



wwPDB X-ray Structure Validation Summary Report ⓘ

Oct 30, 2017 – 09:44 PM EDT

PDB ID : 3QHO
Title : Crystal analysis of the complex structure, Y299F-cellotetraose, of endocellulase from pyrococcus horikoshii
Authors : Kim, H.-W.; Ishikawa, K.
Deposited on : unknown
Resolution : 1.65 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

<http://wwpdb.org/validation/2016/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

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

MolProbity : 4.02b-467
Mogul : 1.7.2 (RC1), CSD as538be (2017)
Xtriage (Phenix) : 1.9-1692
EDS : rb-20030345
Percentile statistics : 20161228.v01 (using entries in the PDB archive December 28th 2016)
Refmac : 5.8.0135
CCP4 : 6.5.0
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : rb-20030345

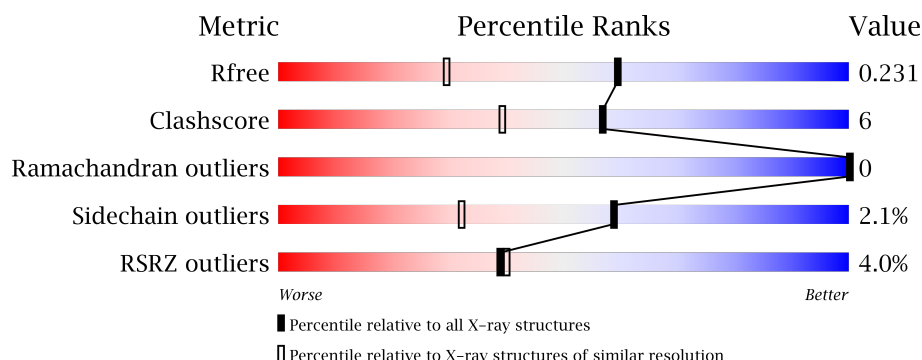
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.65 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}	100719	1368 (1.66-1.66)
Clashscore	112137	1468 (1.66-1.66)
Ramachandran outliers	110173	1438 (1.66-1.66)
Sidechain outliers	110143	1438 (1.66-1.66)
RSRZ outliers	101464	1371 (1.66-1.66)

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. 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	458	<div> <div>2%</div> <div>68% 13% 18%</div> </div>
1	B	458	<div> <div>2%</div> <div>72% 10% 18%</div> </div>
1	C	458	<div> <div>5%</div> <div>71% 12% 18%</div> </div>

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
3	PO4	C	462	-	-	X	-

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 9884 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.

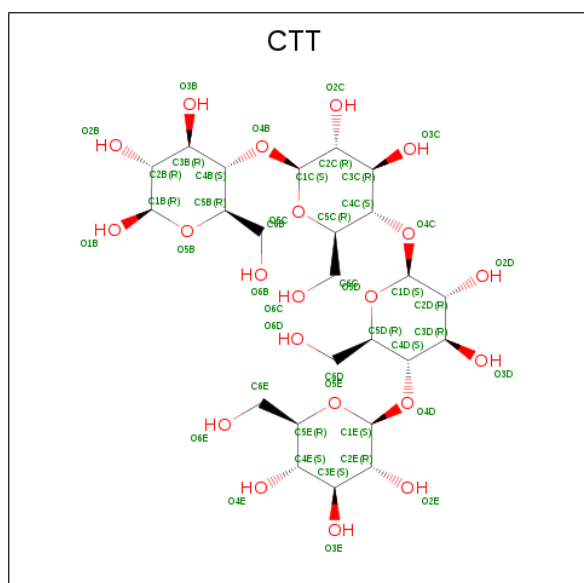
- Molecule 1 is a protein called 458aa long hypothetical endo-1,4-beta-glucanase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	377	Total	C	N	O	S	0	0	0
			3070	2002	502	556	10			
1	B	377	Total	C	N	O	S	0	2	0
			3089	2013	506	560	10			
1	C	377	Total	C	N	O	S	0	2	0
			3085	2010	504	560	11			

There are 3 discrepancies between the modelled and reference sequences:

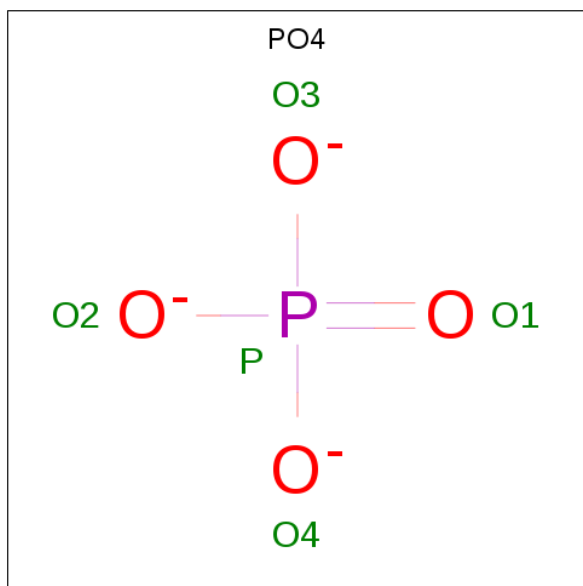
Chain	Residue	Modelled	Actual	Comment	Reference
A	299	PHE	TYR	ENGINEERED MUTATION	UNP O58925
B	299	PHE	TYR	ENGINEERED MUTATION	UNP O58925
C	299	PHE	TYR	ENGINEERED MUTATION	UNP O58925

- Molecule 2 is beta-D-glucopyranosyl-(1->4)-beta-D-glucopyranosyl-(1->4)-beta-D-glucopyranosyl-(1->4)-beta-D-glucopyranose (three-letter code: CTT) (formula: C₂₄H₄₂O₂₁).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	0
			45	24	21		
2	B	1	Total	C	O	0	0
			45	24	21		
2	C	1	Total	C	O	0	0
			45	24	21		

- Molecule 3 is PHOSPHATE ION (three-letter code: PO4) (formula: O₄P).



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

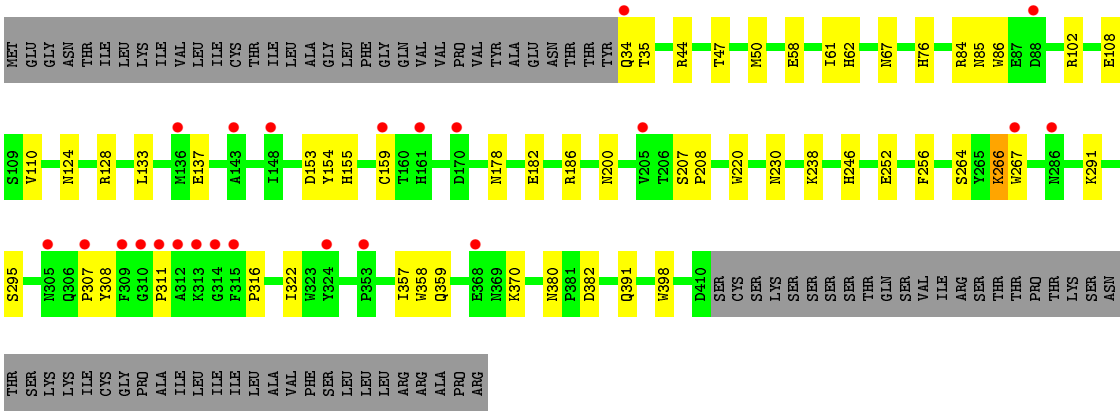
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	190	Total	O	0	0
			190	190		
4	B	160	Total	O	0	0
			160	160		

Continued on next page...

Continued from previous page...

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	C	130	Total	O	0	0
			130	130		



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	161.16Å 58.53Å 138.32Å 90.00° 109.24° 90.00°	Depositor
Resolution (Å)	33.67 – 1.65 40.26 – 1.63	Depositor EDS
% Data completeness (in resolution range)	94.8 (33.67-1.65) 92.3 (40.26-1.63)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.57 (at 1.63Å)	Xtriage
Refinement program	REFMAC 5.5.0072	Depositor
R, R_{free}	0.187 , 0.227 0.196 , 0.231	Depositor DCC
R_{free} test set	6965 reflections (5.28%)	DCC
Wilson B-factor (Å ²)	18.8	Xtriage
Anisotropy	0.537	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.41 , 49.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	9884	wwPDB-VP
Average B, all atoms (Å ²)	25.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.45% 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 ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: CTT, 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	1.28	12/3181 (0.4%)	1.15	16/4342 (0.4%)
1	B	1.25	6/3201 (0.2%)	1.05	10/4369 (0.2%)
1	C	1.01	0/3196	0.88	2/4362 (0.0%)
All	All	1.19	18/9578 (0.2%)	1.03	28/13073 (0.2%)

The worst 5 of 18 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	159	CYS	CB-SG	7.55	1.95	1.82
1	A	309	PHE	CE1-CZ	6.50	1.49	1.37
1	B	289	ARG	CB-CG	-6.29	1.35	1.52
1	A	69	PHE	CE1-CZ	6.26	1.49	1.37
1	A	303	VAL	CB-CG1	-6.11	1.40	1.52

The worst 5 of 28 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	89	MET	CG-SD-CE	-7.42	88.33	100.20
1	A	131	ASP	CB-CG-OD1	7.16	124.74	118.30
1	A	83	LYS	CD-CE-NZ	6.82	127.39	111.70
1	A	400	ASP	CB-CG-OD1	6.71	124.34	118.30
1	B	84	ARG	NE-CZ-NH2	-6.51	117.04	120.30

There are no chirality outliers.

There are no planarity outliers.

5.2 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	3070	0	2910	33	0
1	B	3089	0	2919	32	0
1	C	3085	0	2919	40	0
2	A	45	0	42	0	0
2	B	45	0	42	2	0
2	C	45	0	42	0	0
3	A	5	0	0	0	0
3	C	20	0	0	3	0
4	A	190	0	0	7	1
4	B	160	0	0	0	0
4	C	130	0	0	5	1
All	All	9884	0	8874	104	1

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 6.

The worst 5 of 104 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:C:266:LYS:H	1:C:266:LYS:HD2	0.91	1.04
1:C:266:LYS:N	1:C:266:LYS:HD2	1.74	0.97
1:B:62[A]:HIS:ND1	1:B:372:CYS:SG	2.41	0.94
1:C:266:LYS:H	1:C:266:LYS:CD	1.77	0.93
1:A:367:ILE:HD13	4:A:650:HOH:O	1.67	0.92

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:A:609:HOH:O	4:C:481:HOH:O[4_545]	1.59	0.61

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	375/458 (82%)	366 (98%)	9 (2%)	0	100	100
1	B	377/458 (82%)	368 (98%)	9 (2%)	0	100	100
1	C	377/458 (82%)	363 (96%)	14 (4%)	0	100	100
All	All	1129/1374 (82%)	1097 (97%)	32 (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	324/396 (82%)	316 (98%)	8 (2%)	53	25
1	B	326/396 (82%)	320 (98%)	6 (2%)	64	40
1	C	326/396 (82%)	320 (98%)	6 (2%)	64	40
All	All	976/1188 (82%)	956 (98%)	20 (2%)	59	36

5 of 20 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	136	MET
1	B	153	ASP
1	C	207	SER
1	A	406	LYS
1	B	94	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 21 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	124	ASN
1	B	200	ASN
1	C	124	ASN
1	B	67	ASN
1	C	161	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](#)

8 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	$\# Z > 2$
2	CTT	A	2739	-	48,48,48	1.47	7 (14%)	71,71,71	1.94	20 (28%)
3	PO4	A	459	-	4,4,4	0.54	0	6,6,6	0.94	1 (16%)
2	CTT	B	2739	-	48,48,48	1.33	6 (12%)	71,71,71	1.92	21 (29%)
2	CTT	C	2739	-	48,48,48	1.17	3 (6%)	71,71,71	1.87	22 (30%)
3	PO4	C	459	-	4,4,4	0.97	0	6,6,6	1.06	0
3	PO4	C	460	-	4,4,4	0.64	0	6,6,6	1.22	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
3	PO4	C	461	-	4,4,4	0.47	0	6,6,6	1.23	1 (16%)
3	PO4	C	462	-	4,4,4	1.10	1 (25%)	6,6,6	1.01	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	CTT	A	2739	-	-	0/20/100/100	0/4/4/4
3	PO4	A	459	-	-	0/0/0/0	0/0/0/0
2	CTT	B	2739	-	-	0/20/100/100	0/4/4/4
2	CTT	C	2739	-	-	0/20/100/100	0/4/4/4
3	PO4	C	459	-	-	0/0/0/0	0/0/0/0
3	PO4	C	460	-	-	0/0/0/0	0/0/0/0
3	PO4	C	461	-	-	0/0/0/0	0/0/0/0
3	PO4	C	462	-	-	0/0/0/0	0/0/0/0

The worst 5 of 17 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	2739	CTT	O5B-C1B	-3.39	1.37	1.43
2	B	2739	CTT	O4D-C4D	-3.15	1.36	1.43
2	B	2739	CTT	C4D-C5D	-2.27	1.46	1.52
2	B	2739	CTT	O3E-C3E	2.06	1.47	1.43
3	C	462	PO4	P-O1	2.10	1.55	1.50

The worst 5 of 65 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	2739	CTT	O5C-C1C-C2C	-5.50	99.69	110.30
2	A	2739	CTT	O5B-C1B-C2B	-4.55	102.49	110.04
2	C	2739	CTT	C3D-C4D-C5D	-4.11	102.15	110.88
2	A	2739	CTT	O5D-C5D-C6D	-4.04	96.73	106.41
2	A	2739	CTT	C3D-C4D-C5D	-3.97	102.46	110.88

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

4 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	2739	CTT	2	0
3	C	460	PO4	1	0
3	C	461	PO4	1	0
3	C	462	PO4	2	0

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

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	377/458 (82%)	-0.02	11 (2%)	52	54	9, 21, 38, 48	8 (2%)
1	B	377/458 (82%)	-0.07	11 (2%)	52	54	9, 21, 36, 45	9 (2%)
1	C	377/458 (82%)	0.26	23 (6%)	22	20	13, 29, 45, 56	10 (2%)
All	All	1131/1374 (82%)	0.06	45 (3%)	39	40	9, 24, 41, 56	27 (2%)

The worst 5 of 45 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	88	ASP	5.4
1	C	136	MET	5.4
1	B	286	ASN	4.8
1	A	136	MET	4.7
1	B	136	MET	3.9

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 carbohydrates 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. 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, 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	LLDF	B-factors(\AA^2)	Q<0.9
3	PO4	C	462	5/5	0.93	0.14	1.58	34,39,41,45	0
3	PO4	A	459	5/5	0.98	0.10	1.08	33,39,40,43	0
2	CTT	B	2739	45/45	0.92	0.09	0.72	20,28,33,38	0
2	CTT	C	2739	45/45	0.91	0.11	0.39	29,38,44,52	0
2	CTT	A	2739	45/45	0.94	0.08	-0.33	21,28,34,45	0
3	PO4	C	459	5/5	0.96	0.09	-0.40	32,38,44,46	0
3	PO4	C	461	5/5	0.99	0.04	-1.49	24,25,26,30	0
3	PO4	C	460	5/5	0.99	0.04	-2.34	19,23,27,28	0

6.5 Other polymers [i](#)

There are no such residues in this entry.