wwPDB X-ray Structure Validation Summary Report (i)

Feb 1, 2016 – 02:29 AM GMT

PDB ID	:	2HCV
Title	:	Crystal structure of L-rhamnose isomerase from Pseudomonas stutzeri with metal ion
Authors	:	Yoshida, H.; Yamada, M.; Takada, G.; Izumori, K.; Kamitori, S.
Deposited on	:	2006-06-19
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
http://wwpdb.org/validation/2016/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

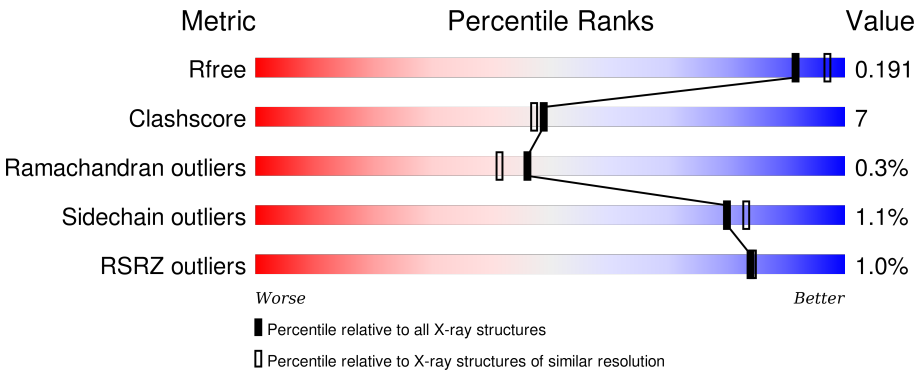
MolProbity	:	4.02b-467
Mogul	:	1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20026688
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	trunk26865

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 2.00 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}	91344	6249 (2.00-2.00)
Clashscore	102246	7340 (2.00-2.00)
Ramachandran outliers	100387	7248 (2.00-2.00)
Sidechain outliers	100360	7247 (2.00-2.00)
RSRZ outliers	91569	6262 (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 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 <=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	438	2% 81% 15% •
1	B	438	81% 14% •
1	C	438	% 84% 12% •
1	D	438	81% 14% 5%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 14801 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 L-rhamnose isomerase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	421	3260	2048	584	619	9	0	0	0
1	B	420	3253	2043	583	618	9	0	0	0
1	C	421	3260	2048	584	619	9	0	0	0
1	D	417	3237	2034	580	614	9	0	0	0

There are 36 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	150	ASN	ASP	ENGINEERED	UNP Q75WH8
A	431	GLY	-	CLONING ARTIFACT	UNP Q75WH8
A	432	SER	-	CLONING ARTIFACT	UNP Q75WH8
A	433	HIS	-	EXPRESSION TAG	UNP Q75WH8
A	434	HIS	-	EXPRESSION TAG	UNP Q75WH8
A	435	HIS	-	EXPRESSION TAG	UNP Q75WH8
A	436	HIS	-	EXPRESSION TAG	UNP Q75WH8
A	437	HIS	-	EXPRESSION TAG	UNP Q75WH8
A	438	HIS	-	EXPRESSION TAG	UNP Q75WH8
B	150	ASN	ASP	ENGINEERED	UNP Q75WH8
B	431	GLY	-	CLONING ARTIFACT	UNP Q75WH8
B	432	SER	-	CLONING ARTIFACT	UNP Q75WH8
B	433	HIS	-	EXPRESSION TAG	UNP Q75WH8
B	434	HIS	-	EXPRESSION TAG	UNP Q75WH8
B	435	HIS	-	EXPRESSION TAG	UNP Q75WH8
B	436	HIS	-	EXPRESSION TAG	UNP Q75WH8
B	437	HIS	-	EXPRESSION TAG	UNP Q75WH8
B	438	HIS	-	EXPRESSION TAG	UNP Q75WH8
C	150	ASN	ASP	ENGINEERED	UNP Q75WH8
C	431	GLY	-	CLONING ARTIFACT	UNP Q75WH8
C	432	SER	-	CLONING ARTIFACT	UNP Q75WH8

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Chain	Residue	Modelled	Actual	Comment	Reference
C	433	HIS	-	EXPRESSION TAG	UNP Q75WH8
C	434	HIS	-	EXPRESSION TAG	UNP Q75WH8
C	435	HIS	-	EXPRESSION TAG	UNP Q75WH8
C	436	HIS	-	EXPRESSION TAG	UNP Q75WH8
C	437	HIS	-	EXPRESSION TAG	UNP Q75WH8
C	438	HIS	-	EXPRESSION TAG	UNP Q75WH8
D	150	ASN	ASP	ENGINEERED	UNP Q75WH8
D	431	GLY	-	CLONING ARTIFACT	UNP Q75WH8
D	432	SER	-	CLONING ARTIFACT	UNP Q75WH8
D	433	HIS	-	EXPRESSION TAG	UNP Q75WH8
D	434	HIS	-	EXPRESSION TAG	UNP Q75WH8
D	435	HIS	-	EXPRESSION TAG	UNP Q75WH8
D	436	HIS	-	EXPRESSION TAG	UNP Q75WH8
D	437	HIS	-	EXPRESSION TAG	UNP Q75WH8
D	438	HIS	-	EXPRESSION TAG	UNP Q75WH8

- Molecule 2 is ZINC ION (three-letter code: ZN) (formula: Zn).

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

- Molecule 3 is water.

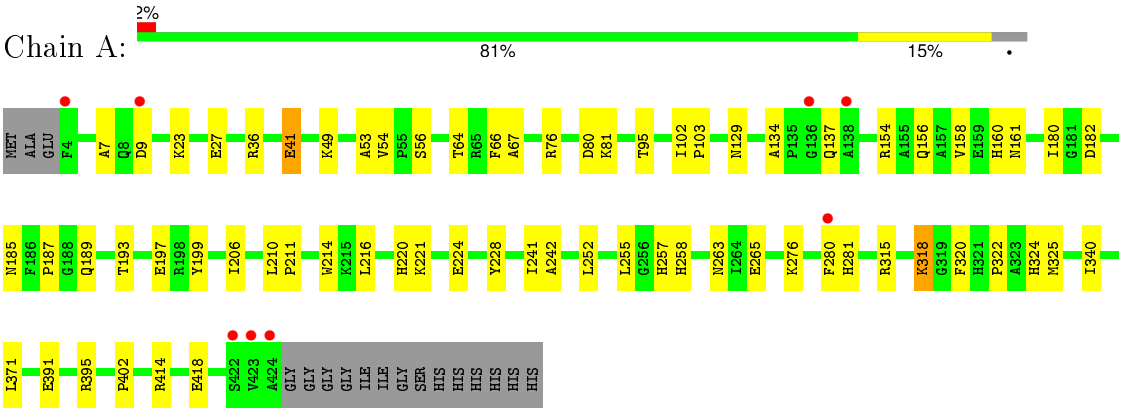
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	408	408	408	0	0
3	B	474	474	474	0	0
3	C	420	420	420	0	0
3	D	481	481	481	0	0

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 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.

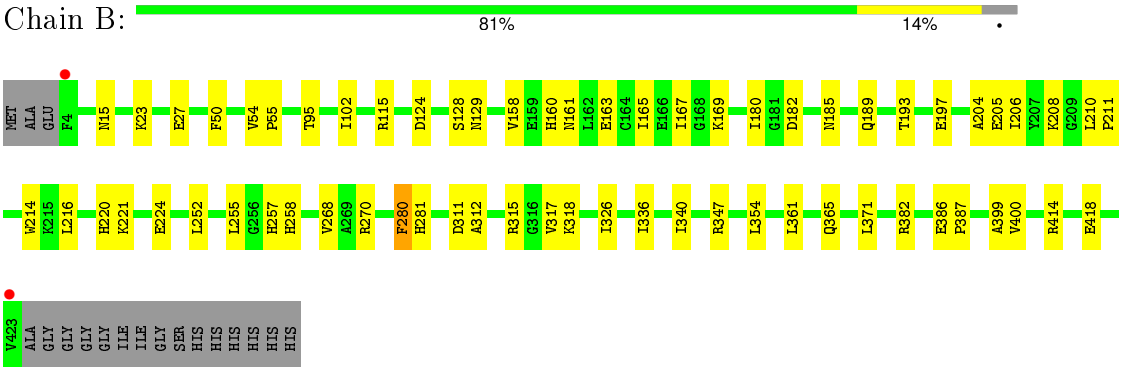
- Molecule 1: L-rhamnose isomerase

Chain A:



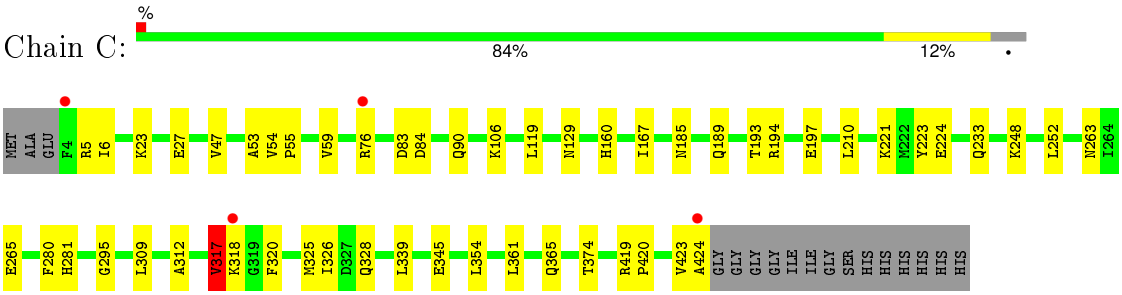
- Molecule 1: L-rhamnose isomerase

Chain B:



- Molecule 1: L-rhamnose isomerase

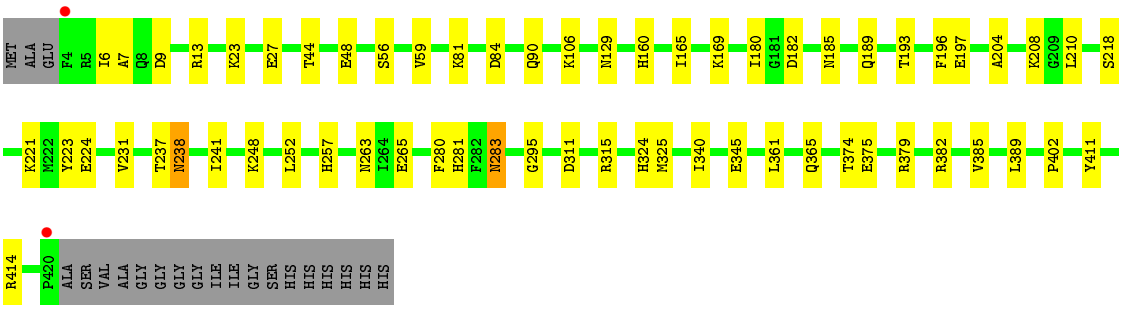
Chain C:



- Molecule 1: L-rhamnose isomerase

Chain D:

81%
14%
5%


MET
ALA
GLU
F4
R5
I6
A7
Q8
D9
R13
K23
E27
T44
E48
S56
V59
K81
D84
Q90
K106
N129
H160
I165
K169
I180
G181
D182
N185
Q189
T193
F196
E197
A204
K208
G209
L210
S218
K221
M222
Y223
E224
V231
T237
N238
I241
K248
L252
H257
N263
I264
E265
F280
H281
F282
N283
G295
D311
R315
H324
M325
I340
E345
L361
Q365
T374
E375
R379
R382
V385
L389
P402
Y411
R414
P420
ALA
SER
VAL
ALA
GLY
GLY
GLY
GLY
ILE
ILE
GLY
SER
HIS
HIS
HIS
HIS
HIS
HIS

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	74.26Å 103.97Å 107.02Å 90.00° 106.81° 90.00°	Depositor
Resolution (Å)	48.79 – 2.00 48.79 – 2.00	Depositor EDS
% Data completeness (in resolution range)	92.3 (48.79-2.00) 92.3 (48.79-2.00)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	7.25 (at 2.00Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.155 , 0.192 0.155 , 0.191	Depositor DCC
R_{free} test set	9706 reflections (10.01%)	DCC
Wilson B-factor (Å^2)	17.5	Xtriage
Anisotropy	0.349	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.37 , 58.2	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.31$	Xtriage
Outliers	0 of 99884 reflections	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	14801	wwPDB-VP
Average B, all atoms (Å^2)	20.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.68% 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, 0.375 respectively for untwinned datasets, and 0.333, 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: ZN

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	0/3332	0.53	0/4518
1	B	0.31	0/3325	0.53	0/4508
1	C	0.31	0/3332	0.51	0/4518
1	D	0.31	0/3309	0.53	0/4486
All	All	0.31	0/13298	0.53	0/18030

There are no bond length outliers.

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	3260	0	3165	51	0
1	B	3253	0	3153	52	0
1	C	3260	0	3165	45	0
1	D	3237	0	3141	39	0
2	A	2	0	0	0	0
2	B	2	0	0	0	0
2	C	2	0	0	0	0
2	D	2	0	0	0	0
3	A	408	0	0	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	474	0	0	13	0
3	C	420	0	0	10	0
3	D	481	0	0	6	0
All	All	14801	0	12624	185	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 7.

The worst 5 of 185 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:129:ASN:H	1:A:160:HIS:HE1	1.13	0.93
1:B:129:ASN:H	1:B:160:HIS:HE1	1.16	0.93
1:C:129:ASN:H	1:C:160:HIS:HE1	1.21	0.88
1:B:128:SER:HA	3:B:886:HOH:O	1.73	0.87
3:B:892:HOH:O	1:D:231:VAL:HG13	1.71	0.87

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	419/438 (96%)	410 (98%)	8 (2%)	1 (0%)	52	48
1	B	418/438 (95%)	407 (97%)	10 (2%)	1 (0%)	52	48
1	C	419/438 (96%)	404 (96%)	13 (3%)	2 (0%)	34	26
1	D	415/438 (95%)	404 (97%)	10 (2%)	1 (0%)	52	48
All	All	1671/1752 (95%)	1625 (97%)	41 (2%)	5 (0%)	46	41

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	317	VAL
1	A	224	GLU
1	B	224	GLU
1	C	224	GLU
1	D	224	GLU

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	330/341 (97%)	326 (99%)	4 (1%)	78	81
1	B	329/341 (96%)	325 (99%)	4 (1%)	78	81
1	C	330/341 (97%)	328 (99%)	2 (1%)	90	93
1	D	328/341 (96%)	324 (99%)	4 (1%)	78	81
All	All	1317/1364 (97%)	1303 (99%)	14 (1%)	80	83

5 of 14 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	354	LEU
1	B	371	LEU
1	D	283	ASN
1	B	280	PHE
1	D	238	ASN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 25 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	258	HIS
1	C	90	GLN
1	D	344	ASN
1	B	344	ASN
1	C	160	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)

Of 8 ligands modelled in this entry, 8 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.

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)

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	421/438 (96%)	-0.41	8 (1%)	70	70	12, 18, 32, 53	0
1	B	420/438 (95%)	-0.59	2 (0%)	91	92	10, 16, 29, 50	0
1	C	421/438 (96%)	-0.38	4 (0%)	84	84	12, 18, 35, 60	0
1	D	417/438 (95%)	-0.57	2 (0%)	91	92	11, 17, 27, 38	0
All	All	1679/1752 (95%)	-0.49	16 (0%)	84	84	10, 17, 31, 60	0

The worst 5 of 16 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	136	GLY	3.4
1	A	424	ALA	3.2
1	A	138	ALA	2.9
1	A	422	SER	2.8
1	B	423	VAL	2.8

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(Å^2)	Q<0.9
2	ZN	C	506	1/1	0.90	0.11	0.83	57,57,57,57	1
2	ZN	A	502	1/1	0.92	0.09	-0.67	54,54,54,54	1
2	ZN	B	504	1/1	0.92	0.06	-2.02	50,50,50,50	1
2	ZN	D	508	1/1	0.99	0.05	-2.36	40,40,40,40	1
2	ZN	A	501	1/1	1.00	0.04	-3.53	32,32,32,32	0
2	ZN	D	507	1/1	1.00	0.03	-3.67	26,26,26,26	0
2	ZN	B	503	1/1	0.99	0.03	-5.80	30,30,30,30	0
2	ZN	C	505	1/1	1.00	0.03	-8.89	30,30,30,30	0

6.5 Other polymers (i)

There are no such residues in this entry.