Full wwPDB X-ray Structure Validation Report (i)

May 14, 2020 – 06:55 pm BST

PDB ID	:	2AE5
Title	:	Glutaryl 7-Aminocephalosporanic Acid Acylase: mutational study of activation mechanism
Authors	:	Kim, J.K.; Yang, I.S.; Shin, H.J.; Cho, K.J.; Ryu, E.K.; Kim, S.H.; Park, S.S.; Kim, K.H.
Deposited on	:	2005-07-21
Resolution	:	2.24 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

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

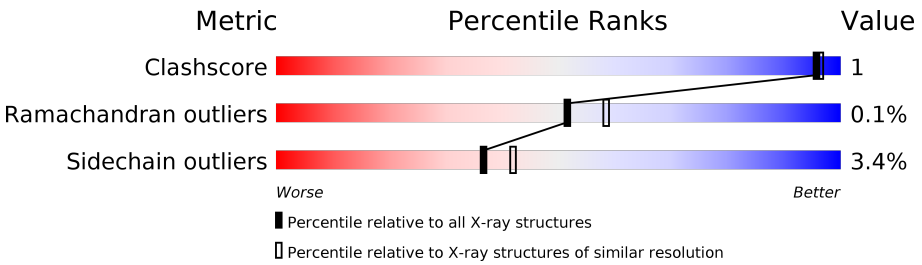
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.24 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))
Clashscore	141614	2539 (2.26-2.22)
Ramachandran outliers	138981	2489 (2.26-2.22)
Sidechain outliers	138945	2490 (2.26-2.22)

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 >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5%

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	166	87% 8% • •
2	B	528	92% 6% •

2 Entry composition (i)

There are 5 unique types of molecules in this entry. The entry contains 5756 atoms, of which 0 are hydrogens and 0 are deuteriums.

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.

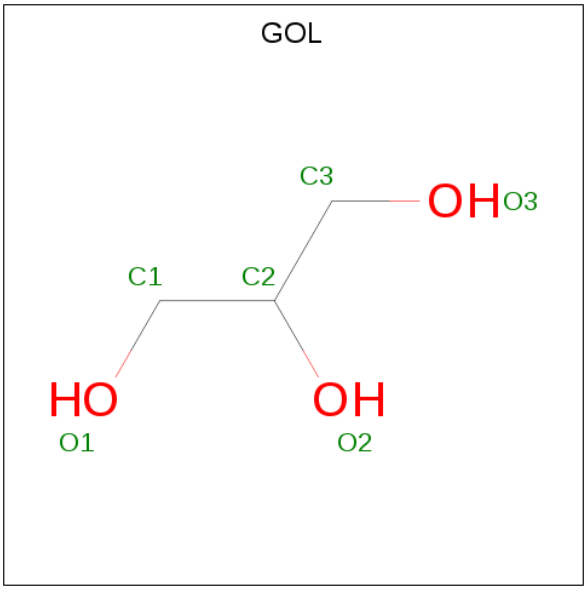
- Molecule 1 is a protein called Glutaryl 7-Aminocephalosporanic Acid Acylase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	159	1242	789	218	234	1	0	0	0

- Molecule 2 is a protein called Glutaryl 7-Aminocephalosporanic Acid Acylase.

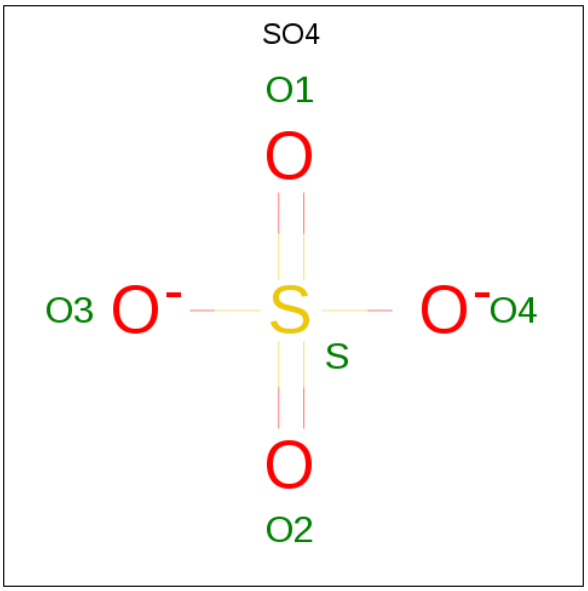
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	522	4121	2606	727	776	12	0	0	0

- Molecule 3 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
3	A	1	6	3	3	0	0

- Molecule 4 is SULFATE ION (three-letter code: SO4) (formula: O_4S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	O	S		
4	B	1	5	4	1	0	0

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
5	A	104	104	104	0	0
			Total	O		
5	B	278	278	278	0	0

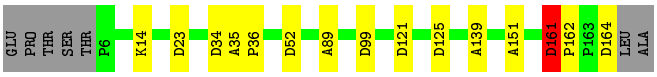
3 Residue-property plots (i)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. 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. 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.

Note EDS was not executed.

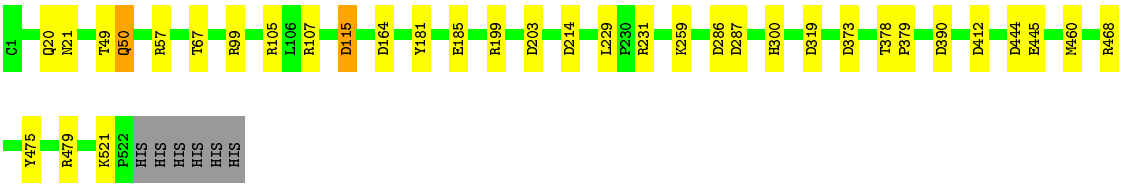
- Molecule 1: Glutaryl 7-Aminocephalosporanic Acid Acylase

Chain A:



- Molecule 2: Glutaryl 7-Aminocephalosporanic Acid Acylase

Chain B:



4 Data and refinement statistics (i)

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α, β, γ	73.74Å 73.74Å 383.35Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.00 – 2.24	Depositor
% Data completeness (in resolution range)	92.5 (50.00-2.24)	Depositor
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	CNS, REFMAC 5.1.24	Depositor
R, R_{free}	0.173 , 0.209	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	5756	wwPDB-VP
Average B, all atoms (Å^2)	26.0	wwPDB-VP

5 Model quality (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: GOL, SO4

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	0.55	1/1284 (0.1%)	0.82	10/1759 (0.6%)
2	B	0.51	0/4236	0.80	11/5783 (0.2%)
All	All	0.52	1/5520 (0.0%)	0.80	21/7542 (0.3%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	151	ALA	C-N	-6.44	1.19	1.34

All (21) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	125	ASP	CB-CG-OD2	8.16	125.64	118.30
1	A	151	ALA	O-C-N	-6.98	111.53	122.70
2	B	214	ASP	CB-CG-OD2	6.44	124.10	118.30
2	B	287	ASP	CB-CG-OD2	6.27	123.94	118.30
2	B	203	ASP	CB-CG-OD2	6.08	123.77	118.30
2	B	373	ASP	CB-CG-OD2	6.00	123.70	118.30
1	A	52	ASP	CB-CG-OD2	5.99	123.69	118.30
2	B	444	ASP	CB-CG-OD2	5.99	123.69	118.30
1	A	121	ASP	CB-CG-OD2	5.70	123.43	118.30
2	B	164	ASP	CB-CG-OD2	5.59	123.33	118.30
2	B	319	ASP	CB-CG-OD2	5.59	123.33	118.30
1	A	161	ASP	CB-CG-OD2	5.56	123.30	118.30
1	A	164	ASP	CB-CG-OD2	5.52	123.27	118.30
1	A	151	ALA	CA-C-N	5.47	129.23	117.20
1	A	23	ASP	CB-CG-OD2	5.32	123.09	118.30
2	B	390	ASP	CB-CG-OD2	5.29	123.06	118.30
1	A	99	ASP	CB-CG-OD2	5.25	123.02	118.30
2	B	412	ASP	CB-CG-OD2	5.24	123.02	118.30

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	115	ASP	CB-CG-OD2	5.13	122.92	118.30
1	A	34	ASP	CB-CG-OD2	5.01	122.81	118.30
2	B	286	ASP	CB-CG-OD2	5.01	122.81	118.30

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts (i)

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 hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1242	0	1150	7	0
2	B	4121	0	3956	5	0
3	A	6	0	8	0	0
4	B	5	0	0	0	0
5	A	104	0	0	0	0
5	B	278	0	0	0	0
All	All	5756	0	5114	12	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 1.

All (12) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:50:GLN:HE22	2:B:57:ARG:HH11	1.31	0.77
1:A:161:ASP:HB3	1:A:162:PRO:CD	2.19	0.73
2:B:50:GLN:H	2:B:50:GLN:HE21	1.44	0.64
1:A:161:ASP:HB3	1:A:162:PRO:HD3	1.85	0.59
2:B:229:LEU:O	2:B:231:ARG:HG3	2.12	0.49
1:A:161:ASP:CB	1:A:162:PRO:CD	2.90	0.49
2:B:378:THR:HB	2:B:379:PRO:HA	1.96	0.46
1:A:161:ASP:HB3	1:A:162:PRO:HD2	1.98	0.43
1:A:35:ALA:HB3	1:A:36:PRO:HD3	2.00	0.42
2:B:20:GLN:HG2	2:B:67:THR:HB	2.02	0.42
1:A:89:ALA:CB	1:A:139:ALA:HB2	2.50	0.42

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:161:ASP:CB	1:A:162:PRO:HD3	2.49	0.42

There are no symmetry-related clashes.

5.3 Torsion angles (i)

5.3.1 Protein backbone (i)

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	157/166 (95%)	152 (97%)	4 (2%)	1 (1%)	25	23
2	B	520/528 (98%)	506 (97%)	14 (3%)	0	100	100
All	All	677/694 (98%)	658 (97%)	18 (3%)	1 (0%)	51	58

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	161	ASP

5.3.2 Protein sidechains (i)

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	122/128 (95%)	121 (99%)	1 (1%)	81	87
2	B	431/437 (99%)	413 (96%)	18 (4%)	30	32
All	All	553/565 (98%)	534 (97%)	19 (3%)	37	42

All (19) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	14	LYS
2	B	21	ASN
2	B	49	THR
2	B	50	GLN
2	B	99	ARG
2	B	105	ARG
2	B	107	ARG
2	B	115	ASP
2	B	181	TYR
2	B	185	GLU
2	B	199	ARG
2	B	259	LYS
2	B	300	HIS
2	B	445	GLU
2	B	460	MET
2	B	468	ARG
2	B	475	TYR
2	B	479	ARG
2	B	521	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	7	GLN
1	A	53	ASN
1	A	83	ASN
1	A	91	GLN
2	B	50	GLN
2	B	480	GLN
2	B	485	HIS

5.3.3 RNA (i)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates (i)

There are no carbohydrates in this entry.

5.6 Ligand geometry (i)

2 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
3	GOL	A	401	-	5,5,5	0.34	0	5,5,5	0.37	0
4	SO4	B	529	-	4,4,4	0.14	0	6,6,6	0.50	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	GOL	A	401	-	-	2/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	401	GOL	C1-C2-C3-O3
3	A	401	GOL	O2-C2-C3-O3

There are no ring outliers.

No monomer is involved in short contacts.

5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	A	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	A	151:ALA	C	152:SER	N	1.19

6 Fit of model and data (i)

6.1 Protein, DNA and RNA chains (i)

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates (i)

EDS was not executed - this section is therefore empty.

6.4 Ligands (i)

EDS was not executed - this section is therefore empty.

6.5 Other polymers (i)

EDS was not executed - this section is therefore empty.