



wwPDB X-ray Structure Validation Summary Report ⓘ

Apr 25, 2026 – 12:06 PM EDT

PDB ID : 2XTK / pdb_00002xtk
Title : ChiA1 from *Aspergillus fumigatus* in complex with acetazolamide
Authors : Schuettelkopf, A.W.; van Aalten, D.M.F.
Deposited on : 2010-10-11
Resolution : 2.00 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 ⓘ 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 ⓘ](#)) were used in the production of this report:

MolProbity : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtrriage (Phenix) : 2.0
EDS : 3.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

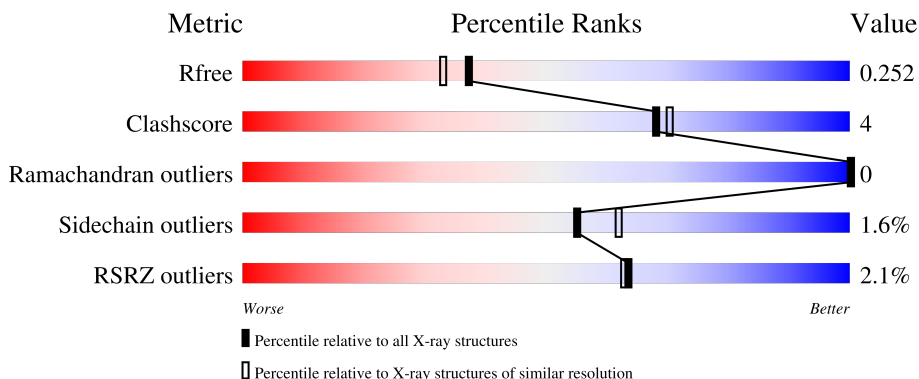
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

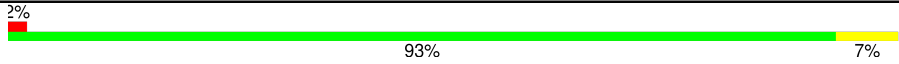
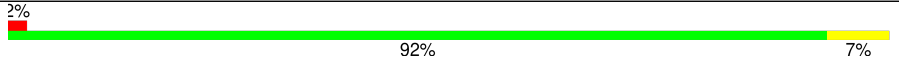
The reported resolution of this entry is 2.00 Å.

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}	180053	10052 (2.00-2.00)
Clashscore	190562	11152 (2.00-2.00)
Ramachandran outliers	187476	11031 (2.00-2.00)
Sidechain outliers	187428	11029 (2.00-2.00)
RSRZ outliers	180081	10067 (2.00-2.00)

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 of 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 $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	310	 2% 93% 7%
1	B	310	 2% 92% 7%

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
2	AZM	A	1339[A]	-	X	-	-
2	AZM	A	1339[B]	-	X	X	-
2	AZM	B	1339	-	X	-	-
3	PO4	A	1342	-	X	-	-

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 5307 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.

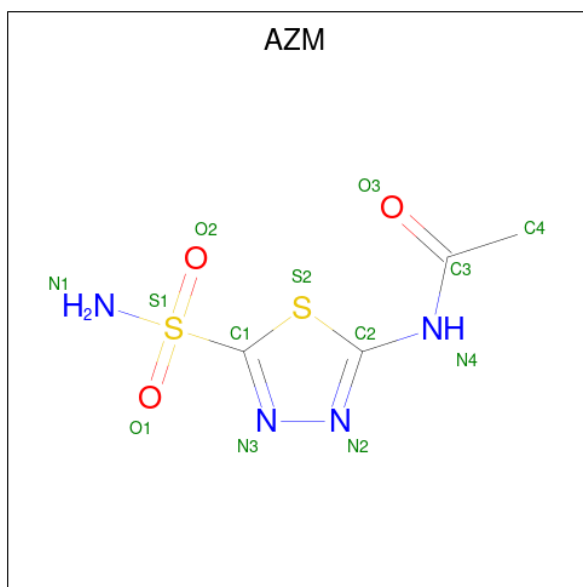
- Molecule 1 is a protein called CLASS III CHITINASE CHIA1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	310	Total 2414	C 1554	N 384	O 464	S 12	0	1	0
1	B	309	Total 2403	C 1545	N 382	O 464	S 12	0	1	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	28	PHE	-	cloning artifact	UNP B0Y2Y2
B	28	PHE	-	cloning artifact	UNP B0Y2Y2

- Molecule 2 is 5-ACETAMIDO-1,3,4-THIADIAZOLE-2-SULFONAMIDE (CCD ID: AZM) (formula: C₄H₆N₄O₃S₂).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	S		
2	A	1	Total 26	C 8	N 8	O 6	S 4	0	1

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	S		
2	B	1	13	4	4	3	2	0	0

- Molecule 3 is PHOSPHATE ION (CCD ID: PO4) (formula: O₄P).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	O	P	0	0
			5	4	1		
3	A	1	Total	O	P	0	0
			5	4	1		
3	A	1	Total	O	P	0	0
			5	4	1		
3	A	1	Total	O	P	0	0
			5	4	1		
3	A	1	Total	O	P	0	0
			5	4	1		
3	A	1	Total	O	P	0	0
			5	4	1		
3	B	1	Total	O	P	0	0
			5	4	1		
3	B	1	Total	O	P	0	0
			5	4	1		

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

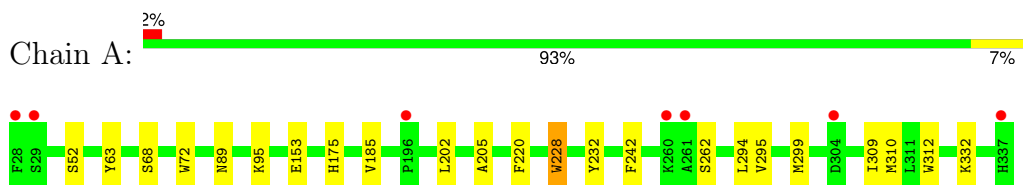
- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	214	Total O 214 214	0	0
4	B	157	Total O 157 157	0	0

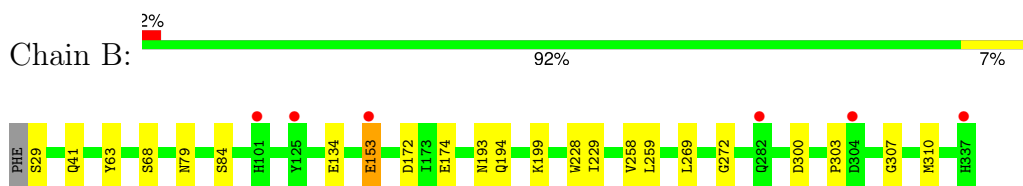
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide 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 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: CLASS III CHITINASE CHIA1



- Molecule 1: CLASS III CHITINASE CHIA1



4 Data and refinement statistics

Property	Value	Source
Space group	I 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	76.64Å 125.83Å 211.69Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	19.80 – 2.00 19.80 – 2.00	Depositor EDS
% Data completeness (in resolution range)	100.0 (19.80-2.00) 97.9 (19.80-2.00)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.31 (at 2.01Å)	Xtrriage
Refinement program	REFMAC 5.5.0088	Depositor
R, R_{free}	0.216 , 0.249 0.217 , 0.252	Depositor DCC
R_{free} test set	3440 reflections (5.07%)	wwPDB-VP
Wilson B-factor (Å ²)	23.0	Xtrriage
Anisotropy	0.301	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 34.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	5307	wwPDB-VP
Average B, all atoms (Å ²)	27.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.25% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

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: AZM, PO4

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	0.97	1/2490 (0.0%)	0.94	0/3396
1	B	0.93	0/2478	0.95	0/3380
All	All	0.95	1/4968 (0.0%)	0.94	0/6776

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	89	ASN	CG-OD1	5.01	1.33	1.23

There are no bond angle outliers.

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	2414	0	2253	16	0
1	B	2403	0	2242	15	0
2	A	26	0	12	7	0
2	B	13	0	6	1	0
3	A	40	0	0	1	0
3	B	40	0	0	1	0
4	A	214	0	0	0	0
4	B	157	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	5307	0	4513	34	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 4.

The worst 5 of 34 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:B:303:PRO:HD2	3:B:1341:PO4:O4	1.76	0.86
1:A:185:VAL:HG13	1:A:202:LEU:HD13	1.66	0.78
2:A:1339[B]:AZM:HN12	1:B:193:ASN:HB3	1.54	0.73
2:A:1339[A]:AZM:S2	2:A:1339[A]:AZM:O3	2.50	0.70
2:A:1339[A]:AZM:HN12	1:B:194:GLN:HG2	1.58	0.69

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	309/310 (100%)	302 (98%)	7 (2%)	0	100	100
1	B	308/310 (99%)	296 (96%)	12 (4%)	0	100	100
All	All	617/620 (100%)	598 (97%)	19 (3%)	0	100	100

There are no Ramachandran outliers to report.

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	254/253 (100%)	252 (99%)	2 (1%)	73	80
1	B	253/253 (100%)	247 (98%)	6 (2%)	43	47
All	All	507/506 (100%)	499 (98%)	8 (2%)	55	62

5 of 8 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	300	ASP
1	B	258	VAL
1	B	199	LYS
1	B	153	GLU
1	B	228	TRP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	176	ASN
1	A	230	GLN
1	B	102	GLN
1	B	230	GLN
1	B	337	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 oligosaccharides in this entry.

5.6 Ligand geometry

19 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	PO4	B	1346	-	4,4,4	1.02	0	6,6,6	0.62	0
3	PO4	B	1343	-	4,4,4	0.85	0	6,6,6	0.58	0
3	PO4	A	1346	-	4,4,4	1.16	0	6,6,6	0.64	0
3	PO4	B	1341	-	4,4,4	1.56	1 (25%)	6,6,6	0.30	0
3	PO4	A	1342	-	4,4,4	3.84	4 (100%)	6,6,6	0.77	0
3	PO4	A	1347	-	4,4,4	0.95	0	6,6,6	0.88	0
3	PO4	A	1341	-	4,4,4	0.78	0	6,6,6	0.81	0
3	PO4	B	1340	-	4,4,4	0.77	0	6,6,6	0.66	0
3	PO4	B	1344	-	4,4,4	0.87	0	6,6,6	0.46	0
3	PO4	A	1343	-	4,4,4	1.06	0	6,6,6	0.68	0
3	PO4	A	1345	-	4,4,4	1.19	0	6,6,6	0.42	0
3	PO4	A	1344	-	4,4,4	1.05	0	6,6,6	0.63	0
2	AZM	A	1339[A]	-	13,13,13	5.50	9 (69%)	19,19,19	6.11	13 (68%)
3	PO4	B	1342	-	4,4,4	0.60	0	6,6,6	0.86	0
3	PO4	A	1340	-	4,4,4	1.51	0	6,6,6	0.35	0
2	AZM	A	1339[B]	-	13,13,13	11.66	6 (46%)	19,19,19	8.08	10 (52%)
3	PO4	B	1347	-	4,4,4	1.00	0	6,6,6	0.97	0
2	AZM	B	1339	-	13,13,13	4.51	7 (53%)	19,19,19	4.65	14 (73%)
3	PO4	B	1345	-	4,4,4	1.18	0	6,6,6	0.77	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	AZM	B	1339	-	-	6/10/10/10	0/1/1/1
2	AZM	A	1339[B]	-	-	2/10/10/10	0/1/1/1
2	AZM	A	1339[A]	-	-	0/10/10/10	0/1/1/1

The worst 5 of 27 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	1339[B]	AZM	C1-S1	-39.22	1.49	1.78
2	A	1339[A]	AZM	C1-S2	-11.68	1.60	1.73
2	A	1339[B]	AZM	C2-S2	-10.08	1.57	1.73
2	A	1339[B]	AZM	C1-N3	8.18	1.35	1.29
2	B	1339	AZM	C1-N3	7.61	1.35	1.29

The worst 5 of 37 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	1339[B]	AZM	C1-S2-C2	22.24	96.02	85.47
2	A	1339[B]	AZM	S2-C1-N3	-21.87	104.59	116.10
2	A	1339[A]	AZM	C1-S2-C2	17.52	93.79	85.47
2	A	1339[A]	AZM	S2-C1-N3	-13.80	108.83	116.10
2	B	1339	AZM	S2-C1-N3	-10.87	110.37	116.10

There are no chirality outliers.

5 of 8 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	1339	AZM	N3-C1-S1-N1
2	B	1339	AZM	S2-C1-S1-N1
2	A	1339[B]	AZM	N3-C1-S1-O1
2	A	1339[B]	AZM	S2-C1-S1-O1
2	B	1339	AZM	N3-C1-S1-O1

There are no ring outliers.

5 monomers are involved in 10 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	1341	PO4	1	0
3	A	1345	PO4	1	0
2	A	1339[A]	AZM	3	0
2	A	1339[B]	AZM	4	0
2	B	1339	AZM	1	0

5.7 Other polymers [i](#)

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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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, 95th 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	310/310 (100%)	-0.01	7 (2%) 61 60	16, 24, 35, 55	3 (0%)
1	B	309/310 (99%)	0.09	6 (1%) 66 66	16, 26, 38, 56	1 (0%)
All	All	619/620 (99%)	0.04	13 (2%) 63 63	16, 25, 37, 56	4 (0%)

The worst 5 of 13 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	337	HIS	5.3
1	A	28	PHE	4.7
1	A	337	HIS	4.2
1	A	260	LYS	4.1
1	B	153	GLU	3.3

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

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

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

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, 95th 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(\AA^2)	Q<0.9
3	PO4	B	1342	5/5	0.84	0.18	60,61,62,63	0
3	PO4	B	1346	5/5	0.84	0.17	59,59,60,61	0
3	PO4	B	1343	5/5	0.86	0.11	62,63,64,65	0
3	PO4	B	1340	5/5	0.88	0.16	51,52,53,53	0
3	PO4	A	1344	5/5	0.89	0.14	51,51,51,52	0
3	PO4	A	1347	5/5	0.89	0.15	53,53,53,54	0
3	PO4	A	1345	5/5	0.90	0.11	54,55,55,57	0
2	AZM	A	1339[B]	13/13	0.90	0.13	28,29,33,34	13
3	PO4	B	1344	5/5	0.90	0.11	57,59,59,60	0
2	AZM	A	1339[A]	13/13	0.90	0.13	23,26,29,29	13
2	AZM	B	1339	13/13	0.91	0.10	27,39,47,47	0
3	PO4	A	1343	5/5	0.92	0.10	53,55,55,55	0
3	PO4	B	1347	5/5	0.93	0.11	44,45,47,48	0
3	PO4	A	1340	5/5	0.94	0.11	43,44,47,47	0
3	PO4	B	1345	5/5	0.95	0.07	52,52,53,53	0
3	PO4	B	1341	5/5	0.95	0.10	37,37,40,42	0
3	PO4	A	1346	5/5	0.95	0.10	40,41,41,43	0
3	PO4	A	1342	5/5	0.97	0.08	30,30,31,31	5
3	PO4	A	1341	5/5	0.98	0.07	28,29,32,33	0

6.5 Other polymers [i](#)

There are no such residues in this entry.