Saccharopine dehydrogenase  1.5.1.8
(NADP⁺, L-lysine-forming)

1 Nomenclature

EC number
1.5.1.8

Systematic name
N°-(L-1,3-dicarboxypropyl)-L-lysine:NADP⁺ oxidoreductase (L-lysine-forming)

Recommended name
saccharopine dehydrogenase (NADP⁺, L-lysine-forming)

Synonyms
L-lysine-α-ketoglutarate reductase
LKR
LOR
dehydrogenase, saccharopine (nicotinamide adenine dinucleotide phosphate, lysine-forming)
lysine-2-oxoglutarate reductase
lysine-α-ketoglutarate reductase
lysine-ketoglutarate reductase
lysine-ketoglutaric reductase
lysine:α-ketoglutarate:TPNH oxidoreductase (ε-N-[glutaryl-2]-L-lysine forming)
saccharopine (nicotinamide adenine dinucleotide phosphate, lysine-forming)
dehydrogenase
saccharopine dehydrogenase
saccharopine dehydrogenase (NADP, lysine-forming)
saccharopine dehydrogenase (nicotinamide adenine dinucleotide phosphate, lysine-forming)

CAS registry number
9031-19-0

2 Source Organism

<1> Zea mays (hybrid F-352 [14]) [2, 3, 12, 14, 19]
<2> Rattus norvegicus (pregnant Sprague-Dawley rats [1]; male Wistar strain [4]; Wistar strain [8]; male Sprague-Dawley rats [11]) [1, 4, 8, 11]
<3> Homo sapiens [5-10]
<4> Papio sp. [9]
<5> *Sus scrofa* [8]
<6> *Canis familiaris* (mongrels [8]) [8]
<7> *Felis catus* (tabby [8]) [8]
<8> *Bos taurus* [8-10]
<9> *Ovis aries* [8]
<10> *Saccharomyces cerevisiae* (strains 8973b and 8989c, mutant lys1, lacking LKR activity, used as expression system for enzyme from Arabidopsis thaliana, lysine-ketoglutarate reductase EC 1.5.1.8 and saccharopine dehydrogenase EC 1.5.1.9 are two separate proteins [13]) [10, 13, 14, 20]
<11> *Neurospora* sp. [10]
<12> *Oryza sativa* (IAC 165 [12,15]) [12, 15, 19]
<13> *Arabidopsis thaliana* (ecotype Landsberg erecta and Columbia [17,20]; var. C24 [20]) [12, 13, 17, 20]
<14> *Glycine max* (cv. Samsun [16]) [16, 19]
<15> *Brassica napus* (var. oleifera cv. Samourai [18]) [18]
<16> *Nicotiana tabacum* [14, 16, 17]

3 Reaction and Specificity

**Catalyzed reaction**

\[N^\text{-}(\text{-}1,3\text{-dicarboxypropyl})\text{-}l\text{-}lysine + NADP}^+ + H_2O = l\text{-}lysine + 2\text{-oxoglutarate} + NADPH + H^+ \]  \(<3\) reaction mechanism [5]; <12> ordered sequence mechanism, where 2-oxoglutarate is first substrate and saccharopine is last product [15])

**Reaction type**

oxidation  
redox reaction  
reduction

**Natural substrates and products**

5 \( l\text{-}lysine + 2\text{-oxoglutarate} + NADPH <1-3, 5-16> \) (<1-3, 5-9, 12, 13, 15> lysine catabolism [1, 2, 7, 8, 12-15, 18, 20]; <13> first enzyme in lysine catabolism [20]; <3> important role in the degradation of lysine [8]; <2,3> saccharopine pathway is the major route of lysine breakdown [1,6]; <1> first step in lysine breakdown in the endosperm during seed development [3]; <8> major catabolic pathway of lysine in mammalian livers [10]; <2> initial enzyme of saccharopine-dependent lysine degradation, lysine transport into the mitochondrion may control lysine degradation [11]; <14> first and possibly a rate-limiting step in lysine catabolism [19]; <10,11> biosynthetic pathway of lysine in yeast and fungi [10,13,14]; <10> plays essential role in lysine biosynthesis, LKR and SDH are separate polypeptides [20]; <10> lysine anabolic function is regulated by complex transcriptional and post-transcriptional controls [13]; <10> increase in free lysine concentration in cells decrease enzyme activity through repression of lys1 gene, precursor \( \alpha\text{-}aminoacidipic-\delta\text{-}semialdehyde modulates a transcriptional factor that controls transcription of lys1 gene [14];