<110> CJ CheilJedang Corporation

<120> Novel microorganism for producing D-type lactic acid

<130> OPA13048/PCT

<150> KR10-2012-0042894
<151> 2012-04-24

<160> 32

<170> KopatentIn 2.0

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<220>
<223> primer

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37

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<211> 50
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 2
ttgcgtaagc aaaaatttta gtcatggtga tatcatcctt tcttatgtgc
50

<210> 3
<211> 50
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 3
gcacataaga aaggatgata tcaccatgac taaaattttt gcttacgcaa
50

<210> 4
<211> 55
<212> DNA

<213> Artificial Sequence

<220>
<223> primer

<400> 4
tggttgctta cttatcagtg atcgtgatga ttagccaacc ttaactggag tttca
55

<210> 5
<211> 55
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 5
tgaaactcca gttaaggttg gctaatcatc acgatcactg ataagtaagc aacca
55

<210> 6
<211> 39
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 6
atatgcacta gtgcttgtta aggatttgtg tcaagcctt
39

<210> 7
<211> 35
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 7
atctctcgag tctgacttac ctttcggatc aaaat
35

<210> 8
<211> 25
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 8
ctcaaattcc tcctcatgaa gatct
25

<210> 9
<211> 50
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 9
cgtcaagatc ttcatgagga ggaatttgag atgaaaatta ttgcatatgc
50

<210> 10
<211> 50
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 10
ccgttaagct gagcgcttaa cctgacgagc ttagtcaaac ttaacttgcg
50

<210> 11
<211> 25
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 11
gctcgtcagg ttaagcgctc agctt
25

<210> 12
<211> 35
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 12
atatactagt ccgttggctg ggcattgcgt cattc
35

<210> 13
<211> 35
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 13
ccccctcgag ctggtaatac atcattaact gccgc
35

<210> 14
<211> 50
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 14
ttgcgtaagc aaaaatttta gtcatggtga tatcatcctt tcttatgtgc
50

<210> 15
<211> 50
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 15
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50

<210> 16
<211> 50
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 16
ggtttaaaat cagttatggt gaagattagc caaccttaac tggagtttca
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<210> 17
<211> 50
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 17
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50

<210> 18
<211> 35
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 18
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35

<210> 19
<211> 35
<212> DNA
<213> Artificial Sequence

<220>
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<400> 19
ccccctcgag aaccaagcgt ccaagaatgt ttgct
35

<210> 20
<211> 50
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 20

gtacagcata tgcaataatt ttcatcctaa acccctcctt gacaggtagc
50

<210> 21
<211> 50
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 21
gctacctgtc aaggaggggt ttaggatgaa aattattgca tatgctgtac
50

<210> 22
<211> 50
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 22
aaaaatactg acgatgggtt gtgttttagt caaacttaac ttgcgtatca
50

<210> 23
<211> 50
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 23
tgatacgcaa gttaagtttg actaaaacac aacccatcgt cagtattttt
50

<210> 24
<211> 35
<212> DNA
<213> Artificial Sequence

<220>
<223> primer

<400> 24
tagaactagt caaccgttgt cgaaagcatt gcggt
35

<210> 25
<211> 981
<212> DNA
<213> Lactobacillus paracasei ldh

<400> 25
gtggcaagta ttacggataa ggatcaccaa aaagttattc tcgttggtga cggcgccgtt
60

ggttcaagtt atgcctacgc aatggttttg caaggtatcg ctcaggaaat cggaatcgtt
120

gacattttca aggacaagac aaagggtgac gcgattgact tgagcaacgc gctcccattc
180

acaagtccta agaagattta ttcagctgaa tacagcgatg ctaaggatgc tgatctggtt
240

gttatcacag ctggcgctcc tcagaagcct ggcgaaactc gtttggactt ggttaacaag
300

aacttgaaga tcttgaagtc cattgttgac ccaatcgttg attccggctt taacggtatt
360

ttcttagttg ctgccaaccc agttgacatt ttgacctatg caacttggaa actttctggc
420

ttcccgaaga accgggttgt tggttccggt acttcactgg acaccgcccg cttccgtcag
480

tccattgctg aaatggttaa tgttgacgct cgttcggtcc acgcttacat catgggcgaa
540

catggtgaca ctgaattccc tgtatggtcc cacgctaaca ttggtggcgt taccatcgct
600

gaatgggtta aggctcatcc agaaatcaag gaagacaagc ttgttaagat gtttgaagac
660

gttcgtgacg ccgcttatga aatcatcaaa ctcaagggtg cgaccttcta tggtatcgca
720

actgcccttg cccggatttc aaaggcaatc cttaacgacg aaaatgcggt tctgccactt
780

tccgtttaca tggatggtca atatggcttg aacgacatct acatcggtac cccagctgtg
840

atcaaccgta atggtatcca gaacatcctg gaaatcccat tgaccgatca cgaagaagaa
900

tccatgcaga aatctgcttc tcaattgaag aaggttctga ccgatgcttt cgctaagaat
960

gacatcgaaa ctcgtcagta a
981

<210> 26
<211> 999
<212> DNA
<213> Lactobacillus paracasei ldh1

<400> 26
atgaaaatta ttgcatatgc tgtacgtgat gacgaacgtc cattcttcga tacttggatg
60

aaagaaaacc cagatgttga agttaaatta gttccagaat tacttactga agacaacgtt
120

gacttagcta aaggcttcga cggtgccgat gtataccaac aaaaggacta tactgctgaa
180

gtattgaaca agttagccga cgaaggggtt aagaacatct ctcttcgtaa cgttggtgtt
240

gataacttgg acgttcctac tgttaaagca cgtggcttaa acatttctaa cgtacctgca
300

tactcaccaa atgcgattgc tgaattatca gtaacgcaat tgatgcaatt attacgtcaa
360

accccattgt tcaataagaa gttagctaag caagacttcc gttgggcacc agatattgcc
420

aaggaattaa acaccatgac tgttggtgtt atcggtactg gtcggattgg ccgtgctgcc
480

atcgatattt tcaaaggctt cggcgctaag gttatcggtt acgatgttta ccggaatgct
540

gaacttgaaa aggaaggcat gtacgttgac accttggacg aattatacgc ccaagctgat
600

gttatcacgt tacacgttcc tgcattgaag gataactacc acatgttgaa tgcggatgcc
660

ttcagcaaga tgaaagatgg cgcctacatc ttgaactttg ctcgtgggac actcatcgat
720

tcagaagact tgatcaaagc cttagacagt ggcaaagttg ccggtgccgc tcttgatacg
780

tatgaatacg aaactaagat cttcaacaaa gaccttgaag gtcaaacgat tgatgacaag
840

gtcttcatga acttgttcaa ccgcgacaat gttttgatta caccacatac ggctttctac
900

actgaaactg ccgttcacaa catggtgcac gtttcaatga acagtaacaa acaattcatc
960

gaaactggta aagctgatac gcaagttaag tttgactaa
999

<210>	27
<211>	981
<212>	DNA
<213>	Lactobacillus casei ldh1

<400>	27
gtggcaagta ttacggataa ggatcaccaa aaagttattc tcgttggtga cggcgccgtt
60

ggttcaagtt atgcctacgc aatggttttg caaggtatcg ctcaggaaat cggaatcgtt
120

gacattttca aggacaagac aaagggtgac gcgattgact tgagcaacgc gctcccattc
180

acaagtccta agaagattta ttcagctgaa tacagcgatg ctaaggatgc tgatctggtt
240

gttatcacag ctggcgctcc tcagaagcct ggcgaaactc gtttggactt ggttaacaag
300

aacttgaaga tcttgaagtc cattgttgac ccaatcgttg attccggctt taacggtatt
360

ttcttagttg ctgccaaccc agttgacatt ttgacctatg caacttggaa actttctggc
420

ttcccgaaga accgggttgt tggttccggt acttcactgg acaccgcccg cttccgtcag
480

tccattgctg aaatggttaa tgttgacgct cgttcggtcc acgcttacat catgggcgaa
540

catggtgaca ctgaattccc tgtatggtcc cacgctaaca ttggtggcgt taccatcgct
600

gaatgggtta aggctcatcc agaaatcaag gaagacaagc ttgttaagat gtttgaagac
660

gttcgtgacg ccgcttatga aatcatcaaa ctcaagggtg cgaccttcta tggtatcgca
720

actgcccttg cccggatttc aaaggcaatc cttaacgacg aaaatgcggt tctgccactt
780

tccgtttaca tggatggtca atatggcttg aacgacatct acatcggtac cccagctgtg
840

atcaaccgta atggtatcca gaacatcctg gaaatcccat tgaccgatca cgaagaagaa
900

tccatgcaga aatctgcttc tcaattgaag aaggttctga ccgatgcttt cgctaagaat
960

gacatcgaaa ctcgtcagta a
981

<210> 28
<211> 939
<212> DNA
<213> Lactobacillus casei ldh2

<400> 28
atgcggaaca acggcaatat tattttaatt ggtgatggcg cgattggatc aagttatgcg
60

ttcaactgtc tcaccaccgg cgtcggccag agtcttggta ttattgatgt taacgaaaaa
120

cgcgtgcaag gtgacgtcga agatctttct gattccctac cttacacgtc acagaagaat
180

atttatgcgg ccagctatga agattgcaaa tatgccgata ttatcgtcat cacagccgga
240

attgcccaaa agccaggtca gacacgccta caacttttgg ccatcaacgc aaagatcatg
300

aaagaaatca cacataacat tatggcaagc gggttcaatg ggtttattct agtcgcatcc
360

aatccagtcg atgtccttgc cgaattagtc ttgcaagaat ccggcttgcc acgtaatcag
420

gtgctgggat cagggacggc gcttgattca gctcgcttac ggtctgagat cggtctgcgt
480

tataacgtgg acgcccggat tgtgcacggc tacatcatgg gtgaacacgg cgattctgaa
540

tttccagttt gggactacac caacattggc ggcaaaccga ttcttgattg gattcctaaa
600

gatcgccagg ataaagatct gcctgatatt agcgagcgcg tcaaaacggc tgcttatggc
660

atcattgaga aaaaaggtgc cactttctac ggcattgctg cctcattaac ccgtttaacc
720

agcgccttct tgaatgatga tcgcgcagca ttcgcaatgt ccgtccattt ggaaggcgaa
780

tacggcttgt caggtgtttc catcggtgta ccggtaatcc tcggcgctaa tggcttagaa
840

cgcatcattg agctggattt gaacccagaa gatcataagc ggttagccga ttctgcagct
900

attttgaaag aaaatctgaa gaaggctcaa gaagcttaa
939

<210> 29

<211> 981
<212> DNA
<213> Lactobacillus rhamnosus LGG_02523

<400> 29
gtggcaagta ttacggataa ggatcaccaa aaagttattc tcgttggtga tggcgccgtt
60

ggttcaagct atgcctatgc aatggttttg caaggtatcg ctcaagaaat cgggattgtt
120

gacattttca aggacaagac gaaaggtgac gcaattgatt taagcaacgc gctcccattc
180

accagtccta agaagattta ttctgctgaa tacagcgatg ccaaggatgc tgatctggtt
240

gttatcactg ctggtgctcc tcaaaagcct ggcgaaactc gcttggatct ggttaacaag
300

aacttgaaga ttttgaagtc cattgttgat ccgatcgtgg attctggctt taacggtatc
360

ttcttggttg ctgctaaccc agttgatatc ttgacttatg ctacttggaa gctttccgga
420

ttcccgaaga gccgggttgt tggttcaggt acttctctgg acaccgctcg tttccgtcaa
480

tccattgctg aaatggttaa cgttgatgct cgttccgtcc acgcatatat catgggtgaa
540

cacggcgaca cagaattccc tgtatggtcc cacgctaaca ttggtggcgt taccatcgct
600

gaatgggtta aagcacatcc agaaatcaaa gaagacaaac ttgttaagat gtttgaagac
660

gttcgtgacg ctgcttacga aatcatcaaa ctcaagggtg caaccttcta cggtatcgca
720

actgctttgg cacggatttc caaagcaatt cttaacgatg aaaatgcggt actcccattg
780

tccgtttaca tggacggcca atatggcttg aacgacatct acattggtac acctgctgtg
840

atcaaccgca atggtattca gaacattctg gaaatcccat tgaccgacca cgaagaagaa
900

tccatgcaga agtcggcttc acaattgaag aaagttctga ccgatgcgtt tgctaagaac
960

gacatcgaaa cacgtcagta a
981

<210> 30

<211> 939
<212> DNA
<213> Lactobacillus rhamnosus LGG_00606

<400> 30
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60

tttaactgtt taacgaccgg cgttggtcaa agcctgggca ttattgacgt caatgagaaa
120

cgagtacaag gcgatgtgga ggatctttcg gacgcgctgc cgtatacgtc ccaaaagaat
180

atctatgcag cgagttatga agactgcaaa tacgccgata tcattgtgat cacggctggc
240

atcgcgcaaa agcccggtca gacccgactg gaactgttgt cgatcaatgc caaaatcata
300

aaagaaatca cgcacaatat catggccagt ggttttaatg gttttattct cgttgcctca
360

aacccggtcg acgtgctcgc ggaattagtg ctggaagaat cggggctgcc gcgtaaccaa
420

gtactaggct caggtacagc gctggattca gcccgtctgc gttcggaaat cggcttgcgt
480

tacaatgtgg atgcgcgcat tgtccacggc tacatcatgg gcgaacatgg cgactccgaa
540

tttccggttt gggattacac caatattggc ggcaaaccga ttctcgattg gattcccaaa
600

aatcgccaag caagtgattt agctgaaatc agccaccgcg ttaaaactgc cgcatatggc
660

atcattgaaa agaaaggtgc tactttctac ggaatcgccg cttcgctcac ccgcctgacc
720

agtgcctttt tgaatgacga ccgggcagca ttcgcgatgt cggtccatct tgacggtgag
780

tatggtttgt caggtgtctc cattggggta ccggttatcc tcggcgcaaa cggcttagaa
840

cgtatcatcg aacttgattt aaacgcggaa gaccacaaac gcctggctga ctctgctgcc
900

attttgaaag ataatttaaa gaaggcacag gaagcctag
939

<210> 31
<211> 333
<212> PRT
<213> Lactobacillus delbrueckii ldhA

<400> 31

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Leu Lys Glu Trp Glu Asp Ala His Lys Asp Val Glu Val Glu Tyr Thr
             20                  25                  30

Asp Lys Leu Leu Thr Pro Glu Thr Val Ala Leu Ala Lys Gly Ala Asp
         35                  40                  45

Gly Val Val Val Tyr Gln Gln Leu Asp Tyr Thr Ala Glu Thr Leu Gln
     50                  55                  60

Ala Leu Ala Asp Asn Gly Ile Thr Lys Met Ser Leu Arg Asn Val Gly
 65                  70                  75                  80

Val Asp Asn Ile Asp Met Ala Lys Ala Lys Glu Leu Gly Phe Gln Ile
                 85                  90                  95

Thr Asn Val Pro Val Tyr Ser Pro Asn Ala Ile Ala Glu His Ala Ala
            100                 105                 110

Ile Gln Ala Ala Arg Ile Leu Arg Gln Asp Lys Ala Met Asp Glu Lys
        115                 120                 125

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

Arg Asp Gln Val Val Gly Val Ile Gly Thr Gly His Ile Gly Gln Val
145                 150                 155                 160

Phe Met Gln Ile Met Glu Gly Phe Gly Ala Lys Val Ile Ala Tyr Asp
                165                 170                 175

Ile Phe Arg Asn Pro Glu Leu Glu Lys Lys Gly Tyr Tyr Val Asp Ser
            180                 185                 190

Leu Asp Asp Leu Tyr Lys Gln Ala Asp Val Ile Ser Leu His Val Pro
        195                 200                 205

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

Met Lys Gln Asp Val Val Ile Val Asn Val Ser Arg Gly Pro Leu Val
225                 230                 235                 240

Asp Thr Asp Ala Val Ile Arg Gly Leu Asp Ser Gly Lys Ile Phe Gly
                245                 250                 255

Tyr Ala Met Asp Val Tyr Glu Gly Glu Val Gly Ile Phe Asn Glu Asp
            260                 265                 270

Trp Glu Gly Lys Glu Phe Pro Asp Ala Arg Leu Ala Asp Leu Ile Ala
        275                 280                 285

Arg Pro Asn Val Leu Val Thr Pro His Thr Ala Phe Tyr Thr Thr His
    290                 295                 300
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Ala Val Arg Asn Met Val Val Lys Ala Phe Asp Asn Asn Leu Glu Leu
305                 310                 315                 320

Val Glu Gly Lys Glu Ala Glu Thr Pro Val Lys Val Gly
                325                 330
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<210> 32
<211> 332
<212> PRT
<213> Lactobacillus plantarum ldhD

<400> 32

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Asp Thr Trp Met Lys Glu Asn Pro Asp Val Glu Val Lys Leu Val Pro
             20                  25                  30

Glu Leu Leu Thr Glu Asp Asn Val Asp Leu Ala Lys Gly Phe Asp Gly
         35                  40                  45

Ala Asp Val Tyr Gln Gln Lys Asp Tyr Thr Ala Glu Val Leu Asn Lys
     50                  55                  60

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

Asp Asn Leu Asp Val Pro Thr Val Lys Ala Arg Gly Leu Asn Ile Ser
                 85                  90                  95

Asn Val Pro Ala Tyr Ser Pro Asn Ala Ile Ala Glu Leu Ser Val Thr
            100                 105                 110

Gln Leu Met Gln Leu Leu Arg Gln Thr Pro Leu Phe Asn Lys Lys Leu
        115                 120                 125

Ala Lys Gln Asp Phe Arg Trp Ala Pro Asp Ile Ala Lys Glu Leu Asn
    130                 135                 140

Thr Met Thr Val Gly Val Ile Gly Thr Gly Arg Ile Gly Arg Ala Ala
145                 150                 155                 160

Ile Asp Ile Phe Lys Gly Phe Gly Ala Lys Val Ile Gly Tyr Asp Val
                165                 170                 175

Tyr Arg Asn Ala Glu Leu Glu Lys Glu Gly Met Tyr Val Asp Thr Leu
            180                 185                 190

Asp Glu Leu Tyr Ala Gln Ala Asp Val Ile Thr Leu His Val Pro Ala
        195                 200                 205

Leu Lys Asp Asn Tyr His Met Leu Asn Ala Asp Ala Phe Ser Lys Met
    210                 215                 220

Lys Asp Gly Ala Tyr Ile Leu Asn Phe Ala Arg Gly Thr Leu Ile Asp
225                 230                 235                 240
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Ser Glu Asp Leu Ile Lys Ala Leu Asp Ser Gly Lys Val Ala Gly Ala
                245                 250                 255

Ala Leu Asp Thr Tyr Glu Tyr Glu Thr Lys Ile Phe Asn Lys Asp Leu
            260                 265                 270

Glu Gly Gln Thr Ile Asp Asp Lys Val Phe Met Asn Leu Phe Asn Arg
        275                 280                 285

Asp Asn Val Leu Ile Thr Pro His Thr Ala Phe Tyr Thr Glu Thr Ala
    290                 295                 300

Val His Asn Met Val His Val Ser Met Asn Ser Asn Lys Gln Phe Ile
305                 310                 315                 320

Glu Thr Gly Lys Ala Asp Thr Gln Val Lys Phe Asp
                325                 330
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