

SEQUENCE LISTING

<110> Univerza v Ljubljani

<120> Cytochrome P450 from Rhizopus oryzae and uses thereof

<130> P003113pc

<160> 3

<170> PatentIn version 3.3

<210> 1

<211> 526

<212> PRT

<213> Rhizopus oryzae

<400> 1

Met Met Glu Ile Ala Glu Phe Ala Leu Glu Ser Tyr Arg Ser Thr Leu
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Glu Lys Ile Leu Pro Val Leu Gln Lys Lys Ser Lys Lys Ser Tyr Ile
20 25 30

Gly Ala Ala Ile Thr Leu Ile Val Leu His Arg Ile Tyr Ser Tyr Phe
35 40 45

Lys Val Pro Lys Arg Phe Gln His Leu Pro Lys Leu Ser Tyr Phe Pro
50 55 60

Ser Ala Lys Ser Ile Phe Asn Asn Glu Pro Ile Tyr Asp Arg Tyr Lys
65 70 75 80

Arg Leu Val Phe Pro Val Ile Lys Glu Asn Asn Gly Ile Tyr Val Ser
85 90 95

Lys Ile Ser Phe Asp Trp Thr Val Tyr Ile Ala Asn Pro Val Ala Ala
100 105 110

Lys His Val Leu Leu Lys Ala Asp Leu Tyr Pro Lys Ser His Asp Phe
115 120 125

Leu Lys Met Leu Gly Ser Asn Ser Pro Val Val Gln Phe Leu Gly Tyr
130 135 140

Asp Ser Val Gly Leu Thr Asn Gly His Val Trp Lys Asn Gln Arg Lys
145 150 155 160

Leu Met Asn Pro Ala Phe His Arg Ser Met Pro Ile Asn Thr Met Ser
165 170 175

Thr Val Ile Pro Asp Leu Phe Phe Val Ile Glu Lys Glu Asn Gly Thr
180 185 190

Ile Ala Val Pro Ser Val Met Arg Asp Phe Thr Leu Asp Val Leu Gly
195 200 205

Leu Thr Val Phe Gly Phe Asp Phe Lys Ala Leu Lys Gly Asp Pro Asp
1

210	215	220
Glu Trp Thr Lys Thr Phe Thr Leu Ala Asn Glu Gly Leu Phe Asp Pro 225 230 235 240		
Ile Leu Asn Ile Phe Gly Pro Phe Ser Phe Ile Leu Thr Ala Ile Phe 245 250 255		
Pro Lys Arg Arg Glu Gln Leu Lys Ala Val Ala Lys Leu Asn Gly Lys 260 265 270		
Leu Glu Gln Leu Ile His Gln Lys Arg Met Glu Ile Glu Asn Gly Ala 275 280 285		
Tyr Ser Asn Thr Pro Glu Asn Glu Lys Asp Leu Val Ala Leu Met Leu 290 295 300		
Glu Ala Glu Lys Arg Gly Glu Gly Leu Thr Asn Asp Leu Glu Leu Arg 305 310 315 320		
His Asn Ile Ala Gly Phe Phe Leu Ala Gly His Asp Thr Thr Ala Asn 325 330 335		
Ala Leu Ser Phe Cys Phe Tyr Asn Leu Ala Lys Asn Lys His Val Gln 340 345 350		
Asn Lys Leu Arg Gln Glu Ile Ile Ser Val Leu Gly Asp Asp Pro Lys 355 360 365		
Asp Val Val Pro Thr Leu Asp Gln Leu Lys Glu Met Pro Tyr Leu Asn 370 375 380		
Leu Val Leu Lys Glu Asn Leu Arg Leu Asn Gly Pro Ala Asp Asn Ile 385 390 395 400		
Leu Pro Arg Val Ala Ala Lys Asp Met Val Val Asp Gly Thr Phe Ile 405 410 415		
Pro Lys Gly Ala Thr Val Asn Ile Asp Ile Tyr Gly Ile His His Asn 420 425 430		
Pro Lys Phe Trp Asn Asn Pro Asp Asp Phe Ile Pro Glu Arg Leu Asp 435 440 445		
Glu Asn Gly Glu Gln Asp Ser His Asp Gly Leu Thr Trp Leu Pro Phe 450 455 460		
Gly Asn Gly Ala Arg Gln Cys Leu Gly Met Asn Phe Ser Leu Thr Glu 465 470 475 480		
Gln Arg Leu Leu Leu Val Met Met Ile Arg Lys Tyr Glu Ile Asp Val 485 490 495		
Pro Lys Asp Ser Ile His Tyr Glu Arg Val Ile Phe Gly Ser Glu Thr		

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Thr Pro Pro Asn Ser Leu Glu	Leu Thr Phe Lys Lys	Arg Tyr
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<211> 526		
<212> PRT		
<213> Rhizopus oryzae		
<400> 2		
Met Glu Leu Val Gln Phe Val Asp Lys Ser Tyr Arg Glu Ile Leu Glu		
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Lys Leu Leu Pro Val Leu Gln Lys Lys Ser Lys Trp Ser Tyr Ile Ser		
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Ala Ala Ala Leu Leu Ile Thr Ile Gln Gln Ile Tyr Ser Tyr Leu His		
35	40	45
Val Pro Lys Lys Phe Arg His Ile Pro Ser Val Ser Ser Leu Ala Met		
50	55	60
Ala Met Ser Phe Leu Arg His Glu Ser Gln Ala Asp Arg Phe Lys Arg		
65	70	75 80
Ile Ile Gln Pro Val Met Asn Lys Gly Asn Gly Val Tyr Val Ser Lys		
85	90	95
Ile Pro Ile Ser Trp Thr Val Tyr Val Ala Asn Pro Val Ile Ala Lys		
100	105	110
His Ile Leu Leu Lys Ser Asp Met Tyr Pro Lys Ser His Asn Gly Phe		
115	120	125
Lys Ile Ile Gly Pro Asn Ser Pro Phe Leu Gln Phe Ile Gly Leu Asn		
130	135	140
Asn Leu Ala Leu Ser Asn Gly His Thr Trp Lys Lys Gln Arg Lys Leu		
145	150	155 160
Met Asn Pro Val Phe His Arg Ser Met Pro Val Lys Met Met Ser Ser		
165	170	175
Val Leu Leu Thr Leu Phe Ser Ala Ile Glu Lys Ala Asp Gly Thr Ile		
180	185	190
Pro Ile Ala Glu Ala Met Lys His Phe Thr Leu Asp Val Leu Gly Tyr		
195	200	205
Thr Ile Phe Asp Phe Asp Phe Lys Ala Leu Lys Gly Asp Pro Asp Asp		
210	215	220
Trp Thr Lys Thr Tyr His Leu Val Asn Glu Ala Leu Ala Asp Pro Val		
225	230	235 240

Leu Asn Val Phe Pro Ser Met Gly Ala Leu Leu Leu Val Leu Leu Pro
 245 250 255
 Val Lys Arg Arg Arg Met Ala Ala Ile Asp Lys Leu Asn Arg Lys Leu
 260 265 270
 Asp Glu Met Ala Gln Lys Lys Arg Arg Glu Ile Gln Lys Gly Ser Tyr
 275 280 285
 Ser Asn Lys Leu Asp Ser Glu Lys Asp Leu Leu Thr Leu Met Leu Glu
 290 295 300
 Ala Glu Asn Asn Gly Glu Gly Leu Leu Ser Asp Thr Glu Leu Arg His
 305 310 315 320
 Asn Leu Ala Thr Phe Phe Leu Ala Gly His Glu Thr Thr Ala Asn Ser
 325 330 335
 Leu Ser Phe Ala Phe Tyr Tyr Leu Ala Gln Asn Lys His Val Gln Gln
 340 345 350
 Lys Leu Arg Glu Glu Val Ile Ser Ile Phe Gly Asp Glu Pro Thr Asp
 355 360 365
 Ile Ala Pro Thr Leu Glu Gln Leu Lys Gln Leu Ser Tyr Leu Asp Leu
 370 375 380
 Val Ile Lys Glu Thr Leu Arg Ile Ala Gly Pro Ile Asp Arg Ile Val
 385 390 395 400
 Pro Arg Val Val Ser Glu Asp Ile Val Val Gly Gly Ala Phe Ile Pro
 405 410 415
 Lys Gly Thr Ser Ala Asn Ile Asp Leu Tyr Ala Ile His His Asn Thr
 420 425 430
 Asn Ile Trp Lys Asn Pro Asp Gln Phe Ile Pro Glu Arg Phe Ala Glu
 435 440 445
 Gly Gly Glu Gln Glu Ser His Glu Gly Leu Thr Trp Val Pro Phe Gly
 450 455 460
 Asn Gly Ala Arg Gln Cys Ile Gly Met Asn Phe Ser Leu Ala Glu Gln
 465 470 475 480
 Arg Ile Val Leu Ala Leu Met Val Arg Lys Tyr Ile Ile Asp Ile Pro
 485 490 495
 Lys Asp Ser Ile His Tyr Asp His Val Val Phe Asp Ser Thr Glu Thr
 500 505 510
 Lys Ala Pro Glu Ser Leu Lys Leu Lys Phe Thr Lys Arg His
 515 520 525

<210> 3
 <211> 713
 <212> PRT
 <213> Rhizopus oryzae

<400> 3

Met Thr Arg Asn Asn Ser His His Leu Leu Asp Thr Val Asp Leu Ile
 1 5 10 15
 Leu Leu Gly Thr Ile Gly Leu Gly Thr Val Ala Trp Phe Ala Arg His
 20 25 30
 Gln Ile Ala Asn Arg Leu Phe Lys Ser Asp Ser Thr Asn Lys Ser Glu
 35 40 45
 Val Lys Asp Glu Ala Lys Thr Pro Lys Gln Glu Arg Asn Phe Val Lys
 50 55 60
 Val Met Gln Gln Gln Gly Arg Arg Val Ile Phe Phe Tyr Gly Ser Gln
 65 70 75 80
 Thr Gly Thr Ala Glu Asp Phe Ala Ser Arg Leu Ala Lys Glu Cys Thr
 85 90 95
 Gln Lys Tyr Gly Val Ser Ala Met Thr Ala Asp Ile Glu Gln Tyr Asp
 100 105 110
 Leu Ser Tyr Leu Asp Ser Val Pro Glu Asp Ser Leu Val Phe Phe Ile
 115 120 125
 Met Ala Thr Tyr Gly Glu Gly Glu Pro Thr Asp Asn Ala Val Asp Phe
 130 135 140
 Trp Asp Leu Leu Ala Glu Glu Val Pro Glu Phe Ser Asn Asp Asp Gly
 145 150 155 160
 Glu Gly Lys Pro Leu Gln Lys Leu Arg Tyr Val Ala Phe Gly Leu Gly
 165 170 175
 Asn Lys Thr Tyr Glu His Tyr Asn Glu Val Ile Arg Lys Val Asp Asn
 180 185 190
 Arg Leu Leu Ser Leu Gly Ala Lys Arg Ile Gly Glu Arg Gly Glu Gly
 195 200 205
 Asp Asp Asp Gly Thr Leu Glu Glu Asp Phe Leu Ala Trp Gln Glu Glu
 210 215 220
 Met Trp Pro Ala Phe Cys Glu Ala Leu Gly Val Asp Glu Ser Asn Ala
 225 230 235 240
 His Ser Gly Pro Arg Gln Ala Ile Phe Lys Ile Glu Glu Leu Thr Ala
 245 250 255

Tyr Asp Gln Ala Lys Val Tyr Leu Gly Glu Ile Gly Glu Trp Leu Lys
 260 265 270
 Glu Gly Ala Ser Ile Val Tyr Asp Ala Lys Arg Pro Tyr Asn Ala Pro
 275 280 285
 Ile Thr Ser Lys Asp Ile Phe Lys Ala Gly Asp Arg His Cys Leu His
 290 295 300
 Leu Glu Ile Asp Ile Ser Asn Thr Asn Leu Ser Tyr Gln Thr Gly Asp
 305 310 315 320
 His Val Ala Ile Trp Pro Thr Asn Asn Glu Val Glu Val Asn Arg Leu
 325 330 335
 Ala Lys Leu Leu Gly Leu Gln Asn Lys Leu Asp Thr Val Ile His Val
 340 345 350
 Gln Ser Leu Asp Pro Ala Ala Ser Lys Lys Tyr Pro Phe Pro Val Pro
 355 360 365
 Thr Thr Tyr Arg Ala Val Phe Arg His Tyr Leu Asp Ile Cys Ser Ala
 370 375 380
 Val Pro Arg Gln Val Leu Met Ser Leu Ile Glu Tyr Ala Pro Thr Glu
 385 390 395 400
 Ala Ser Lys Glu Ala Leu Arg Lys Leu Ala Thr Asp Lys Asp Glu Tyr
 405 410 415
 Arg Val His Val Gly Asp Val Thr Arg Asn Leu Gly Glu Val Leu Gln
 420 425 430
 Met Leu Ala Glu Ser Glu Ser Leu Glu Leu Asp Gly Ala Phe Ser Ser
 435 440 445
 Val Pro Phe Asp Leu Val Ile Glu Ser Ile Ser Arg Leu Gln Pro Arg
 450 455 460
 Tyr Tyr Ser Ile Ser Ser Ser Lys Glu Asn Pro Lys Lys Ile Ala
 465 470 475 480
 Val Thr Ala Val Thr Leu Gln Tyr Thr Pro Glu His Gly Ser Pro Arg
 485 490 495
 Thr Val Tyr Gly Val Asn Thr Asn Tyr Leu Trp Arg Val His Glu Ala
 500 505 510
 Val Asn Asn Leu Thr Pro Asn Ser Val Ile Pro Glu Tyr Asn Leu Thr
 515 520 525
 Gly Pro Arg Asp Ser Leu Phe Ser Gln Gln Gly Lys Val Ala Arg Ile
 530 535 540

Pro Val His Val Arg Arg Ser Gln Phe Lys Leu Pro Arg Asn Pro Thr
545 550 555 560

Val Pro Val Ile Met Ile Gly Pro Gly Thr Gly Val Ala Pro Phe Arg
565 570 575

Gly Phe Val Arg Glu Arg Ala Leu Gln Lys Lys Glu Asn Lys Pro Val
580 585 590

Gly Pro Thr Ile Leu Phe Phe Gly Cys Arg Asn Arg Ala Glu Asp Phe
595 600 605

Leu Tyr Glu Glu Glu Trp Pro Glu Leu Phe Glu Val Leu Gly Gly Asp
610 615 620

Ser Arg Ile Ile Thr Ala Phe Ser Arg Glu Thr Glu Lys Lys Val Tyr
625 630 635 640

Val Gln His Arg Leu Met Glu Asn Gly Gln Glu Met Trp Asn Leu Leu
645 650 655

Glu Lys Gly Ala Tyr Val Tyr Val Cys Gly Asp Ala Lys Asn Met Ala
660 665 670

Arg Asp Val Asn Gln Thr Phe Val Arg Phe Ala Gln Gln Phe Gly Gly
675 680 685

Met Asp Glu Asn Arg Ser Gln Asp Tyr Val Lys Asn Leu Arg Asn Thr
690 695 700

Gly Arg Tyr Gln Glu Asp Val Trp Ser
705 710