SEQUENCE LISTING

<110> Broadbent, Jeff R
Steele, James
Bhowmik, Tarun

<120> Enzymatic methods and enzymes

<130> 30348

<160> 8

<170> PatentIn version 3.3

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<213> Brevibacterium linens

<220>
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<400> 1

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Leu Ser Val Lys Thr Phe Glu Tyr Ser Pro Glu Val Arg Trp Ser Asp
1               5                   10                  15

cag gac atg ctt ggc cac gtg aac aac gcg cgc atg atc acc ctc atc       96
Gln Asp Met Leu Gly His Val Asn Asn Ala Arg Met Ile Thr Leu Ile
            20                  25                  30

gag gag tgc cgc atc agg tgg ctc cat gaa acc gaa gcg ggc agc ctg      144
Glu Glu Cys Arg Ile Arg Trp Leu His Glu Thr Glu Ala Gly Ser Leu
        35                  40                  45

acc ggc ggg ggc atg ctc gtc gcc aac cag tcg atc gac tac ctg ctc      192
Thr Gly Gly Gly Met Leu Val Ala Asn Gln Ser Ile Asp Tyr Leu Leu
    50                  55                  60

ccc gtc atg tac ggc ccc gag ctc aca atg acg gtg acc gtc aag cgg      240
Pro Val Met Tyr Gly Pro Glu Leu Thr Met Thr Val Thr Val Lys Arg
65                  70                  75                  80

atc ggc agc tcc tcg ttc act gtc cac acg cgt ggt gac cag agc ggc      288
Ile Gly Ser Ser Ser Phe Thr Val His Thr Arg Gly Asp Gln Ser Gly
                85                  90                  95

cag aag gtg ttc aac tcc gac gtc atc ctc gtc cac atc gac cgg gaa      336
Gln Lys Val Phe Asn Ser Asp Val Ile Leu Val His Ile Asp Arg Glu
            100                 105                 110

acc ggc cga cca gca ccg atc acc gag gac att cgc agt gtc ctc gag      384
Thr Gly Arg Pro Ala Pro Ile Thr Glu Asp Ile Arg Ser Val Leu Glu
        115                 120                 125

gaa tac ggc gcc gag gcc ggc tga                                     408
Glu Tyr Gly Ala Glu Ala Gly
    130                 135
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<210> 2
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<212> PRT
<213> Brevibacterium linens

<400> 2

Leu Ser Val Lys Thr Phe Glu Tyr Ser Pro Glu Val Arg Trp Ser Asp
1 5 10 15

Gln Asp Met Leu Gly His Val Asn Asn Ala Arg Met Ile Thr Leu Ile
20 25 30

Glu Glu Cys Arg Ile Arg Trp Leu His Glu Thr Glu Ala Gly Ser Leu
35 40 45

Thr Gly Gly Gly Met Leu Val Ala Asn Gln Ser Ile Asp Tyr Leu Leu
50 55 60

Pro Val Met Tyr Gly Pro Glu Leu Thr Met Thr Val Thr Val Lys Arg
65 70 75 80

Ile Gly Ser Ser Ser Phe Thr Val His Thr Arg Gly Asp Gln Ser Gly
85 90 95

Gln Lys Val Phe Asn Ser Asp Val Ile Leu Val His Ile Asp Arg Glu
100 105 110

Thr Gly Arg Pro Ala Pro Ile Thr Glu Asp Ile Arg Ser Val Leu Glu
115 120 125

Glu Tyr Gly Ala Glu Ala Gly
130 135

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Met Met Gly His Met His Asn Arg Thr Thr Asn Pro His Leu Asn Glu
20 25 30

ttc aca cga gtc ctg ttg gaa ctg aga tgg gga gac atg gat gcc tat 144
Phe Thr Arg Val Leu Leu Glu Leu Arg Trp Gly Asp Met Asp Ala Tyr
35 40 45

ggc cac gtc aac aat gtc acc cag ctg cgt ctg ctc gaa gag gca cgc 192
Gly His Val Asn Asn Val Thr Gln Leu Arg Leu Leu Glu Glu Ala Arg
50 55 60

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gtc cgc gct ctg ggc tca ccg acg cac agc acc gat gca ccc aca act      240
Val Arg Ala Leu Gly Ser Pro Thr His Ser Thr Asp Ala Pro Thr Thr
65                  70                  75                  80

cca ggt cag ctg gga atc tca ggc acg gta tcg ggg atc aca att ccg      288
Pro Gly Gln Leu Gly Ile Ser Gly Thr Val Ser Gly Ile Thr Ile Pro
                85                  90                  95

gcg atc ttc gcc gag gct tcg aac acc acc gag ctg ctc gtc gcc tcc      336
Ala Ile Phe Ala Glu Ala Ser Asn Thr Thr Glu Leu Leu Val Ala Ser
            100                 105                 110

cac gcg atc gaa tat cgc cgt ccc att ccc tac cgt gca ggt ccc att      384
His Ala Ile Glu Tyr Arg Arg Pro Ile Pro Tyr Arg Ala Gly Pro Ile
        115                 120                 125

gcc atc gat ctc gtc atc agc gag gtc aaa ccg gcc tct gtg acg atc      432
Ala Ile Asp Leu Val Ile Ser Glu Val Lys Pro Ala Ser Val Thr Ile
    130                 135                 140

ggt tac agc atc gcc gaa ccc gat ggt tcg gtc ggc tat acg ctg gca      480
Gly Tyr Ser Ile Ala Glu Pro Asp Gly Ser Val Gly Tyr Thr Leu Ala
145                 150                 155                 160

gag acg gtc atc gtc ttt gta gac agg acg acc tcc cga ccg cgt cgc      528
Glu Thr Val Ile Val Phe Val Asp Arg Thr Thr Ser Arg Pro Arg Arg
                165                 170                 175

ctg acc cag gag gag aca gca gca atg gaa gac gtc att cga cct gcc      576
Leu Thr Gln Glu Glu Thr Ala Ala Met Glu Asp Val Ile Arg Pro Ala
            180                 185                 190

gta ccg atg cgg ggt cgc aac cga tga                                  603
Val Pro Met Arg Gly Arg Asn Arg
        195                 200
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<213> Brevibacterium linens

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Val Cys Ser Arg Ser Tyr Arg Gly Pro His Cys Ser Gly Glu Gly Gly
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Met Met Gly His Met His Asn Arg Thr Thr Asn Pro His Leu Asn Glu
            20                  25                  30

Phe Thr Arg Val Leu Leu Glu Leu Arg Trp Gly Asp Met Asp Ala Tyr
        35                  40                  45

Gly His Val Asn Asn Val Thr Gln Leu Arg Leu Leu Glu Glu Ala Arg
    50                  55                  60

Val Arg Ala Leu Gly Ser Pro Thr His Ser Thr Asp Ala Pro Thr Thr
65                  70                  75                  80

Pro Gly Gln Leu Gly Ile Ser Gly Thr Val Ser Gly Ile Thr Ile Pro
                85                  90                  95
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```
Ala Ile Phe Ala Glu Ala Ser Asn Thr Thr Glu Leu Leu Val Ala Ser
            100                 105                 110

His Ala Ile Glu Tyr Arg Arg Pro Ile Pro Tyr Arg Ala Gly Pro Ile
        115                 120                 125

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

Gly Tyr Ser Ile Ala Glu Pro Asp Gly Ser Val Gly Tyr Thr Leu Ala
145                 150                 155                 160

Glu Thr Val Ile Val Phe Val Asp Arg Thr Thr Ser Arg Pro Arg Arg
                165                 170                 175

Leu Thr Gln Glu Glu Thr Ala Ala Met Glu Asp Val Ile Arg Pro Ala
            180                 185                 190

Val Pro Met Arg Gly Arg Asn Arg
        195                 200
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<212> DNA
<213> Brevibacterium linens

<220>
<221> CDS
<222> (1)..(435)

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atg aat ccg cag tcg gac gca ctt cca gat gtc tca ctt gcc tca gcc       48
Met Asn Pro Gln Ser Asp Ala Leu Pro Asp Val Ser Leu Ala Ser Ala
1               5                   10                  15

agc aac ttc gtc gcc gcc tcg ggg ctc gtc atc gac gag gtc acg aac       96
Ser Asn Phe Val Ala Ala Ser Gly Leu Val Ile Asp Glu Val Thr Asn
            20                  25                  30

aca agc gtc cgc ggc cat gcc gat ctg ggc agc gac cac cac acg cct      144
Thr Ser Val Arg Gly His Ala Asp Leu Gly Ser Asp His His Thr Pro
        35                  40                  45

tgg ggc gtc gtc cac ggc ggc gtg tac aca acg ctc gtg gag agc acg      192
Trp Gly Val Val His Gly Gly Val Tyr Thr Thr Leu Val Glu Ser Thr
    50                  55                  60

gga agc att ggt gcc agc cac gct gtg ggc gag cgc ggc gag ttc gcc      240
Gly Ser Ile Gly Ala Ser His Ala Val Gly Glu Arg Gly Glu Phe Ala
65                  70                  75                  80

gtc ggc atc cac aac gcc acc gac ttt ctg cgc ccg acc gcc ggc gcc      288
Val Gly Ile His Asn Ala Thr Asp Phe Leu Arg Pro Thr Ala Gly Ala
                85                  90                  95

cgc gtt gca gtc gag ggc acc gcc ctg cat cag ggc cgg acc cag cag      336
```

```
Arg Val Ala Val Glu Gly Thr Ala Leu His Gln Gly Arg Thr Gln Gln
            100                 105                 110

ctg tgg gag gtc atc atc acc gac acc tca tcg gac aag gtc ctg gcc      384
Leu Trp Glu Val Ile Ile Thr Asp Thr Ser Ser Asp Lys Val Leu Ala
        115                 120                 125

cgc ggc cag ctg cgc ctg cag aac gtc ccc atg ccg aag gag gcc aac      432
Arg Gly Gln Leu Arg Leu Gln Asn Val Pro Met Pro Lys Glu Ala Asn
    130                 135                 140

tga                                                                  435


<210>  6
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<213>  Brevibacterium linens

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Met Asn Pro Gln Ser Asp Ala Leu Pro Asp Val Ser Leu Ala Ser Ala
1               5                   10                  15


Ser Asn Phe Val Ala Ala Ser Gly Leu Val Ile Asp Glu Val Thr Asn
            20                  25                  30


Thr Ser Val Arg Gly His Ala Asp Leu Gly Ser Asp His His Thr Pro
        35                  40                  45


Trp Gly Val Val His Gly Gly Val Tyr Thr Thr Leu Val Glu Ser Thr
    50                  55                  60


Gly Ser Ile Gly Ala Ser His Ala Val Gly Glu Arg Gly Glu Phe Ala
65                  70                  75                  80


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


Arg Val Ala Val Glu Gly Thr Ala Leu His Gln Gly Arg Thr Gln Gln
            100                 105                 110


Leu Trp Glu Val Ile Ile Thr Asp Thr Ser Ser Asp Lys Val Leu Ala
        115                 120                 125


Arg Gly Gln Leu Arg Leu Gln Asn Val Pro Met Pro Lys Glu Ala Asn
    130                 135                 140


<210>  7
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<212>  DNA
<213>  Brevibacterium linens


<220>
<221>  CDS
<222>  (1)..(909)
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atg agc gat gca gaa ccc aca gcg gcc gag gcg aat gtc gac acg ctg       48
Met Ser Asp Ala Glu Pro Thr Ala Ala Glu Ala Asn Val Asp Thr Leu
1               5                   10                  15

cgc aaa gtg ctc gaa ctc gaa agt ctg agc ttc acc tcg gcg tct cgg       96
Arg Lys Val Leu Glu Leu Glu Ser Leu Ser Phe Thr Ser Ala Ser Arg
            20                  25                  30

gag agt gac tac ttc ctc gga cag aat cag tac aaa ccc gat ggg cgc      144
Glu Ser Asp Tyr Phe Leu Gly Gln Asn Gln Tyr Lys Pro Asp Gly Arg
        35                  40                  45

gtc tac ggc ggt cag gtc gtg gcg caa tct gtg gtg gcc gct gcc gcg      192
Val Tyr Gly Gly Gln Val Val Ala Gln Ser Val Val Ala Ala Ala Ala
    50                  55                  60

acc ctg ccg gat gat cgc ctc atc cat tca ctt cac ggc tat ttc ctt      240
Thr Leu Pro Asp Asp Arg Leu Ile His Ser Leu His Gly Tyr Phe Leu
65                  70                  75                  80

cgt gcc ggg gat gtc agc gaa ccg atc gag ttc ggt gtc gaa cga ctc      288
Arg Ala Gly Asp Val Ser Glu Pro Ile Glu Phe Gly Val Glu Arg Leu
                85                  90                  95

cgt gac ggg cga tcg ttc tcc gct cgg cgt gtc cac gcc tat cag aag      336
Arg Asp Gly Arg Ser Phe Ser Ala Arg Arg Val His Ala Tyr Gln Lys
            100                 105                 110

gat gtg cct atc ctg tcc ttg atc gcc tct ttc caa gtc gag cag gag      384
Asp Val Pro Ile Leu Ser Leu Ile Ala Ser Phe Gln Val Glu Gln Glu
        115                 120                 125

ggc ctt gaa cac gct gag acc atg cca tcg ggt ctg ccc ggt cca ctg      432
Gly Leu Glu His Ala Glu Thr Met Pro Ser Gly Leu Pro Gly Pro Leu
    130                 135                 140

gag tgc ccg gag ctg cga gac att ctc gca gga cag gac aca cca cag      480
Glu Cys Pro Glu Leu Arg Asp Ile Leu Ala Gly Gln Asp Thr Pro Gln
145                 150                 155                 160

gtc act gaa tgg ctg aat aag cga ccc ttc gag atc cgt ccg gtc gaa      528
Val Thr Glu Trp Leu Asn Lys Arg Pro Phe Glu Ile Arg Pro Val Glu
                165                 170                 175

gcg tcc ctg tat ctc acc tcc acc gat gac cgc cag cgc gaa cgg cag      576
Ala Ser Leu Tyr Leu Thr Ser Thr Asp Asp Arg Gln Arg Glu Arg Gln
            180                 185                 190

cac gtt tgg ttc cgc gcc agc tcg ccc ttc ggc gat gat ccg gtg ctc      624
His Val Trp Phe Arg Ala Ser Ser Pro Phe Gly Asp Asp Pro Val Leu
        195                 200                 205

aat gct gct gca ctg gcc tat gcc agc gac ttc aac ctg ctc gaa ccg      672
Asn Ala Ala Ala Leu Ala Tyr Ala Ser Asp Phe Asn Leu Leu Glu Pro
    210                 215                 220

gtt ctg cgc cgt cag gga ctg agt tgg acg agt ccg ggg ctc cgg gtg      720
Val Leu Arg Arg Gln Gly Leu Ser Trp Thr Ser Pro Gly Leu Arg Val
225                 230                 235                 240

gcc agc ctc gac cac gcg atg tgg tgg cat cgt cgg gtc cgg gtc gat      768
Ala Ser Leu Asp His Ala Met Trp Trp His Arg Arg Val Arg Val Asp
                245                 250                 255
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gag tgg atg ctc tat gtt cag gag tct cct gcc gcc cag gga ggc cgc      816
Glu Trp Met Leu Tyr Val Gln Glu Ser Pro Ala Ala Gln Gly Gly Arg
            260                 265                 270

ggt ctc ggc tac ggg cgg atc ttc gcc cag acg ggc gag ctg ctg gca      864
Gly Leu Gly Tyr Gly Arg Ile Phe Ala Gln Thr Gly Glu Leu Leu Ala
        275                 280                 285

aca gtg gct caa gag ggc atg gtc cgt gtg aag gct ccg cag tga          909
Thr Val Ala Gln Glu Gly Met Val Arg Val Lys Ala Pro Gln
    290                 295                 300


<210>  8
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<212>  PRT
<213>  Brevibacterium linens

<400>  8

Met Ser Asp Ala Glu Pro Thr Ala Ala Glu Ala Asn Val Asp Thr Leu
1               5                   10                  15


Arg Lys Val Leu Glu Leu Glu Ser Leu Ser Phe Thr Ser Ala Ser Arg
            20                  25                  30


Glu Ser Asp Tyr Phe Leu Gly Gln Asn Gln Tyr Lys Pro Asp Gly Arg
        35                  40                  45


Val Tyr Gly Gly Gln Val Val Ala Gln Ser Val Val Ala Ala Ala Ala
    50                  55                  60


Thr Leu Pro Asp Asp Arg Leu Ile His Ser Leu His Gly Tyr Phe Leu
65                  70                  75                  80


Arg Ala Gly Asp Val Ser Glu Pro Ile Glu Phe Gly Val Glu Arg Leu
                85                  90                  95


Arg Asp Gly Arg Ser Phe Ser Ala Arg Arg Val His Ala Tyr Gln Lys
            100                 105                 110


Asp Val Pro Ile Leu Ser Leu Ile Ala Ser Phe Gln Val Glu Gln Glu
        115                 120                 125


Gly Leu Glu His Ala Glu Thr Met Pro Ser Gly Leu Pro Gly Pro Leu
    130                 135                 140


Glu Cys Pro Glu Leu Arg Asp Ile Leu Ala Gly Gln Asp Thr Pro Gln
145                 150                 155                 160


Val Thr Glu Trp Leu Asn Lys Arg Pro Phe Glu Ile Arg Pro Val Glu
                165                 170                 175


Ala Ser Leu Tyr Leu Thr Ser Thr Asp Asp Arg Gln Arg Glu Arg Gln
            180                 185                 190
```

```
His Val Trp Phe Arg Ala Ser Ser Pro Phe Gly Asp Asp Pro Val Leu
        195                 200                 205

Asn Ala Ala Ala Leu Ala Tyr Ala Ser Asp Phe Asn Leu Leu Glu Pro
    210                 215                 220

Val Leu Arg Arg Gln Gly Leu Ser Trp Thr Ser Pro Gly Leu Arg Val
225                 230                 235                 240

Ala Ser Leu Asp His Ala Met Trp Trp His Arg Arg Val Arg Val Asp
                245                 250                 255

Glu Trp Met Leu Tyr Val Gln Glu Ser Pro Ala Ala Gln Gly Gly Arg
            260                 265                 270

Gly Leu Gly Tyr Gly Arg Ile Phe Ala Gln Thr Gly Glu Leu Leu Ala
        275                 280                 285

Thr Val Ala Gln Glu Gly Met Val Arg Val Lys Ala Pro Gln
    290                 295                 300
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