr
 645 650 655
 Trp Glu Gly Gly Tyr Asn His Val Tyr Thr Thr Pro Thr Ser Gly Thr
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 Ala Thr Val Ile Val Asp Trp Gln Pro
 675 680

<210> 7

<211> 2154

<212> DNA

<213> Paenibacillus illinoisensis

<400> 7

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Met	Phe	Gln	Met	Ala	Lys	Arg	Val	Leu	Leu	Ser	Thr	Thr	Leu	Thr	Phe	48
1				5				10					15			

agc	ctg	ctt	gcc	ggc	agt	gca	ttg	cct	ttc	ctg	cct	gcc	tcc	gcg	att	
Ser	Leu	Leu	Ala	Gly	Ser	Ala	Leu	Pro	Phe	Leu	Pro	Ala	Ser	Ala	Ile	96
			20					25					30			

tat	gcc	gat	gcg	gat	acg	gct	gtc	acc	aac	aag	caa	aat	ttc	agt	acc	
Tyr	Ala	Asp	Ala	Asp	Thr	Ala	Val	Thr	Asn	Lys	Gln	Asn	Phe	Ser	Thr	144
		35					40					45				

gat	gtc	atc	tat	caa	gtt	ttt	acg	gac	cgg	ttt	ctg	gac	ggg	aac	cca	
Asp	Val	Ile	Tyr	Gln	Val	Phe	Thr	Asp	Arg	Phe	Leu	Asp	Gly	Asn	Pro	192
	50					55					60					

tcc	aac	aac	ccc	act	gga	gct	gct	ttt	gat	ggc	aca	tgc	agc	aac	ctg	
Ser	Asn	Asn	Pro	Thr	Gly	Ala	Ala	Phe	Asp	Gly	Thr	Cys	Ser	Asn	Leu	240
65					70					75					80	

aaa	ctg	tac	tgc	ggc	ggc	gac	tgg	cag	ggg	ctg	att	aac	aaa	atc	aat	
Lys	Leu	Tyr	Cys	Gly	Gly	Asp	Trp	Gln	Gly	Leu	Ile	Asn	Lys	Ile	Asn	288
				85					90					95		

gac	aac	tat	ttc	agt	gac	ctg	ggt	gtc	aca	gcc	ctc	tgg	atc	tcc	cag	
Asp	Asn	Tyr	Phe	Ser	Asp	Leu	Gly	Val	Thr	Ala	Leu	Trp	Ile	Ser	Gln	336
			100					105					110			

cct	gtc	gaa	aat	att	ttc	gct	acc	atc	aac	tac	agc	ggt	gta	acc	aac	
Pro	Val	Glu	Asn	Ile	Phe	Ala	Thr	Ile	Asn	Tyr	Ser	Gly	Val	Thr	Asn	384
		115					120					125				

act	gct	tat	cac	ggc	tat	tgg	gca	cgg	gat	ttc	aag	aag	acc	aat	cca	
Thr	Ala	Tyr	His	Gly	Tyr	Trp	Ala	Arg	Asp	Phe	Lys	Lys	Thr	Asn	Pro	432
	130					135					140					

tat	ttc	gga	acc	atg	acc	gat	ttt	cag	aat	ctg	gtg	acc	tcc	gcc	cat	480
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Sequence-Listing

Tyr 145	Phe	Gly	Thr	Met	Thr 150	Asp	Phe	Gln	Asn	Leu 155	Val	Thr	Ser	Ala	His 160	
gct Ala	aaa Lys	ggc Gly	atc Ile	aaa Lys 165	atc Ile	att Ile	att Ile	gat Asp	ttc Phe 170	gcg Ala	cca Pro	aac Asn	cat His	acg Thr 175	ttc Phe	528
cct Pro	gcc Ala	atg Met	gaa Glu 180	acc Thr	gat Asp	acc Thr	tcc Ser	ttc Phe 185	gct Ala	gaa Glu	aac Asn	ggc Gly	aaa Lys 190	ctg Leu	tac Tyr	576
gat Asp	aac Asn	ggc Gly 195	agc Ser	ctg Leu	gtg Val	ggc Gly	ggg Gly 200	tac Tyr	acc Thr	aat Asn	gat Asp	acg Thr 205	aac Asn	gga Gly	tat Tyr	624
ttt Phe	cac His 210	cac His	aat Asn	ggc Gly	ggc Gly	tcc Ser 215	gat Asp	ttc Phe	tcc Ser	act Thr	ctt Leu 220	gag Glu	aat Asn	ggc Gly	att Ile	672
tac Tyr 225	aaa Lys	aac Asn	ctc Leu	tac Tyr	gat Asp 230	ctg Leu	gcc Ala	gat Asp	ctg Leu	aat Asn 235	cac His	aat Asn	aac Asn	agc Ser	acg Thr 240	720
atc Ile	gat Asp	aca Thr	tat Tyr	ttc Phe 245	aaa Lys	gac Asp	gcc Ala	atc Ile	aag Lys 250	ctg Leu	tgg Trp	ctg Leu	gat Asp	atg Met 255	ggc Gly	768
gtg Val	gac Asp	ggc Gly	atc Ile	cgt Arg 260	gtc Val	gat Asp	gcg Ala	gtc Val	aag Lys 265	cac His	atg Met	cca Pro	cag Gln	gga Gly 270	tgg Trp	816
cag Gln	aag Lys	aac Asn	tgg Trp 275	atg Met	tca Ser	tcc Ser	atc Ile	tat Tyr 280	gca Ala	cac His	aag Lys	ccg Pro	gta Val 285	ttt Phe	acc Thr	864
ttc Phe	ggc Gly 290	gaa Glu	tgg Trp	ttc Phe	ctg Leu	gga Gly 295	tct Ser	gct Ala	gca Ala	tcc Ser	gat Asp 300	gcg Ala	gat Asp	aac Asn	aca Thr	912
gat Asp 305	ttt Phe	gcc Ala	aat Asn	gaa Glu	tcc Ser 310	ggt Gly	atg Met	agt Ser	ttg Leu	ctt Leu 315	gat Asp	ttt Phe	cgt Arg	ttc Phe	aat Asn 320	960
tcg Ser	gct Ala	gtc Val	cgc Arg	aac Asn 325	gtg Val	ttc Phe	cgg Arg	gat Asp	aac Asn 330	aca Thr	tcc Ser	aac Asn	atg Met	tac Tyr 335	gcg Ala	1008
ctg Leu	gat Asp	tcc Ser	atg Met 340	ctt Leu	acg Thr	gct Ala	acg Thr	gca Ala 345	gca Ala	gat Asp	tac Tyr	aat Asn	caa Gln 350	gtg Val	aat Asn	1056
gac Asp	caa Gln 355	gtc Val	act Thr	ttc Phe	att Ile	gac Asp	aac Asn 360	cat His	gat Asp	atg Met	gac Asp	cgt Arg 365	ttc Phe	aaa Lys	aca Thr	1104
agt Ser	gcg Ala 370	gtg Val	aac Asn	aac Asn	cgc Arg	cgt Arg 375	ctg Leu	gaa Glu	cag Gln	gct Ala 380	ctg Leu	gcc Ala	ttc Phe	acg Thr	ctg Leu	1152
acc Thr 385	tca Ser	cgc Arg	ggc Gly	gta Val	cct Pro 390	gcc Ala	atc Ile	tat Tyr	tat Tyr	ggg Gly 395	acc Thr	gag Glu	cag Gln	tat Tyr	ctg Leu 400	1200
acc Thr	ggg Gly	aat Asn	ggt Gly	gac Asp 405	ccg Pro	gat Asp	aac Asn	cgg Arg	ggc Gly 410	aaa Lys	atg Met	cct Pro	tcc Ser	ttc Phe 415	tcc Ser	1248
aaa	tcg	acc	aca	gcg	ttc	agc	gtg	atc	agc	aag	ctg	gct	cct	ctg	cgc	1296

Sequence-Listing															
Lys	Ser	Thr	Thr	Ala	Phe	Ser	Val	Ile	Ser	Lys	Leu	Ala	Pro	Leu	Arg
			420					425					430		
aaa	tcc	aac	ccg	gcg	att	gcc	tac	ggg	tcc	aca	cag	cag	cgc	tgg	atc
Lys	Ser	Asn	Pro	Ala	Ile	Ala	Tyr	Gly	Ser	Thr	Gln	Gln	Arg	Trp	Ile
		435					440				445				1344
aac	aat	gat	gta	tat	atc	tat	gag	cgc	aag	ttt	ggc	aaa	agc	gtt	gcc
Asn	Asn	Asp	Val	Tyr	Ile	Tyr	Glu	Arg	Lys	Phe	Gly	Lys	Ser	Val	Ala
	450					455					460				1392
gtt	gtt	gcc	gtt	aac	cgc	aat	ctc	acg	acg	cca	acc	agt	atc	acg	aac
Val	Val	Ala	Val	Asn	Arg	Asn	Leu	Thr	Thr	Pro	Thr	Ser	Ile	Thr	Asn
465					470					475					1440
ctg	aat	acg	tcc	ctt	cca	tca	gga	aca	tac	acc	gat	gtg	ctg	ggc	ggc
Leu	Asn	Thr	Ser	Leu	Pro	Ser	Gly	Thr	Tyr	Thr	Asp	Val	Leu	Gly	Gly
				485					490					495	1488
gtg	ctg	aac	gga	aac	aac	att	act	tca	agt	gga	ggc	aac	att	tct	tcc
Val	Leu	Asn	Gly	Asn	Asn	Ile	Thr	Ser	Ser	Gly	Gly	Asn	Ile	Ser	Ser
			500					505					510		1536
ttc	acg	ctc	gca	gca	gga	gct	acc	gct	gtg	tgg	cag	tat	acg	gca	agt
Phe	Thr	Leu	Ala	Ala	Gly	Ala	Thr	Ala	Val	Trp	Gln	Tyr	Thr	Ala	Ser
		515					520					525			1584
gaa	acg	acg	cca	acc	atc	ggg	cac	gtt	ggc	cct	gta	atg	ggg	aaa	cct
Glu	Thr	Thr	Pro	Thr	Ile	Gly	His	Val	Gly	Pro	Val	Met	Gly	Lys	Pro
	530					535					540				1632
ggg	aac	gtc	gtt	acc	atc	gac	gga	cgg	ggg	ttc	ggc	tcc	acc	aaa	ggg
Gly	Asn	Val	Val	Thr	Ile	Asp	Gly	Arg	Gly	Phe	Gly	Ser	Thr	Lys	Gly
545					550					555					1680
acc	gtc	tac	ttc	ggg	aca	aca	gcc	gtt	acg	ggc	tct	gcc	atc	act	tca
Thr	Val	Tyr	Phe	Gly	Thr	Thr	Ala	Val	Thr	Gly	Ser	Ala	Ile	Thr	Ser
					565					570					1728
tgg	gaa	gac	act	cag	atc	aaa	gtc	acc	att	cca	cca	gta	gca	ggc	ggg
Trp	Glu	Asp	Thr	Gln	Ile	Lys	Val	Thr	Ile	Pro	Pro	Val	Ala	Gly	Gly
			580					585					590		1776
gac	tat	gca	gtg	aaa	gtc	gct	gcc	aat	ggg	gtg	aac	agc	aat	gcc	tat
Asp	Tyr	Ala	Val	Lys	Val	Ala	Ala	Asn	Gly	Val	Asn	Ser	Asn	Ala	Tyr
		595					600					605			1824
aac	gat	ttc	acg	atc	cta	agc	ggc	gat	cag	gtc	tgc	gtt	cgg	ttc	gtc
Asn	Asp	Phe	Thr	Ile	Leu	Ser	Gly	Asp	Gln	Val	Ser	Val	Arg	Phe	Val
	610					615					620				1872
atc	aat	aat	gcc	aca	act	gca	ctg	ggg	gaa	aac	atc	tac	ctg	acg	ggc
Ile	Asn	Asn	Ala	Thr	Thr	Ala	Leu	Gly	Glu	Asn	Ile	Tyr	Leu	Thr	Gly
625					630					635					1920
aac	gtg	tcc	gaa	ctg	ggg	aac	tgg	acc	aca	ggg	gca	gct	tcc	att	gga
Asn	Val	Ser	Glu	Leu	Gly	Asn	Trp	Thr	Thr	Gly	Ala	Ala	Ser	Ile	Gly
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ccg	gct	ttc	aat	cag	gtc	atc	cac	gcc	tac	ccg	act	tgg	tat	tat	gac
Pro	Ala	Phe	Asn	Gln	Val	Ile	His	Ala	Tyr	Pro	Thr	Trp	Tyr	Tyr	Asp
			660					665				670			2016
gta	agt	gtt	cca	gcc	ggg	aaa	cag	ctg	gaa	ttc	aag	ttc	ttc	aag	aaa
Val	Ser	Val	Pro	Ala	Gly	Lys	Gln	Leu	Glu	Phe	Lys	Phe	Phe	Lys	Lys
		675					680					685			2064
aac	ggg	gct	acc	att	acg	tgg	gag	ggg	gga	tcc	aat	cac	acc	ttt	aca
															2112

Sequence-Listing

Asn Gly Ala Thr Ile Thr Trp Glu Gly Gly Ser Asn His Thr Phe Thr
690 695 700

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Thr Pro Thr Ser Gly Thr Ala Thr Val Thr Val Asn Trp Gln
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<212> DNA
<213> Artificial Sequence

<220>
<223> sense primer for PCR

<400> 8
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<210> 9
<211> 30
<212> DNA
<213> Artificial Sequence

<220>
<223> antisense primer for PCR

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tggagaaatc ggagcggcca ttgtggtgaa 30

<210> 10
<211> 30
<212> DNA
<213> Artificial Sequence

<220>
<223> sense primer for PCR

<400> 10
cttccatcag gaacacacac cgatgtgctg 30

<210> 11
<211> 30
<212> DNA
<213> Artificial Sequence

<220>
<223> antisense primer for PCR

<400> 11
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<210> 12
<211> 682
<212> PRT
<213> Artificial Sequence

<220>
<223> mutated CGTase(G178R)

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Gln Val Phe Thr Asp Arg Phe Leu Asp Gly Asn Pro Ser Asn Asn Pro
20 25 30
Thr Gly Ala Ala Phe Asp Gly Thr Cys Ser Asn Leu Lys Leu Tyr Cys
35 40 45
Gly Gly Asp Trp Gln Gly Leu Ile Asn Lys Ile Asn Asp Asn Tyr Phe

Sequence-Listing

50	55	60													
Ser	Asp	Leu	Gly	Val	Thr	Ala	Leu	Trp	Ile	Ser	Gln	Pro	Val	Glu	Asn
65					70					75					80
Ile	Phe	Ala	Thr	Ile	Asn	Tyr	Ser	Gly	Val	Thr	Asn	Thr	Ala	Tyr	His
				85					90					95	
Gly	Tyr	Trp	Ala	Arg	Asp	Phe	Lys	Lys	Thr	Asn	Pro	Tyr	Phe	Gly	Thr
			100					105					110		
Met	Thr	Asp	Phe	Gln	Asn	Leu	Val	Thr	Ser	Ala	His	Ala	Lys	Gly	Ile
		115					120					125			
Lys	Ile	Ile	Ile	Asp	Phe	Ala	Pro	Asn	His	Thr	Phe	Pro	Ala	Met	Glu
	130					135					140				
Thr	Asp	Thr	Ser	Phe	Ala	Glu	Asn	Gly	Lys	Leu	Tyr	Asp	Asn	Gly	Ser
145					150					155					160
Leu	Val	Gly	Gly	Tyr	Thr	Asn	Asp	Thr	Asn	Gly	Tyr	Phe	His	His	Asn
				165					170					175	
Gly	Arg	Ser	Asp	Phe	Ser	Thr	Leu	Glu	Asn	Gly	Ile	Tyr	Lys	Asn	Leu
			180					185					190		
Tyr	Asp	Leu	Ala	Asp	Leu	Asn	His	Asn	Asn	Ser	Thr	Ile	Asp	Thr	Tyr
		195					200					205			
Phe	Lys	Asp	Ala	Ile	Lys	Leu	Trp	Leu	Asp	Met	Gly	Val	Asp	Gly	Ile
	210					215					220				
Arg	Val	Asp	Ala	Val	Lys	His	Met	Pro	Gln	Gly	Trp	Gln	Lys	Asn	Trp
225					230					235					240
Met	Ser	Ser	Ile	Tyr	Ala	His	Lys	Pro	Val	Phe	Thr	Phe	Gly	Glu	Trp
				245					250					255	
Phe	Leu	Gly	Ser	Ala	Ala	Ser	Asp	Ala	Asp	Asn	Thr	Asp	Phe	Ala	Asn
			260					265					270		
Glu	Ser	Gly	Met	Ser	Leu	Leu	Asp	Phe	Arg	Phe	Asn	Ser	Ala	Val	Arg
		275					280					285			
Asn	Val	Phe	Arg	Asp	Asn	Thr	Ser	Asn	Met	Tyr	Ala	Leu	Asp	Ser	Met
	290					295					300				
Leu	Thr	Ala	Thr	Ala	Ala	Asp	Tyr	Asn	Gln	Val	Asn	Asp	Gln	Val	Thr
305					310					315					320
Phe	Ile	Asp	Asn	His	Asp	Met	Asp	Arg	Phe	Lys	Thr	Ser	Ala	Val	Asn
				325					330					335	
Asn	Arg	Arg	Leu	Glu	Gln	Ala	Leu	Ala	Phe	Thr	Leu	Thr	Ser	Arg	Gly
			340					345					350		
Val	Pro	Ala	Ile	Tyr	Tyr	Gly	Thr	Glu	Gln	Tyr	Leu	Thr	Gly	Asn	Gly
		355					360					365			
Asp	Pro	Asp	Asn	Arg	Gly	Lys	Met	Pro	Ser	Phe	Ser	Lys	Ser	Thr	Thr
	370					375					380				
Ala	Phe	Ser	Val	Ile	Ser	Lys	Leu	Ala	Pro	Leu	Arg	Lys	Ser	Asn	Pro
385					390					395					400
Ala	Ile	Ala	Tyr	Gly	Ser	Thr	Gln	Gln	Arg	Trp	Ile	Asn	Asn	Asp	Val
				405					410					415	
Tyr	Ile	Tyr	Glu	Arg	Lys	Phe	Gly	Lys	Ser	Val	Ala	Val	Val	Ala	Val
			420					425					430		
Asn	Arg	Asn	Leu	Thr	Thr	Pro	Thr	Ser	Ile	Thr	Asn	Leu	Asn	Thr	Ser
		435					440					445			
Leu	Pro	Ser	Gly	Thr	Tyr	Thr	Asp	Val	Leu	Gly	Gly	Val	Leu	Asn	Gly
	450					455					460				
Asn	Asn	Ile	Thr	Ser	Ser	Gly	Gly	Asn	Ile	Ser	Ser	Phe	Thr	Leu	Ala
465					470					475					480
Ala	Gly	Ala	Thr	Ala	Val	Trp	Gln	Tyr	Thr	Ala	Ser	Glu	Thr	Thr	Pro
				485					490					495	
Thr	Ile	Gly	His	Val	Gly	Pro	Val	Met	Gly	Lys	Pro	Gly	Asn	Val	Val
			500					505					510		
Thr	Ile	Asp	Gly	Arg	Gly	Phe	Gly	Ser	Thr	Lys	Gly	Thr	Val	Tyr	Phe
		515					520					525			
Gly	Thr	Thr	Ala	Val	Thr	Gly	Ser	Ala	Ile	Thr	Ser	Trp	Glu	Asp	Thr
	530					535					540				
Gln	Ile	Lys	Val	Thr	Ile	Pro	Pro	Val	Ala	Gly	Gly	Asp	Tyr	Ala	Val
545					550					555					560
Lys	Val	Ala	Ala	Asn	Gly	Val	Asn	Ser	Asn	Ala	Tyr	Asn	Asp	Phe	Thr
				565					570					575	
Ile	Leu	Ser	Gly	Asp	Gln	Val	Ser	Val	Arg	Phe	Val	Ile	Asn	Asn	Ala
			580					585					590		
Thr	Thr	Ala	Leu	Gly	Glu	Asn	Ile	Tyr	Leu	Thr	Gly	Asn	Val	Ser	Glu

Sequence-Listing

595 600 605
 Leu Gly Asn Trp Thr Thr Gly Ala Ala Ser Ile Gly Pro Ala Phe Asn
 610 615 620
 Gln Val Ile His Ala Tyr Pro Thr Trp Tyr Tyr Asp Val Ser Val Pro
 625 630 635 640
 Ala Gly Lys Gln Leu Glu Phe Lys Phe Phe Lys Lys Asn Gly Ala Thr
 645 650 655
 Ile Thr Trp Glu Gly Gly Ser Asn His Thr Phe Thr Thr Pro Thr Ser
 660 665 670
 Gly Thr Ala Thr Val Thr Val Asn Trp Gln
 675 680

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 <212> PRT
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<220>
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<400> 13
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 Gln Val Phe Thr Asp Arg Phe Leu Asp Gly Asn Pro Ser Asn Asn Pro
 20 25 30
 Thr Gly Ala Phe Asp Gly Thr Cys Ser Asn Leu Lys Leu Tyr Cys
 35 40 45
 Gly Gly Asp Trp Gln Gly Leu Ile Asn Lys Ile Asn Asp Asn Tyr Phe
 50 55 60
 Ser Asp Leu Gly Val Thr Ala Leu Trp Ile Ser Gln Pro Val Glu Asn
 65 70 75 80
 Ile Phe Ala Thr Ile Asn Tyr Ser Gly Val Thr Asn Thr Ala Tyr His
 85 90 95
 Gly Tyr Trp Ala Arg Asp Phe Lys Lys Thr Asn Pro Tyr Phe Gly Thr
 100 105 110
 Met Thr Asp Phe Gln Asn Leu Val Thr Ser Ala His Ala Lys Gly Ile
 115 120 125
 Lys Ile Ile Ile Asp Phe Ala Pro Asn His Thr Phe Pro Ala Met Glu
 130 135 140
 Thr Asp Thr Ser Phe Ala Glu Asn Gly Lys Leu Tyr Asp Asn Gly Ser
 145 150 155 160
 Leu Val Gly Gly Tyr Thr Asn Asp Thr Asn Gly Tyr Phe His His Asn
 165 170 175
 Gly Gly Ser Asp Phe Ser Thr Leu Glu Asn Gly Ile Tyr Lys Asn Leu
 180 185 190
 Tyr Asp Leu Ala Asp Leu Asn His Asn Asn Ser Thr Ile Asp Thr Tyr
 195 200 205
 Phe Lys Asp Ala Ile Lys Leu Trp Leu Asp Met Gly Val Asp Gly Ile
 210 215 220
 Arg Val Asp Ala Val Lys His Met Pro Gln Gly Trp Gln Lys Asn Trp
 225 230 235 240
 Met Ser Ser Ile Tyr Ala His Lys Pro Val Phe Thr Phe Gly Glu Trp
 245 250 255
 Phe Leu Gly Ser Ala Ala Ser Asp Ala Asp Asn Thr Asp Phe Ala Asn
 260 265 270
 Glu Ser Gly Met Ser Leu Leu Asp Phe Arg Phe Asn Ser Ala Val Arg
 275 280 285
 Asn Val Phe Arg Asp Asn Thr Ser Asn Met Tyr Ala Leu Asp Ser Met
 290 295 300
 Leu Thr Ala Thr Ala Ala Asp Tyr Asn Gln Val Asn Asp Gln Val Thr
 305 310 315 320
 Phe Ile Asp Asn His Asp Met Asp Arg Phe Lys Thr Ser Ala Val Asn
 325 330 335
 Asn Arg Arg Leu Glu Gln Ala Leu Ala Phe Thr Leu Thr Ser Arg Gly
 340 345 350
 Val Pro Ala Ile Tyr Tyr Gly Thr Glu Gln Tyr Leu Thr Gly Asn Gly
 355 360 365

Sequence-Listing

Asp	Pro	Asp	Asn	Arg	Gly	Lys	Met	Pro	Ser	Phe	Ser	Lys	Ser	Thr	Thr
	370					375					380				
Ala	Phe	Ser	Val	Ile	Ser	Lys	Leu	Ala	Pro	Leu	Arg	Lys	Ser	Asn	Pro
385					390					395					400
Ala	Ile	Ala	Tyr	Gly	Ser	Thr	Gln	Gln	Arg	Trp	Ile	Asn	Asn	Asp	Val
				405					410					415	
Tyr	Ile	Tyr	Glu	Arg	Lys	Phe	Gly	Lys	Ser	Val	Ala	Val	Val	Ala	Val
			420					425					430		
Asn	Arg	Asn	Leu	Thr	Thr	Pro	Thr	Ser	Ile	Thr	Asn	Leu	Asn	Thr	Ser
		435					440					445			
Leu	Pro	Ser	Gly	Thr	His	Thr	Asp	Val	Leu	Gly	Gly	Val	Leu	Asn	Gly
	450					455					460				
Asn	Asn	Ile	Thr	Ser	Ser	Gly	Gly	Asn	Ile	Ser	Phe	Thr	Leu	Ala	
465					470					475				480	
Ala	Gly	Ala	Thr	Ala	Val	Trp	Gln	Tyr	Thr	Ala	Ser	Glu	Thr	Thr	Pro
				485					490					495	
Thr	Ile	Gly	His	Val	Gly	Pro	Val	Met	Gly	Lys	Pro	Gly	Asn	Val	Val
			500					505					510		
Thr	Ile	Asp	Gly	Arg	Gly	Phe	Gly	Ser	Thr	Lys	Gly	Thr	Val	Tyr	Phe
		515					520					525			
Gly	Thr	Thr	Ala	Val	Thr	Gly	Ser	Ala	Ile	Thr	Ser	Trp	Glu	Asp	Thr
	530					535					540				
Gln	Ile	Lys	Val	Thr	Ile	Pro	Pro	Val	Ala	Gly	Gly	Asp	Tyr	Ala	Val
545					550					555				560	
Lys	Val	Ala	Ala	Asn	Gly	Val	Asn	Ser	Asn	Ala	Tyr	Asn	Asp	Phe	Thr
				565					570					575	
Ile	Leu	Ser	Gly	Asp	Gln	Val	Ser	Val	Arg	Phe	Val	Ile	Asn	Asn	Ala
			580					585					590		
Thr	Thr	Ala	Leu	Gly	Glu	Asn	Ile	Tyr	Leu	Thr	Gly	Asn	Val	Ser	Glu
		595					600					605			
Leu	Gly	Asn	Trp	Thr	Thr	Gly	Ala	Ala	Ser	Ile	Gly	Pro	Ala	Phe	Asn
	610					615					620				
Gln	Val	Ile	His	Ala	Tyr	Pro	Thr	Trp	Tyr	Tyr	Asp	Val	Ser	Val	Pro
625					630					635				640	
Ala	Gly	Lys	Gln	Leu	Glu	Phe	Lys	Phe	Phe	Lys	Lys	Asn	Gly	Ala	Thr
				645					650					655	
Ile	Thr	Trp	Glu	Gly	Gly	Ser	Asn	His	Thr	Phe	Thr	Thr	Pro	Thr	Ser
			660					665					670		
Gly	Thr	Ala	Thr	Val	Thr	Val	Asn	Trp	Gln						
	675						680								