wwPDB X-ray Structure Validation Summary Report (i)

Dec 3, 2023 – 05:29 am GMT

PDB ID	:	2C58
Title	:	Torpedo californica acetylcholinesterase in complex with 20mM acetylthiocholine
Authors	:	Colletier, J.P.; Fournier, D.; Greenblatt, H.M.; Sussman, J.L.; Zaccai, G.; Silman, I.; Weik, M.
Deposited on	:	2005-10-26
Resolution	:	2.30 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

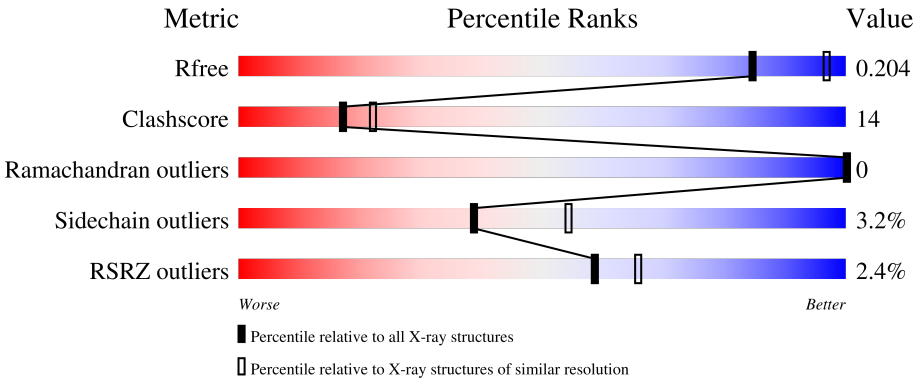
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

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 2.30 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}	130704	5042 (2.30-2.30)
Clashscore	141614	5643 (2.30-2.30)
Ramachandran outliers	138981	5575 (2.30-2.30)
Sidechain outliers	138945	5575 (2.30-2.30)
RSRZ outliers	127900	4938 (2.30-2.30)

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
1	OAS	A	200	-	-	X	-

2 Entry composition (i)

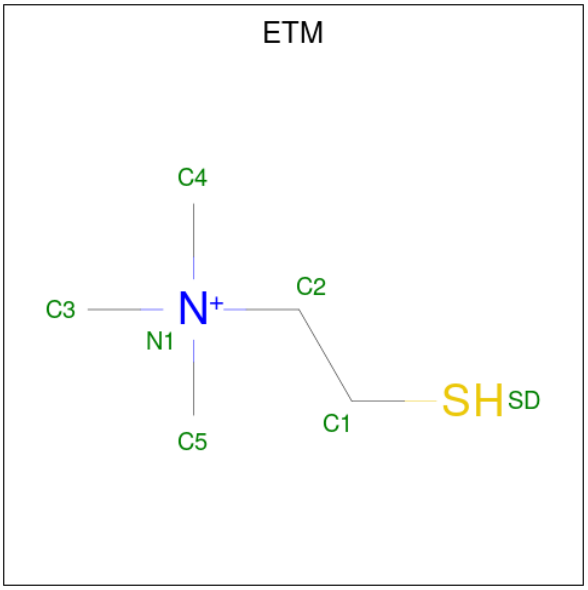
There are 7 unique types of molecules in this entry. The entry contains 5336 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 ACETYLCHOLINESTERASE.

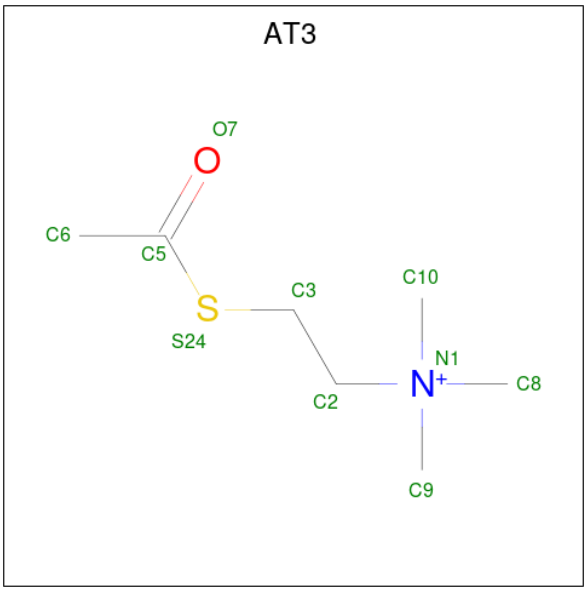
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	533	4427	2824	761	817	25	0	20	1

- Molecule 2 is 2-(TRIMETHYLAMMONIUM)ETHYL THIOL (three-letter code: ETM) (formula: $C_5H_{14}NS$).



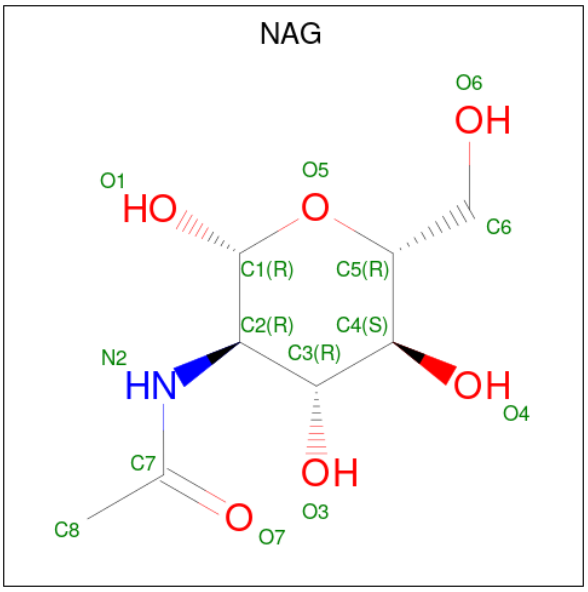
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	S		
2	A	1	7	5	1	1	0	0

- Molecule 3 is ACETYLTHIOCHOLINE (three-letter code: AT3) (formula: $C_7H_{16}NOS$).



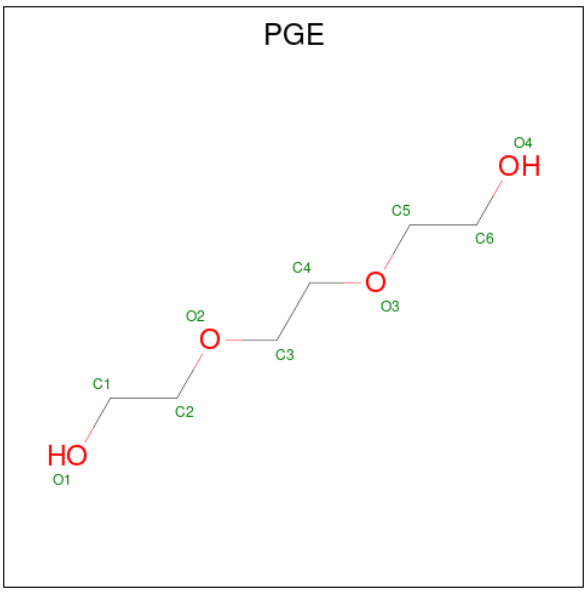
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	N	O	S	0	0
			10	7	1	1	1		

- Molecule 4 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula: $C_8H_{15}NO_6$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	1	Total	C	N	O	0	0
			14	8	1	5		
4	A	1	Total	C	N	O	0	0
			14	8	1	5		

- Molecule 5 is TRIETHYLENE GLYCOL (three-letter code: PGE) (formula: $C_6H_{14}O_4$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	1	Total C O 10 6 4	0	0
5	A	1	Total C O 10 6 4	0	0
5	A	1	Total C O 10 6 4	0	0
5	A	1	Total C O 10 6 4	0	0

- Molecule 6 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	7	Total Cl 7 7	0	0

- Molecule 7 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	817	Total O 817 817	0	0

SEQUENCE-PLOTS INFOmissingINFO

3 Data and refinement statistics (i)

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α, β, γ	113.35Å 113.35Å 138.03Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	20.00 – 2.30 20.00 – 2.20	Depositor EDS
% Data completeness (in resolution range)	99.9 (20.00-2.30) 95.3 (20.00-2.20)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	0.00 (at 2.19Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.172 , 0.210 0.166 , 0.204	Depositor DCC
R_{free} test set	2598 reflections (4.95%)	wwPDB-VP
Wilson B-factor (Å^2)	43.4	Xtriage
Anisotropy	0.594	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 82.5	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.024 for -h,-k,l	Xtriage
F_o,F_c correlation	0.97	EDS
Total number of atoms	5336	wwPDB-VP
Average B, all atoms (Å^2)	52.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.29% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

4 Model quality

4.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: OAS, ETM, NAG, CL, PGE, AT3

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	0.34	0/4541	0.59	0/6158

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

4.2 Too-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 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	4427	0	4251	116	0
2	A	7	0	14	0	0
3	A	10	0	16	3	0
4	A	28	0	26	1	0
5	A	40	0	56	3	0
6	A	7	0	0	2	0
7	A	817	0	0	26	0
All	All	5336	0	4363	124	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 14.

The worst 5 of 124 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)
1:A:230:ASN:H	1:A:230:ASN:HD22	1.06	0.99
6:A:1547:CL:CL	7:A:2054:HOH:O	2.37	0.78
1:A:484:GLU:HB3	1:A:487:SER:HB2	1.67	0.76
1:A:230:ASN:H	1:A:230:ASN:ND2	1.83	0.76
1:A:321:LEU:HD11	1:A:408[B]:VAL:HG22	1.69	0.73

There are no symmetry-related clashes.

4.3 Torsion angles (i)

4.3.1 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	550/537 (102%)	522 (95%)	28 (5%)	0	100 100

There are no Ramachandran outliers to report.

4.3.2 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	484/468 (103%)	468 (97%)	16 (3%)	38 53

5 of 16 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	506	ASN
1	A	481	ASN

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Mol	Chain	Res	Type
1	A	383	ASN
1	A	473	TRP
1	A	350[B]	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 16 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	519	GLN
1	A	506	ASN
1	A	374	GLN
1	A	500	GLN
1	A	324	ASN

4.3.3 RNA

There are no RNA molecules in this entry.

4.4 Non-standard residues in protein, DNA, RNA chains

1 non-standard protein/DNA/RNA residue is 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	$\#\|Z\| > 2$
1	OAS	A	200	1	7,8,9	1.27	1 (14%)	5,9,11	1.72	2 (40%)

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
1	OAS	A	200	1	-	4/5/7/9	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	200	OAS	OG-C1A	2.32	1.44	1.33

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	200	OAS	CB-OG-C1A	-2.24	111.48	117.10
1	A	200	OAS	OG-CB-CA	2.03	114.21	108.48

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	200	OAS	N-CA-CB-OG
1	A	200	OAS	OAC-C1A-OG-CB
1	A	200	OAS	C2A-C1A-OG-CB
1	A	200	OAS	C-CA-CB-OG

There are no ring outliers.

1 monomer is involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	A	200	OAS	6	0

4.5 Carbohydrates (i)

There are no monosaccharides in this entry.

4.6 Ligand geometry (i)

Of 15 ligands modelled in this entry, 7 are monoatomic - leaving 8 for Mogul analysis.

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	$\#\|Z\|>2$
2	ETM	A	1536	-	6,6,6	0.79	0	7,8,8	0.28	0
4	NAG	A	1539	1	14,14,15	0.58	0	17,19,21	0.75	1 (5%)
5	PGE	A	1544	-	9,9,9	0.69	0	8,8,8	0.63	0
4	NAG	A	1540	1	14,14,15	0.57	0	17,19,21	0.61	0
5	PGE	A	1543	-	9,9,9	0.82	0	8,8,8	0.30	0
5	PGE	A	1541	-	9,9,9	0.76	0	8,8,8	1.16	1 (12%)
5	PGE	A	1542	-	9,9,9	1.31	1 (11%)	8,8,8	1.65	2 (25%)
3	AT3	A	1537	-	9,9,9	1.72	1 (11%)	12,12,12	0.59	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
2	ETM	A	1536	-	-	0/4/4/4	-
4	NAG	A	1539	1	-	0/6/23/26	0/1/1/1
5	PGE	A	1544	-	-	0/7/7/7	-
4	NAG	A	1540	1	-	3/6/23/26	0/1/1/1
5	PGE	A	1543	-	-	0/7/7/7	-
5	PGE	A	1541	-	-	1/7/7/7	-
5	PGE	A	1542	-	-	3/7/7/7	-
3	AT3	A	1537	-	-	4/7/7/7	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	1537	AT3	O7-C5	4.74	1.43	1.20
5	A	1542	PGE	O3-C5	2.42	1.52	1.42

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
5	A	1542	PGE	C5-O3-C4	2.58	124.49	113.29
5	A	1541	PGE	O3-C4-C3	2.48	121.56	110.39
5	A	1542	PGE	O2-C3-C4	2.46	121.48	110.39
4	A	1539	NAG	C2-N2-C7	-2.02	120.02	122.90

There are no chirality outliers.

5 of 11 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	1537	AT3	O7-C5-S24-C3
4	A	1540	NAG	C3-C2-N2-C7
4	A	1540	NAG	C8-C7-N2-C2
4	A	1540	NAG	O7-C7-N2-C2
3	A	1537	AT3	C6-C5-S24-C3

There are no ring outliers.

4 monomers are involved in 7 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	A	1544	PGE	2	0
4	A	1540	NAG	1	0
5	A	1542	PGE	1	0
3	A	1537	AT3	3	0

4.7 Other polymers (i)

There are no such residues in this entry.

4.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

5 Fit of model and data

5.1 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^{th} 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^2)	Q<0.9
1	A	532/537 (99%)	-0.51	13 (2%) 59 66	34, 47, 67, 103	0

The worst 5 of 13 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	486	HIS	5.6
1	A	536	ALA	4.9
1	A	485	PRO	4.4
1	A	488	GLN	4.3
1	A	55[A]	SER	3.7

5.2 Non-standard residues in protein, DNA, RNA chains

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. The B-factors column lists the minimum, median, 95^{th} 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	RSCC	RSR	B-factors(Å^2)	Q<0.9
1	OAS	A	200	9/10	0.94	0.10	37,41,57,60	3

5.3 Carbohydrates

There are no monosaccharides in this entry.

5.4 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. The B-factors column lists the minimum,

median, 95^{th} 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	RSCC	RSR	B-factors(Å^2)	Q<0.9
6	CL	A	1550	1/1	0.76	0.20	83,83,83,83	0
5	PGE	A	1542	10/10	0.77	0.28	100,102,103,103	0
5	PGE	A	1544	10/10	0.84	0.24	86,87,94,95	0
4	NAG	A	1540	14/15	0.87	0.28	81,84,89,91	0
4	NAG	A	1539	14/15	0.87	0.28	57,63,67,70	0
5	PGE	A	1541	10/10	0.88	0.30	81,82,86,87	0
6	CL	A	1547	1/1	0.89	0.11	92,92,92,92	0
6	CL	A	1545	1/1	0.89	0.14	88,88,88,88	0
3	AT3	A	1537	10/10	0.92	0.19	87,88,88,88	0
5	PGE	A	1543	10/10	0.92	0.17	56,63,67,68	0
6	CL	A	1548	1/1	0.93	0.05	93,93,93,93	0
6	CL	A	1549	1/1	0.95	0.21	88,88,88,88	0
6	CL	A	1551	1/1	0.95	0.45	125,125,125,125	0
6	CL	A	1546	1/1	0.96	0.23	76,76,76,76	0
2	ETM	A	1536	7/7	0.96	0.23	63,64,65,66	0

5.5 Other polymers (i)

There are no such residues in this entry.