

Xylose isomerase from *Actinoplanes missouriensis*: primary structure of the gene and the protein

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The gene encoding xylose isomerase (XI) from *Actinoplanes missouriensis* has been isolated by complementation of a xylose isomerase defective *Escherichia coli* strain (1). The expression of the xylose isomerase gene in *Saccharomyces cerevisiae* might be used to extend the substrate spectrum of this yeast and to enable the anaerobic fermentation of xylose.

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1  GGGCCACCGGCGATGCTCTCAGCAGCGCGGAGAGCGGTGCCCCGAGTCCAGCCCGTACCGGCGACATCCCGCGGCGAGCCCGATCTGCTCTTTCCGACGGTATCCAGCAC
121  CAGCGCGAGATTTAGCGCTCTCAGCAGCGGTGCCCCGAGTCCAGCCCGTACCGGCGACATCCCGCGGCGAGCCCGATCTGCTCTTTCCGACGGTATCCAGCACCTAA
241  CAAATCCACCGGCGATGCTCTCAGCAGCGGAGAGCGGTGCCCCGAGTCCAGCCCGTACCGGCGACATCCCGCGGCGAGCCCGATCTGCTCTTTCCGACGGTATCCAGCAC
      F S Y Q A T R R D E F S P G L V P T C T G A R R D A T F G D A T R
361  ATCCGCGACCTCAGCCCGTCTCAGCAGCGGAGAGCGGTGCCCCGAGTCCAGCCCGTACCGGCGACATCCCGCGGCGAGCCCGATCTGCTCTTTCCGACGGTATCCAGCAC
      T A L D P V T R A V H K L A R I G A T G I T P R D D L V P P G S D A Q V T R D G I
481  TCTCCGCGGCTCTCAGCAGCGGAGAGCGGTGCCCCGAGTCCAGCCCGTACCGGCGACATCCCGCGGCGAGCCCGATCTGCTCTTTCCGACGGTATCCAGCACCTCCG
      I A G P K X A L D D E T G L I V P H V Y T H L P Y P T F E D G G F Y S H D R S V
601  TCCGCGGCTCTCAGCAGCGGAGAGCGGTGCCCCGAGTCCAGCCCGTACCGGCGACATCCCGCGGCGAGCCCGATCTGCTCTTTCCGACGGTATCCAGCACCTCCG
      R R Y A I R E V L R Q R D L G A B L G A K T L V L H E E R R G A Y T D S A K D V
721  TCCGCGGCTCTCAGCAGCGGAGAGCGGTGCCCCGAGTCCAGCCCGTACCGGCGACATCCCGCGGCGAGCCCGATCTGCTCTTTCCGACGGTATCCAGCACCTCCG
      S A A L D R T R R A L H L L A Q T S E D R G T G L R A I R P P H R P R G D I
841  TCTCCGCGGCTCTCAGCAGCGGAGAGCGGTGCCCCGAGTCCAGCCCGTACCGGCGACATCCCGCGGCGAGCCCGATCTGCTCTTTCCGACGGTATCCAGCACCTCCG
      L L P T A G H A I A P T Q R L R P B L P G I H P R T G R H Q S N L W P T Q G
961  GATCCGCGGCTCTCAGCAGCGGAGAGCGGTGCCCCGAGTCCAGCCCGTACCGGCGACATCCCGCGGCGAGCCCGATCTGCTCTTTCCGACGGTATCCAGCACCTCCG
      I A Q A L W H X K L P H I D L W G Q G P K P D D L V P F G R G D L L H A P S L
1081  TCCGCGGCTCTCAGCAGCGGAGAGCGGTGCCCCGAGTCCAGCCCGTACCGGCGACATCCCGCGGCGAGCCCGATCTGCTCTTTCCGACGGTATCCAGCACCTCCG
      V D L L R W G P D G A P A T D G P R H P D Y K P S I T R D T D G V W S A K A H
1201  ACATCCGCGGCTCTCAGCAGCGGAGAGCGGTGCCCCGAGTCCAGCCCGTACCGGCGACATCCCGCGGCGAGCCCGATCTGCTCTTTCCGACGGTATCCAGCACCTCCG
      I R N Y T L L L T R R A T A T T R A D P P V T Q A L L A S T A R L D L Y P T L W P G
1321  GCGACCGGCTCTCAGCAGCGGAGAGCGGTGCCCCGAGTCCAGCCCGTACCGGCGACATCCCGCGGCGAGCCCGATCTGCTCTTTCCGACGGTATCCAGCACCTCCG
      G C T A B L L D R S A P T D T D A D A V T A L G P P T L L W Q L A I R H L L
1441  TCCGCGGCTCTCAGCAGCGGAGAGCGGTGCCCCGAGTCCAGCCCGTACCGGCGACATCCCGCGGCGAGCCCGATCTGCTCTTTCCGACGGTATCCAGCACCTCCG
      G X I
1561  GAGCCGCGGCTCTCAGCAGCGGAGAGCGGTGCCCCGAGTCCAGCCCGTACCGGCGACATCCCGCGGCGAGCCCGATCTGCTCTTTCCGACGGTATCCAGCAC

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The native XI has a molecular weight of 173,500 daltons and consists of 4 monomeric subunits. We have determined the nucleotide sequence of the gene and deduced the primary structure of the protein. The gene initiates with GTG and consists of a 1185 bp open reading frame which encodes a XI monomer of 394 amino acids and 43,500 daltons. The total GC content is 68%. 94% of the bases in the third wobble position of the codons are G and C.

The gene shows 74-92% homology with other xylose isomerase genes from *Streptomyces* (2,3). The homology with *Bacillus* and *E. coli* isomerase genes is weak (4,5). However, two conserved regions are found at the protein level in all species examined so far. These regions are underlined in the sequence shown above and probably represent functional domains.

References

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