



# wwPDB X-ray Structure Validation Summary Report i

Feb 27, 2014 – 10:41 AM GMT

PDB ID : 2PS2  
Title : Crystal structure of putative mandelate racemase/muconate lactonizing enzyme from *Aspergillus oryzae*  
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Deposited on : 2007-05-04  
Resolution : 1.80 Å(reported)

This is a wwPDB validation summary report for a publicly released PDB entry.  
We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)  
A user guide is available at <http://wwpdb.org/ValidationPDFNotes.html>

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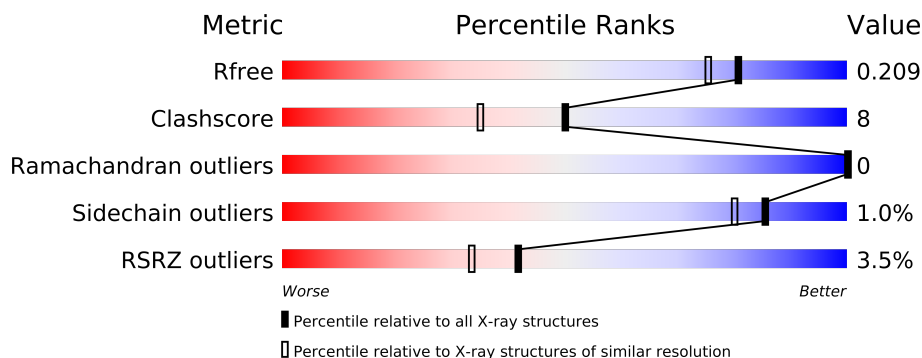
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity	:	4.02b-467
Mogul	:	1.15 2013
Xtriage (Phenix)	:	dev-1323
EDS	:	stable22639
Percentile statistics	:	21963
Refmac	:	5.8.0049
CCP4	:	6.3.0 (Settle)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP)	:	stable22683

# 1 Overall quality at a glance

The reported resolution of this entry is 1.80 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	66092	3513 (1.80-1.80)
Clashscore	79885	4461 (1.80-1.80)
Ramachandran outliers	78287	4404 (1.80-1.80)
Sidechain outliers	78261	4403 (1.80-1.80)
RSRZ outliers	66119	3515 (1.80-1.80)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	371	
1	B	371	
1	C	371	
1	D	371	

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 11750 atoms, of which 0 are hydrogen and 0 are deuterium.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Putative mandelate racemase/muconate lactonizing enzyme.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	361	Total	C	N	O	S	0	0	0
			2739	1723	478	524	14			
1	B	361	Total	C	N	O	S	0	0	0
			2739	1723	478	524	14			
1	C	361	Total	C	N	O	S	0	0	0
			2739	1723	478	524	14			
1	D	361	Total	C	N	O	S	0	0	0
			2739	1723	478	524	14			

- Molecule 2 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	1	Total	Mg	0	0
			1	1		
2	A	1	Total	Mg	0	0
			1	1		
2	D	1	Total	Mg	0	0
			1	1		
2	C	1	Total	Mg	0	0
			1	1		

- Molecule 3 is water.

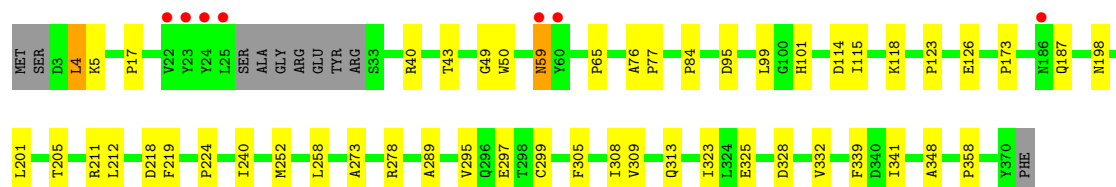
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	206	Total	O	0	0
			206	206		
3	B	167	Total	O	0	0
			167	167		
3	C	222	Total	O	0	0
			222	222		
3	D	195	Total	O	0	0
			195	195		

### 3 Residue-property plots

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ( $RSRZ > 2$ ). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

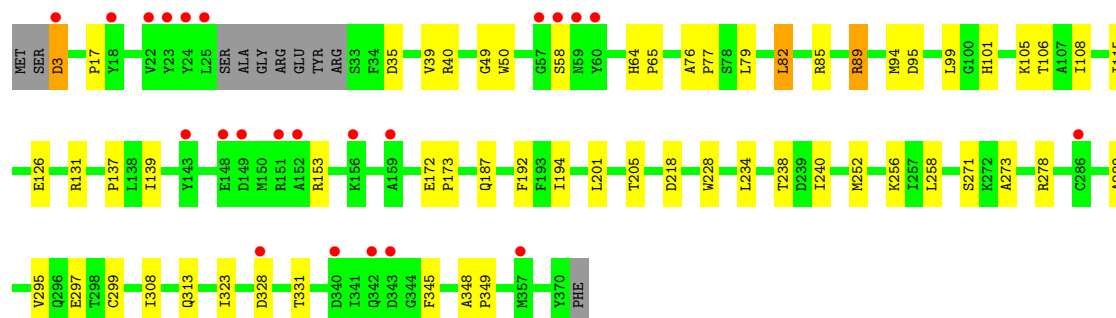
- Molecule 1: Putative mandelate racemase/muconate lactonizing enzyme

Chain A: 



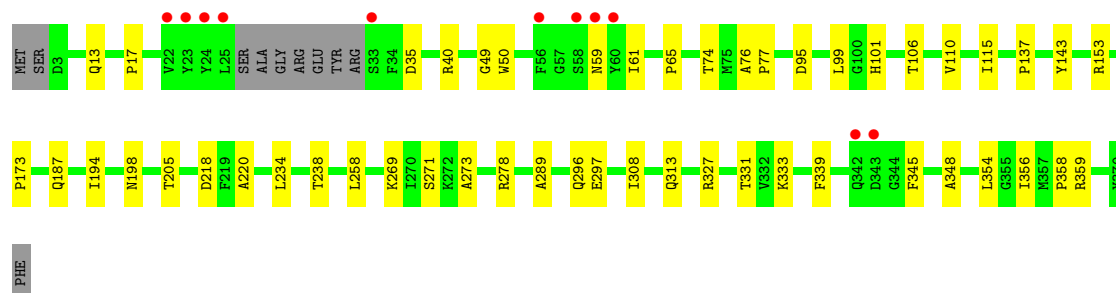
- Molecule 1: Putative mandelate racemase/muconate lactonizing enzyme

Chain B: 



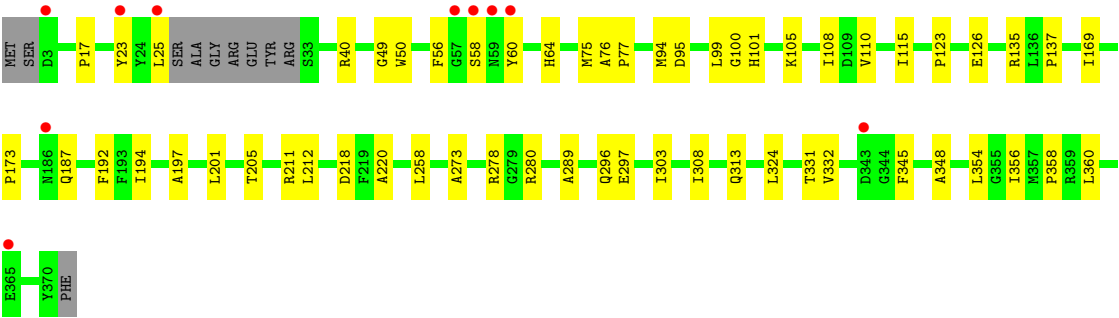
- Molecule 1: Putative mandelate racemase/muconate lactonizing enzyme

Chain C: 



- Molecule 1: Putative mandelate racemase/muconate lactonizing enzyme

Chain D: 



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	94.86Å 94.86Å 330.67Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	24.77 – 1.80 39.59 – 1.80	Depositor EDS
% Data completeness (in resolution range)	97.2 (24.77-1.80) 97.4 (39.59-1.80)	Depositor EDS
$R_{merge}$	0.07	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.77 (at 1.81Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, $R_{free}$	0.194 , 0.209 0.194 , 0.209	Depositor DCC
$R_{free}$ test set	6934 reflections (5.07%)	DCC
Wilson B-factor (Å <sup>2</sup> )	20.7	Xtriage
Anisotropy	0.048	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.38 , 38.3	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning	$\langle  L  \rangle = 0.47$ , $\langle L^2 \rangle = 0.29$	Xtriage
Outliers	0 of 139794 reflections	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	11750	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	23.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.20% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

## 5 Model quality

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: MG

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 5$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# $ Z  > 5$	RMSZ	# $ Z  > 5$
1	A	0.30	0/2784	0.58	0/3776
1	B	0.28	0/2784	0.58	0/3776
1	C	0.29	0/2784	0.59	0/3776
1	D	0.29	0/2784	0.58	0/3776
All	All	0.29	0/11136	0.58	0/15104

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

### 5.2 Close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2739	0	2762	43	0
1	B	2739	0	2762	43	0
1	C	2739	0	2762	37	0
1	D	2739	0	2762	47	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
2	D	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	A	206	0	0	3	0
3	B	167	0	0	7	0
3	C	222	0	0	3	0
3	D	195	0	0	3	0
All	All	11750	0	11048	165	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 8.

The worst 5 of 165 close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:D:99:LEU:HD23	1:D:100:GLY:N	1.93	0.83
1:A:339:PHE:HB2	1:A:341:ILE:HD11	1.64	0.80
1:C:313:GLN:HE21	1:C:348:ALA:H	1.30	0.79
1:B:313:GLN:HE21	1:B:348:ALA:H	1.28	0.79
1:D:211:ARG:HG3	3:D:518:HOH:O	1.83	0.78

There are no symmetry-related clashes.

## 5.3 Torsion angles

### 5.3.1 Protein backbone ⓘ

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution. The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	357/371 (96%)	346 (97%)	11 (3%)	0	100	100
1	B	357/371 (96%)	346 (97%)	11 (3%)	0	100	100
1	C	357/371 (96%)	346 (97%)	11 (3%)	0	100	100
1	D	357/371 (96%)	348 (98%)	9 (2%)	0	100	100
All	All	1428/1484 (96%)	1386 (97%)	42 (3%)	0	100	100

There are no Ramachandran outliers to report.



### 5.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution. The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	290/298 (97%)	286 (99%)	4 (1%)	78	69
1	B	290/298 (97%)	285 (98%)	5 (2%)	73	61
1	C	290/298 (97%)	288 (99%)	2 (1%)	91	88
1	D	290/298 (97%)	289 (100%)	1 (0%)	96	94
All	All	1160/1192 (97%)	1148 (99%)	12 (1%)	85	80

5 of 12 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	82	LEU
1	B	89	ARG
1	C	13	GLN
1	B	3	ASP
1	B	328	ASP

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 20 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	313	GLN
1	C	13	GLN
1	D	101	HIS
1	B	187	GLN
1	B	198	ASN

### 5.3.3 RNA ⓘ

There are no RNA chains in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

## 5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

## 5.6 Ligand geometry ⓘ

Of 4 ligands modelled in this entry, 4 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

## 5.7 Other polymers ⓘ

There are no such residues in this entry.

## 5.8 Polymer linkage issues

There are no chain breaks in this entry.

## 6 Fit of model and data ⓘ

### 6.1 Protein, DNA and RNA chains ⓘ

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95<sup>th</sup> percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å <sup>2</sup> )	Q<0.9
1	A	361/371 (97%)	-0.18	7 (1%) 64 58	13, 20, 33, 52	0
1	B	361/371 (97%)	0.16	23 (6%) 19 14	14, 23, 36, 52	0
1	C	361/371 (97%)	-0.10	11 (3%) 48 40	13, 20, 36, 52	0
1	D	361/371 (97%)	-0.10	10 (2%) 50 43	14, 22, 35, 51	0
All	All	1444/1484 (97%)	-0.06	51 (3%) 42 33	13, 21, 36, 52	0

The worst 5 of 51 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	25	LEU	14.4
1	C	24	TYR	12.2
1	B	24	TYR	10.6
1	B	23	TYR	9.2
1	A	25	LEU	8.9

### 6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

### 6.3 Carbohydrates ⓘ

There are no carbohydrates in this entry.

### 6.4 Ligands ⓘ

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors

of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSR	LLDF	B-factors( $\text{\AA}^2$ )	Q<0.9
2	MG	D	401	1/1	0.10	0.65	25,25,25,25	0
2	MG	C	401	1/1	0.09	0.13	23,23,23,23	0
2	MG	B	401	1/1	0.09	-0.56	23,23,23,23	0
2	MG	A	401	1/1	0.04	-1.28	19,19,19,19	0

## 6.5 Other polymers ⓘ

There are no such residues in this entry.