

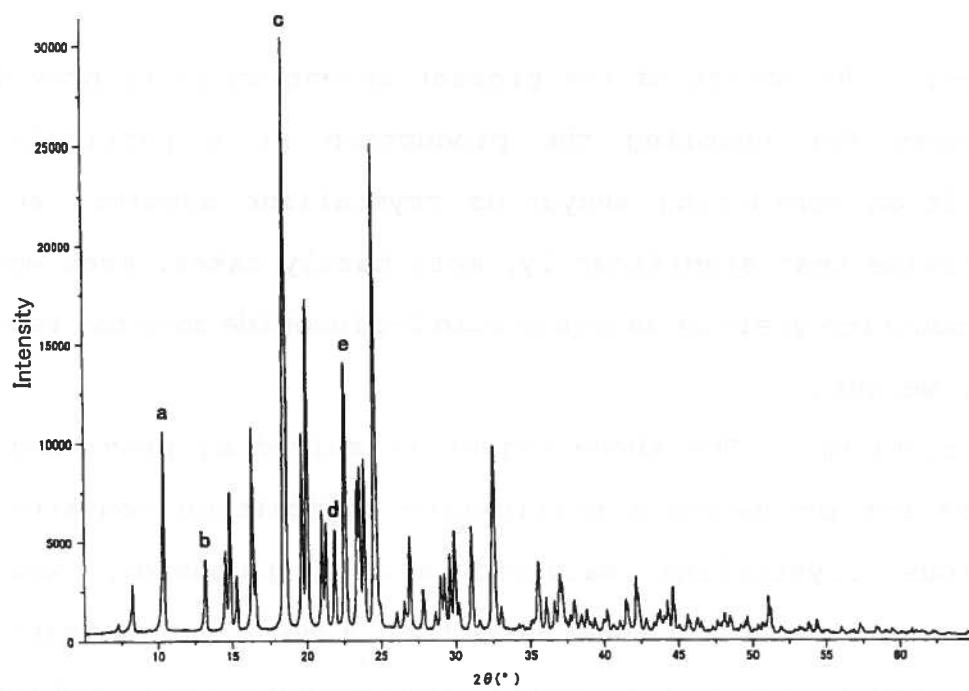


FIG. 1

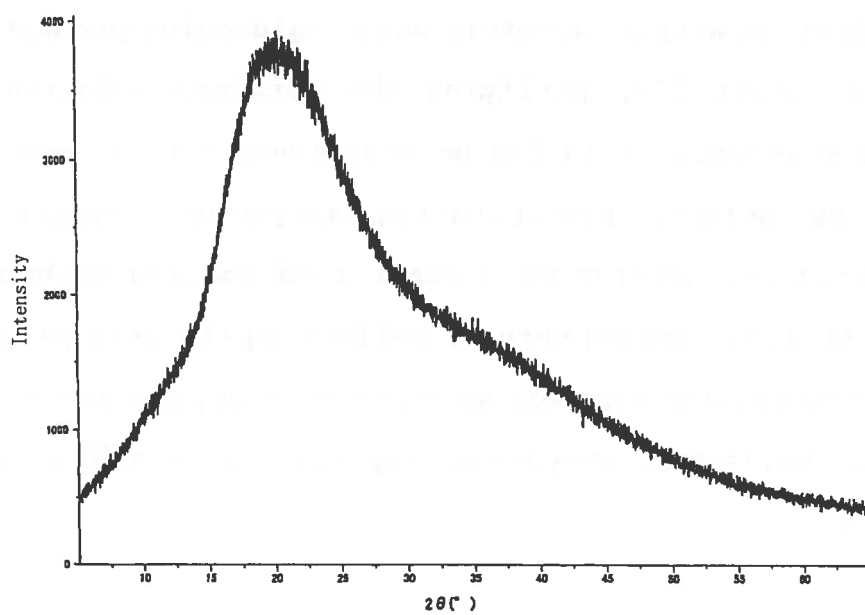


FIG. 2

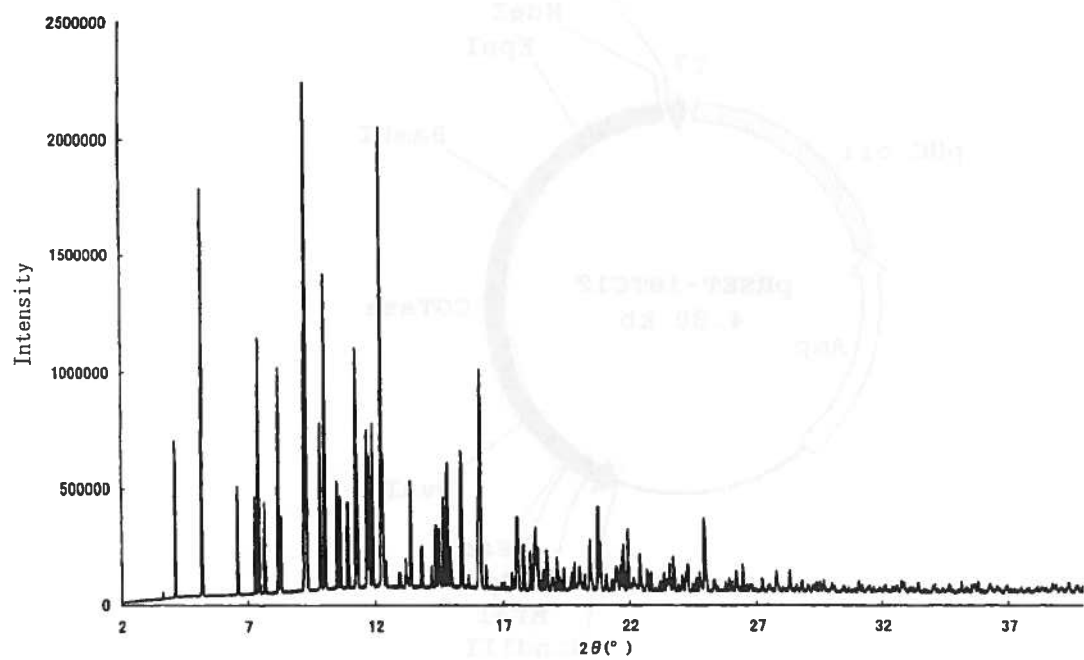


FIG. 3

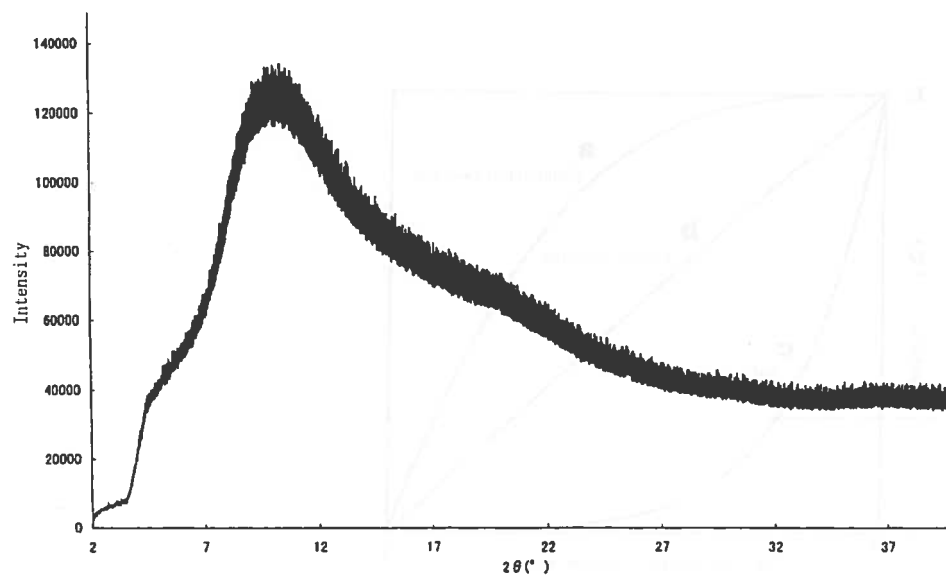


FIG. 4

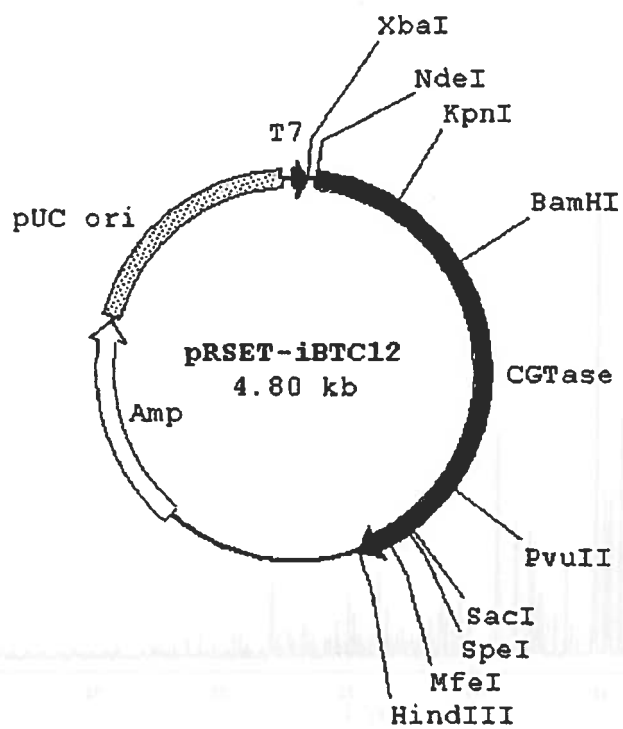


FIG. 5

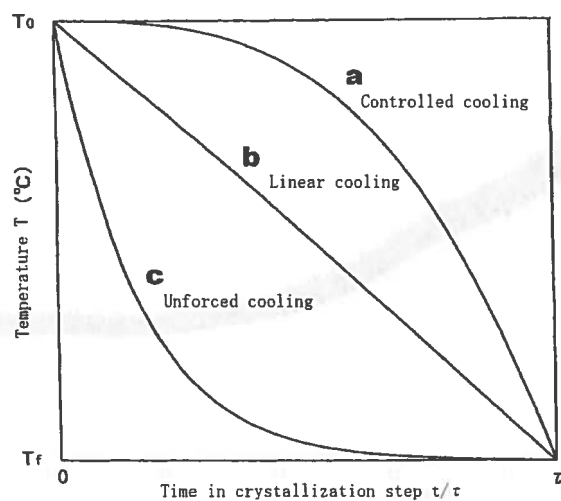


FIG. 6

SEQUENCE LISTING

<110> Hayashibara Co., Ltd.

<120> Process for producing a particulate composition comprising anhydrous crystalline 2-O-alpha-glucosyl-L-ascorbic acid

<130> WO1240

<160> 7

<210> 1

<211> 680

<212> PRT

<213> Geobacillus stearothermophilus

<400> 1

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			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
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<211> 2133

<212> DNA

<213> *Geobacillus stearothermophilus*

<400> 2

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gca att ttt ata gta tct gat acg cag aaa gtc acc gtt gaa gca gct	96
Ala Ile Phe Ile Val Ser Asp Thr Gln Lys Val Thr Val Glu Ala Ala	
20 25 30	
gga aat ctt aat aag gta aac ttt aca tca gat gtt gtc tat caa att	144
Gly Asn Leu Asn Lys Val Asn Phe Thr Ser Asp Val Val Tyr Gln Ile	
35 40 45	
gta gtg gat cga ttt gtg gat gga aat aca tcc aat aat ccg agt gga	192
Val Val Asp Arg Phe Val Asp Gly Asn Thr Ser Asn Asn Pro Ser Gly	
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gca tta ttt agc tca gga tgt acg aat tta cgc aag tat tgc ggt gga	240
Ala Leu Phe Ser Ser Gly Cys Thr Asn Leu Arg Lys Tyr Cys Gly Gly	
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gat tgg caa ggc atc atc aat aaa att aac gat ggg tat tta aca gat	288
Asp Trp Gln Gly Ile Ile Asn Lys Ile Asn Asp Gly Tyr Leu Thr Asp	
85 90 95	
atg ggt gtg aca gcg ata tgg att tct cag cct gta gaa aat gta ttt	336
Met Gly Val Thr Ala Ile Trp Ile Ser Gln Pro Val Glu Asn Val Phe	
100 105 110	
tct gtg atg aat gat gca agc ggt tca gcc tcc tat cat ggt tat tgg	384
Ser Val Met Asn Asp Ala Ser Gly Ser Ala Ser Tyr His Gly Tyr Trp	
115 120 125	
gcg cgc gat ttc aaa aag cca aac ccg ttt ttt ggt acc ctc agt gat	432
Ala Arg Asp Phe Lys Lys Pro Asn Pro Phe Phe Gly Thr Leu Ser Asp	
130 135 140	
ttc caa cgt tta gtt gat gcc gca cat gca aaa gga ata aag gta att	480
Phe Gln Arg Leu Val Asp Ala Ala His Ala Lys Gly Ile Lys Val Ile	
145 150 155 160	
att gac ttt gcc ccc aac cat act tct cct gct tca gaa acg aat cct	528
Ile Asp Phe Ala Pro Asn His Thr Ser Pro Ala Ser Glu Thr Asn Pro	
165 170 175	
tct tat atg gaa aac gga cga ctg tac gat aat ggg aca ttg ctt ggc	576
Ser Tyr Met Glu Asn Gly Arg Leu Tyr Asp Asn Gly Thr Leu Leu Gly	
180 185 190	
ggg tac aca aat gat gcc aac atg tat ttt cac cat aac ggt gga aca	624
Gly Tyr Thr Asn Asp Ala Asn Met Tyr Phe His His Asn Gly Gly Thr	
195 200 205	
acg ttt tcc agc tta gag gat ggg att tat cga aat ctg ttt gac ttg	672
Thr Phe Ser Ser Leu Glu Asp Gly Ile Tyr Arg Asn Leu Phe Asp Leu	
210 215 220	
gcg gac ctt aac cat cag aac cct gtt att gat agg tat tta aaa gat	720
Ala Asp Leu Asn His Gln Asn Pro Val Ile Asp Arg Tyr Leu Lys Asp	
225 230 235 240	
gca gta aaa atg tgg ata gat atg ggg att gat ggt atc cgt atg gat	768
Ala Val Lys Met Trp Ile Asp Met Gly Ile Asp Gly Ile Arg Met Asp	

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att	gat	aac	tat	cgt	cct	gtc	ttt	acg	ttt	ggg	gag	tgg	ttt	ttg	tca	864
Ile	Asp	Asn	Tyr	Arg	Pro	Val	Phe	Thr	Phe	Gly	Glu	Trp	Phe	Leu	Ser	
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gaa	aat	gaa	gtg	gac	gcg	aac	aat	cat	tac	ttt	gcc	aat	gaa	agt	gga	912
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	290					295					300					
atg	agt	ttg	ctc	gat	ttt	cgt	ttc	gga	caa	aag	ctt	cgt	caa	gta	ttg	960
Met	Ser	Leu	Leu	Asp	Phe	Arg	Phe	Gly	Gln	Lys	Leu	Arg	Gln	Val	Leu	
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cgc	aat	aac	agc	gat	aat	tgg	tat	ggc	ttt	aat	caa	atg	att	caa	gat	1008
Arg	Asn	Asn	Ser	Asp	Asn	Trp	Tyr	Gly	Phe	Asn	Gln	Met	Ile	Gln	Asp	
			325					330					335			
acg	gca	tca	gca	tat	gac	gag	gtt	ctc	gat	caa	gta	aca	ttc	ata	gac	1056
Thr	Ala	Ser	Ala	Tyr	Asp	Glu	Val	Leu	Asp	Gln	Val	Thr	Phe	Ile	Asp	
		340						345					350			
aac	cat	gat	atg	gat	cgg	ttt	atg	att	gac	gga	gga	gat	ccg	cgc	aag	1104
Asn	His	Asp	Met	Asp	Arg	Phe	Met	Ile	Asp	Gly	Gly	Asp	Pro	Arg	Lys	
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Val	Asp	Met	Ala	Leu	Ala	Val	Leu	Leu	Thr	Ser	Arg	Gly	Val	Pro	Asn	
	370				375						380					
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Ile	Tyr	Tyr	Gly	Thr	Glu	Gln	Tyr	Met	Thr	Gly	Asn	Gly	Asp	Pro	Asn	
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aat	cgt	aag	atg	atg	agt	tca	ttc	aat	aaa	aat	act	cgc	gcg	tat	caa	1248
Asn	Arg	Lys	Met	Met	Ser	Ser	Phe	Asn	Lys	Asn	Thr	Arg	Ala	Tyr	Gln	
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Val	Ile	Gln	Lys	Leu	Ser	Ser	Leu	Arg	Arg	Asn	Asn	Pro	Ala	Leu	Ala	
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Tyr	Gly	Asp	Thr	Glu	Gln	Arg	Trp	Ile	Asn	Gly	Asp	Val	Tyr	Val	Tyr	
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Glu	Arg	Gln	Phe	Gly	Lys	Asp	Val	Val	Leu	Val	Ala	Val	Asn	Arg	Ser	
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tca	agc	agt	aat	tac	tcg	att	act	ggc	tta	ttt	aca	gct	tta	cca	gca	1440
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Gly	Thr	Tyr	Thr	Asp	Gln	Leu	Gly	Gly	Leu	Leu	Asp	Gly	Asn	Thr	Ile	
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caa	gtc	ggg	tca	aat	gga	tca	gtt	aat	gca	ttt	gac	tta	gga	ccg	ggg	1536
Gln	Val	Gly	Ser	Asn	Gly	Ser	Val	Asn	Ala	Phe	Asp	Leu	Gly	Pro	Gly	
		500					505					510				
gaa	gtc	ggg	gta	tgg	gca	tac	agt	gca	aca	gaa	agc	acg	cca	att	att	1584
Glu	Val	Gly	Val	Trp	Ala	Tyr	Ser	Ala	Thr	Glu	Ser	Thr	Pro	Ile	Ile	
		515					520					525				
ggg	cat	gtt	gga	ccg	atg	atg	ggg	caa	gtc	ggg	cat	caa	gta	acc	att	1632

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gat	ggc	gaa	gga	ttc	gga	aca	aat	acg	ggc	act	gtg	aag	ttc	gga	acg	1680
Asp	Gly	Glu	Gly	Phe	Gly	Thr	Asn	Thr	Gly	Thr	Val	Lys	Phe	Gly	Thr	
545					550					555					560	
aca	gct	gcc	aat	gtt	gtg	tct	tg	tct	aac	aat	caa	atc	gtt	gtg	gct	1728
Thr	Ala	Ala	Asn	Val	Val	Ser	Trp	Ser	Asn	Asn	Gln	Ile	Val	Val	Ala	
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gta	cca	aat	gtg	tca	cca	gga	aaa	tat	aat	att	acc	gtc	caa	tca	tca	1776
Val	Pro	Asn	Val	Ser	Pro	Gly	Lys	Tyr	Asn	Ile	Thr	Val	Gln	Ser	Ser	
			580					585					590			
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gat	caa	gtg	tca	gtg	cgg	ttt	gtt	gtt	aat	aac	gcg	act	acc	aat	cta	1872
Asp	Gln	Val	Ser	Val	Arg	Phe	Val	Val	Asn	Asn	Ala	Thr	Thr	Asn	Leu	
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625					630						635				640	
gac	act	agt	aag	gca	atc	ggg	cca	atg	ttc	aat	caa	gtg	gtt	tac	tcc	1968
Asp	Thr	Ser	Lys	Ala	Ile	Gly	Pro	Met	Phe	Asn	Gln	Val	Val	Tyr	Ser	
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Tyr	Pro	Thr	Trp	Tyr	Ile	Asp	Val	Ser	Val	Pro	Glu	Gly	Lys	Thr	Ile	
			660				665						670			
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Glu	Phe	Lys	Phe	Ile	Lys	Lys	Asp	Ser	Gln	Gly	Asn	Val	Thr	Trp	Glu	
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	690					695					700					
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Ile	Ile	Val	Asp	Trp	Gln	Asn										
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<210> 3

<211> 681

<212> PRT

<213> Thermoanaerobacter thermosulfurigenes

<400> 3

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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	
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Ser	Tyr	His	Gly	Tyr	Trp	Ala	Arg	Asp	Phe	Lys	Lys	Pro	Asn	Pro	Phe	
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Phe	Gly	Ser	Phe	Thr	Asp	Phe	Gln	Asn	Leu	Ile	Ala	Thr	Ala	His	Ala	
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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	
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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	
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Lys	Val	Arg	Gln	Val	Phe	Arg	Asp	Asn	Thr	Asp	Thr	Met	Tyr	Gly	Leu	
	290					295					300					
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305					310					315				320		
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			325					330						335		
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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	
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Thr	Leu	Ala	Pro	Gly	Glu	Val	Ala	Val	Trp	Gln	Tyr	Val	Ser	Thr	Thr	

				485					490					495			
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		
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	595					600						605					
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Gln	Val	Val	Tyr	Gln	Tyr	Pro	Thr	Trp	Tyr	Tyr	Asp	Val	Ser	Val	Pro		
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Ala	Gly	Thr	Thr	Ile	Glu	Phe	Ile	Lys	Lys	Asn	Gly	Ser	Thr	Val	Thr		
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Trp	Glu	Gly	Gly	Tyr	Asn	His	Val	Tyr	Thr	Thr	Pro	Thr	Ser	Gly	Thr		
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<210> 4

<211> 680

<212> PRT

<213> Artificial amino acid sequence

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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	Arg
				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		
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	His	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	
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Lys	Ile	Ile	Val	Asp	Trp	Gln	Asn									
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<210> 5

<211> 680

<212> PRT

<213> Artificial amino acid sequence

<400> 5

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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	Ile	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	
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
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Lys	Ile	Ile	Val	Asp	Trp	Gln	Asn								
		675					680								

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 <211> 686
 <212> PRT
 <213> Bacillus macerans

<400> 6															
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			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
145					150					155					160
Gly	Thr	Leu	Leu	Gly	Lys	Tyr	Ser	Asn	Asp	Thr	Ala	Gly	Leu	Phe	His
				165					170					175	
His	Asn	Gly	Gly	Thr	Asp	Phe	Ser	Thr	Thr	Glu	Ser	Gly	Ile	Tyr	Lys
			180					185					190		
Asn	Leu	Tyr	Asp	Leu	Ala	Asp	Ile	Asn	Gln	Asn	Asn	Asn	Thr	Ile	Asp
		195					200					205			
Ser	Tyr	Leu	Lys	Glu	Ser	Ile	Gln	Leu	Trp	Leu	Asn	Leu	Gly	Val	Asp
	210					215					220				
Gly	Ile	Arg	Phe	Asp	Ala	Val	Lys	His	Met	Pro	Gln	Gly	Trp	Gln	Lys
225					230					235					240
Ser	Tyr	Val	Ser	Ser	Ile	Tyr	Ser	Ser	Ala	Asn	Pro	Val	Phe	Thr	Phe
				245					250					255	
Gly	Glu	Trp	Phe	Leu	Gly	Pro	Asp	Glu	Met	Thr	Gln	Asp	Asn	Ile	Asn
			260					265					270		
Phe	Ala	Asn	Gln	Ser	Gly	Met	His	Leu	Leu	Asp	Phe	Ala	Phe	Ala	Gln
		275					280					285			

Glu	Ile	Arg	Glu	Val	Phe	Arg	Asp	Lys	Ser	Glu	Thr	Met	Thr	Asp	Leu	290	295	300
Asn	Ser	Val	Ile	Ser	Ser	Thr	Gly	Ser	Ser	Tyr	Asn	Tyr	Ile	Asn	Asn	305	310	315
Met	Val	Thr	Phe	Ile	Asp	Asn	His	Asp	Met	Asp	Arg	Phe	Gln	Gln	Ala	325	330	335
Gly	Ala	Ser	Thr	Arg	Pro	Thr	Glu	Gln	Ala	Leu	Ala	Val	Thr	Leu	Thr	340	345	350
Ser	Arg	Gly	Val	Pro	Ala	Ile	Tyr	Tyr	Gly	Thr	Glu	Gln	Tyr	Met	Thr	355	360	365
Gly	Asn	Gly	Asp	Pro	Asn	Asn	Arg	Gly	Met	Met	Thr	Gly	Phe	Asp	Thr	370	375	380
Asn	Lys	Thr	Ala	Tyr	Lys	Val	Ile	Lys	Ala	Leu	Ala	Pro	Leu	Arg	Lys	385	390	395
Ser	Asn	Pro	Ala	Leu	Ala	Tyr	Gly	Ser	Thr	Thr	Gln	Arg	Trp	Val	Asn	405	410	415
Ser	Asp	Val	Tyr	Val	Tyr	Glu	Arg	Lys	Phe	Gly	Ser	Asn	Val	Ala	Leu	420	425	430
Val	Ala	Val	Asn	Arg	Ser	Ser	Thr	Thr	Ala	Tyr	Pro	Ile	Ser	Gly	Ala	435	440	445
Leu	Thr	Ala	Leu	Pro	Asn	Gly	Thr	Tyr	Thr	Asp	Val	Leu	Gly	Gly	Leu	450	455	460
Leu	Asn	Gly	Asn	Ser	Ile	Thr	Val	Asn	Gly	Gly	Thr	Val	Ser	Asn	Phe	465	470	475
Thr	Leu	Ala	Ala	Gly	Gly	Thr	Ala	Val	Trp	Gln	Tyr	Thr	Thr	Thr	Glu	485	490	495
Ser	Ser	Pro	Ile	Ile	Gly	Asn	Val	Gly	Pro	Thr	Met	Gly	Lys	Pro	Gly	500	505	510
Asn	Thr	Ile	Thr	Ile	Asp	Gly	Arg	Gly	Phe	Gly	Thr	Thr	Lys	Asn	Lys	515	520	525
Val	Thr	Phe	Gly	Thr	Thr	Ala	Val	Thr	Gly	Ala	Asn	Ile	Val	Ser	Trp	530	535	540
Glu	Asp	Thr	Glu	Ile	Lys	Val	Lys	Val	Pro	Asn	Val	Ala	Ala	Gly	Asn	545	550	555
Thr	Ala	Val	Thr	Val	Thr	Asn	Ala	Ala	Gly	Thr	Thr	Ser	Ala	Ala	Phe	565	570	575
Asn	Asn	Phe	Asn	Val	Leu	Thr	Ala	Asp	Gln	Val	Thr	Val	Arg	Phe	Lys	580	585	590
Val	Asn	Asn	Ala	Thr	Thr	Ala	Leu	Gly	Gln	Asn	Val	Tyr	Leu	Thr	Gly	595	600	605
Asn	Val	Ala	Glu	Leu	Gly	Asn	Trp	Thr	Ala	Ala	Asn	Ala	Ile	Gly	Pro	610	615	620
Met	Tyr	Asn	Gln	Val	Glu	Ala	Ser	Tyr	Pro	Thr	Trp	Tyr	Phe	Asp	Val	625	630	635
Ser	Val	Pro	Ala	Asn	Thr	Ala	Leu	Gln	Phe	Lys	Phe	Ile	Lys	Val	Asn	645	650	655
Gly	Ser	Thr	Val	Thr	Trp	Glu	Gly	Gly	Asn	Asn	His	Thr	Phe	Thr	Ser	660	665	670
Pro	Ser	Ser	Gly	Val	Ala	Thr	Val	Thr	Val	Asp	Trp	Gln	Asn			675	680	685

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 <211> 682
 <212> PRT
 <213> *Paenibacillus illinoisensis*

<400> 7
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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	
				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	
		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									