spore photoproduct lyase 4.1.99.14

1 Nomenclature

EC number
4.1.99.14

Systematic name
spore photoproduct pyrimidine-lyase

Recommended name
spore photoproduct lyase

Synonyms
SAM <2> [1]
SP lyase <1,2> [1,2]
SPL <2> [1,2]
spore photoproduct lyase <1,2> [1]

2 Source Organism

<1> *Bacillus subtilis* [1]
<2> *Clostridium acetobutylicum* [2]

3 Reaction and Specificity

Catalyzed reaction
(5R)-5,6-dihydro-5-(thymidin-7-yl)thymidine (in double-helical DNA) = thymidylyl-(3'→5')-thymidylate (in double-helical DNA)

Natural substrates and products
S (5''R)-α-5''(6''H)-bithymine + S-adenosyl-L-methionine <2> (<2> SPL repairs specifically the 5R isomer. (5R)-α-5(6H)-bithymine is the diastereomer produced upon UV irradiation of a TpT dinucleotide [2]) (Reversibility: ?) [2]
P thymidylyl-(3'-5')-thymidylate + 5'-deoxyadenosine + L-methionine

Substrates and products
S (5''-R)-α-5''(6''-H)-bithymine + S-adenosyl-L-methionine <2> (<2> SPL repairs specifically the 5R isomer. (5R)-α-5(6H)-bithymine is the diastereomer produced upon UV irradiation of a TpT dinucleotide [2]; <2> SPL repairs specifically the 5R isomer [2]) (Reversibility: ?) [2]
P thymidylyl-(3'-5')-thymidylate + 5'-deoxyadenosine + L-methionine

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S 5-thyminyl-5,6 dihydrothymine + S-adenosyl-L-methionine <1> (Reversibility: ?) [1]
P thymidylyl-(3'-5')-thymidylate + 5'-deoxyadenosine + L-methionine

Cofactors/prosthetic groups
S-adenosyl-L-methionine <1> [1]

Metals, ions
Fe <2> (<2> iron-sulfur enzyme, 2.9 Fe per enzyme [2]) [2]

5 Isolation/Preparation/Mutation/Application

Cloning
<2> (overexpression in Escherichia coli) [2]

Application
analysis <1> (<1> a rapid separation technique for detecting and quantitating SP by chromatography : tritiated thymine-containing photoproducts from trifluoroacetic acid-hydrolyzed DNA purified from UV-irradiated cells or spores of Bacillus subtilis are identified and isolated from paper chromatograms, subjected to HPLC on a Microsorb phenyl 5-micrometer column using 100% water as the mobile phase, and detected by scintillation counting of collected fractions [1]) [1]

References

[1] Sun, Y.; Palasingam, K.; Nicholson, W.L.: High-pressure liquid chromatography assay for quantitatively monitoring spore photoproduct repair mediated by spore photoproduct lyase during germination of uv-irradiated Bacillus subtilis spores. Anal. Biochem., **221**, 61-65 (1994)
[2] Chandra, T.; Silver, S.C.; Zilinskas, E.; Shepard, E.M.; Broderick, W.E.; Broderick, J.B.: Spore photoproduct lyase catalyzes specific repair of the 5R but not the 5S spore photoproduct. J. Am. Chem. Soc., **131**, 2420-2421 (2009)