Supplementary Information

Synthesis, Crystal Structure, Cell Viability and *in vitro* Antiviral Activities Over Arboviruses of Novel Adamantane-Derived Schiff Bases

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Table S1. Selected geometric parameters for for atdTiof and rtdFhba

atdTiof			
Bond	Length / Å	Bond	Length / Å
S1–C1	1.7132 (18)	C8–H8	1.0000
S1–C4	1.7224 (17)	C9–C10	1.533 (2)
N1–C5	1.271 (2)	C9–H9A	0.9900
N1–C6	1.468 (2)	C9–H9B	0.9900
C1–C2	1.361 (3)	C10–C11	1.531 (2)
C1–H1	0.9500	C10–C14	1.534 (2)
C2–C3	1.420 (3)	C10–H10	1.0000
C2–H2	0.9500	C11–H11A	0.9900
C3–C4	1.377 (2)	C11–H11B	0.9900
C3–H3	0.9500	C12–C13	1.534 (2)
C4–C5	1.453 (2)	C12–H12A	0.9900
C5–H5	0.9500	C12–H12B	0.9900
C6–C12	1.537 (2)	C13–C15	1.533 (2)
C6–C7	1.539 (2)	C13–C14	1.533 (2)
C6–C11	1.542 (2)	C13–H13	1.0000
C7–C8	1.534 (2)	C14–H14A	0.9900
C7–H7A	0.9900	C14–H14B	0.9900
C7–H7B	0.9900	C15–H15A	0.9900
C8–C15	1.535 (2)	C15–H15B	0.9900
C8–C9	1.536 (2)		
C1–S1–C4	91.63 (9)	C8–C9–H9B	109.7
C5–N1–C6	119.94 (14)	H9A–C9–H9B	108.2
C2–C1–S1	112.32 (14)	C11–C10–C9	109.36 (14)
C2–C1–H1	123.8	C11–C10–C14	109.44 (13)
S1–C1–H1	123.8	C9–C10–C14	109.24 (13)
C1–C2–C3	112.31 (16)	C11–C10–H10	109.6
C1–C2–H2	123.8	C9–C10–H10	109.6
C3–C2–H2	123.8	C14–C10–H10	109.6
C4–C3–C2	112.51 (15)	C10–C11–C6	110.61 (13)
C4–C3–H3	123.7	C10–C11–H11A	109.5
C2–C3–H3	123.7	C6–C11–H11A	109.5
C3–C4–C5	126.07 (15)	C10–C11–H11B	109.5
C3–C4–S1	111.24 (13)	C6–C11–H11B	109.5
C5–C4–S1	122.62 (13)	H11A–C11–H11B	108.1
N1–C5–C4	122.73 (15)	C13–C12–C6	110.46 (12)
N1–C5–H5	118.6	C13–C12–H12A	109.6

C4–C5–H5	118.6	C6–C12–H12A	109.6
N1–C6–C12	116.10 (13)	C13–C12–H12B	109.6
N1–C6–C7	107.55 (13)	C6–C12–H12B	109.6
C12–C6–C7	108.89 (12)	H12A–C12–H12B	108.1
N1–C6–C11	107.12 (13)	C15–C13–C14	109.61 (14)
C12–C6–C11	108.17 (13)	C15–C13–C12	109.31 (14)
C7–C6–C11	108.83 (13)	C14–C13–C12	109.54 (13)
C8–C7–C6	110.25 (13)	C15–C13–H13	109.5
C8–C7–H7A	109.6	C14–C13–H13	109.5
C6–C7–H7A	109.6	C12–C13–H13	109.5
C8–C7–H7B	109.6	C13–C14–C10	109.37 (14)
C6–C7–H7B	109.6	C13–C14–H14A	109.8
H7A–C7–H7B	108.1	C10–C14–H14A	109.8
C7–C8–C15	109.46 (14)	C13–C14–H14B	109.8
C7–C8–C9	109.49 (13)	C10–C14–H14B	109.8
C15–C8–C9	109.04 (14)	H14A–C14–H14B	108.2
C7–C8–H8	109.6	C13–C15–C8	109.56 (13)
C15–C8–H8	109.6	C13–C15–H15A	109.8
C9–C8–H8	109.6	C8–C15–H15A	109.8
C10–C9–C8	109.83 (13)	C13–C15–H15B	109.8
C10–C9–H9A	109.7	C8–C15–H15B	109.8
C8–C9–H9A	109.7	H15A–C15–H15B	108.2
C10–C9–H9B	109.7		

rtdFhba

F1–C3	1.3641 (16)	C11–C12	1.5266 (18)
O1–C6	1.3474 (17)	C11–C15	1.5282 (19)
O1–H1	0.90 (2)	C11–H11	1.0000
N1–C7	1.2699 (17)	C12–C13	1.5296 (18)
N1–C8	1.4644 (17)	C12–H12A	0.9900
C1–C2	1.3934 (19)	C12–H12B	0.9900
C1–C6	1.4090 (19)	C13–C18	1.528 (2)
C1–C7	1.4581 (18)	C13–C14	1.5284 (18)
C2–C3	1.3671 (19)	C13–H13	1.0000
C2–H2	0.9500	C14–H14A	0.9900
C3–C4	1.377 (2)	C14–H14B	0.9900
C4–C5	1.376 (2)	C15–C16	1.526 (2)
C4–H4	0.9500	C15–H15A	0.9900
C5–C6	1.388 (2)	C15–H15B	0.9900
C5–H5	0.9500	C16–C18	1.528 (2)
C7–H7	0.9500	C16–C17	1.533 (2)
C8–C19	1.515 (2)	C16–H16	1.0000
C8–C9	1.5468 (18)	C17–H17A	0.9900

C8–H8	1.0000	C17–H17B	0.9900
C9–C14	1.5339 (17)	C18–H18A	0.9900
C9–C10	1.5386 (18)	C18–H18B	0.9900
C9–C17	1.5394 (17)	C19–H19A	0.9800
C10–C11	1.5343 (18)	C19–H19B	0.9800
C10–H10A	0.9900	C19–H19C	0.9800
C10–H10B	0.9900		
C6–O1–H1	107.1 (13)	C11–C12–H12A	109.8
C7–N1–C8	120.75 (12)	C13–C12–H12A	109.8
C2–C1–C6	119.15 (12)	C11–C12–H12B	109.8
C2–C1–C7	119.99 (12)	C13–C12–H12B	109.8
C6–C1–C7	120.87 (12)	H12A–C12–H12B	108.2
C3–C2–C1	119.20 (13)	C18–C13–C14	109.81 (12)
C3–C2–H2	120.4	C18–C13–C12	109.37 (12)
C1–C2–H2	120.4	C14–C13–C12	108.98 (11)
F1–C3–C2	119.19 (13)	C18–C13–H13	109.6
F1–C3–C4	118.39 (12)	C14–C13–H13	109.6
C2–C3–C4	122.42 (13)	C12–C13–H13	109.6
C5–C4–C3	118.96 (13)	C13–C14–C9	111.24 (11)
C5–C4–H4	120.5	C13–C14–H14A	109.4
C3–C4–H4	120.5	C9–C14–H14A	109.4
C4–C5–C6	120.48 (13)	C13–C14–H14B	109.4
C4–C5–H5	119.8	C9–C14–H14B	109.4
C6–C5–H5	119.8	H14A–C14–H14B	108.0
O1–C6–C5	118.90 (13)	C16–C15–C11	109.40 (11)
O1–C6–C1	121.32 (12)	C16–C15–H15A	109.8
C5–C6–C1	119.78 (13)	C11–C15–H15A	109.8
N1–C7–C1	121.62 (12)	C16–C15–H15B	109.8
N1–C7–H7	119.2	C11–C15–H15B	109.8
C1–C7–H7	119.2	H15A–C15–H15B	108.2
N1–C8–C19	107.49 (12)	C15–C16–C18	109.53 (12)
N1–C8–C9	109.98 (10)	C15–C16–C17	109.17 (12)
C19–C8–C9	114.91 (12)	C18–C16–C17	109.80 (13)
N1–C8–H8	108.1	C15–C16–H16	109.4
C19–C8–H8	108.1	C18–C16–H16	109.4
C9–C8–H8	108.1	C17–C16–H16	109.4
C14–C9–C10	108.18 (10)	C16–C17–C9	110.72 (11)
C14–C9–C17	108.27 (11)	C16–C17–H17A	109.5
C10–C9–C17	108.21 (11)	C9–C17–H17A	109.5
C14–C9–C8	108.53 (10)	C16–C17–H17B	109.5
C10–C9–C8	113.10 (11)	C9–C17–H17B	109.5
C17–C9–C8	110.42 (11)	H17A–C17–H17B	108.1

C11–C10–C9	110.28 (10)	C13–C18–C16	109.27 (11)
C11–C10–H10A	109.6	C13–C18–H18A	109.8
C9–C10–H10A	109.6	C16–C18–H18A	109.8
C11–C10–H10B	109.6	C13–C18–H18B	109.8
C9–C10–H10B	109.6	C16–C18–H18B	109.8
H10A–C10–H10B	108.1	H18A–C18–H18B	108.3
C12–C11–C15	109.52 (11)	C8–C19–H19A	109.5
C12–C11–C10	109.74 (10)	C8–C19–H19B	109.5
C15–C11–C10	109.52 (11)	H19A–C19–H19B	109.5
C12–C11–H11	109.3	C8–C19–H19C	109.5
C15–C11–H11	109.3	H19A–C19–H19C	109.5
C10–C11–H11	109.3	H19B–C19–H19C	109.5
C11–C12–C13	109.39 (11)		

atdTiof: (adamantan-1-yl)-1-(thiophen-2-yl)methanimine, rtdFhba: 2-{[1-(adamantan-l-yl)ethyl]iminomethyl}-4-fluorophenol.

Structural determinations of atdTiof and rtdFhba

Table S2. Hydrogen-bond geometry for atdTiof and rtdFhba

Compound	D–H···A	D–H / Å	H···A / Å	D···A / Å	D–H···A / °
atdTiof	C2–H2···S1^{i}	0.95	2.99	3.921 (2)	169
rtdFhba	O1–H1···N1	0.90 (2)	1.76 (2)	2.5813 (15)	149.7 (19)

atdTiof: (adamantan-1-yl)-1-(thiophen-2-yl)methanimine, rtdFhba: 2-{[1-(adamantan-l-yl)ethyl]iminomethyl}-4-fluorophenol. Symmetry code: (i) –x + 2, y – 1/2, –z + 1.

SMILES (simplified molecular input line entry specification) strings for the molecular structures described in the manuscript

atdTiof

[CH]1[CH]S[C]([CH]1)[CH][N]C12CC3CC(CC(C3)C1)C2

rtdFhba

C[C@@H]([N][CH][C]1[CH][C](F)[CH][CH][C]1O)C12CC3CC(CC(C3)C1)C2

Spectroscopic analysis

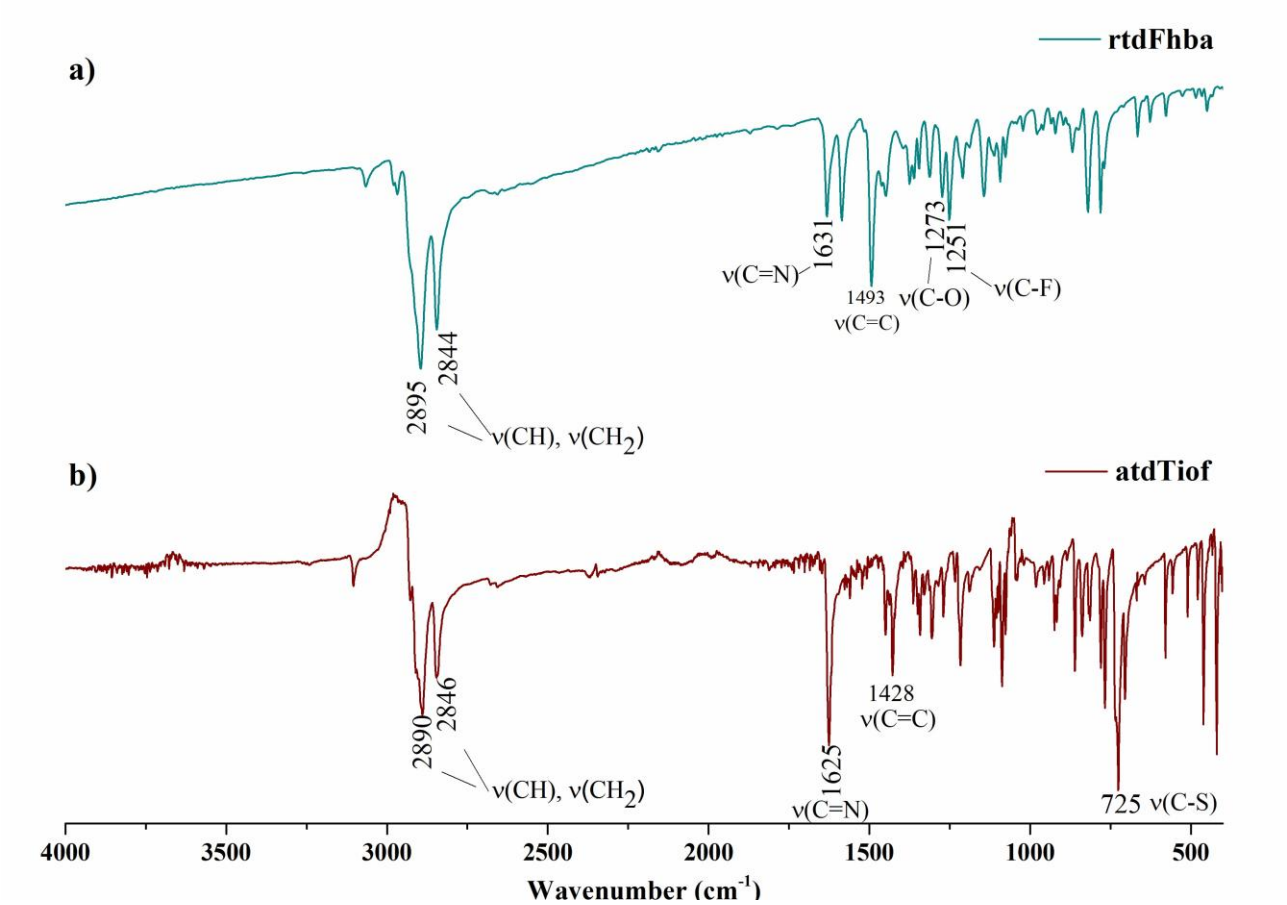

Figure S1. Infrared absorption spectra of (a) rtdFhba and (b) atdTiof.

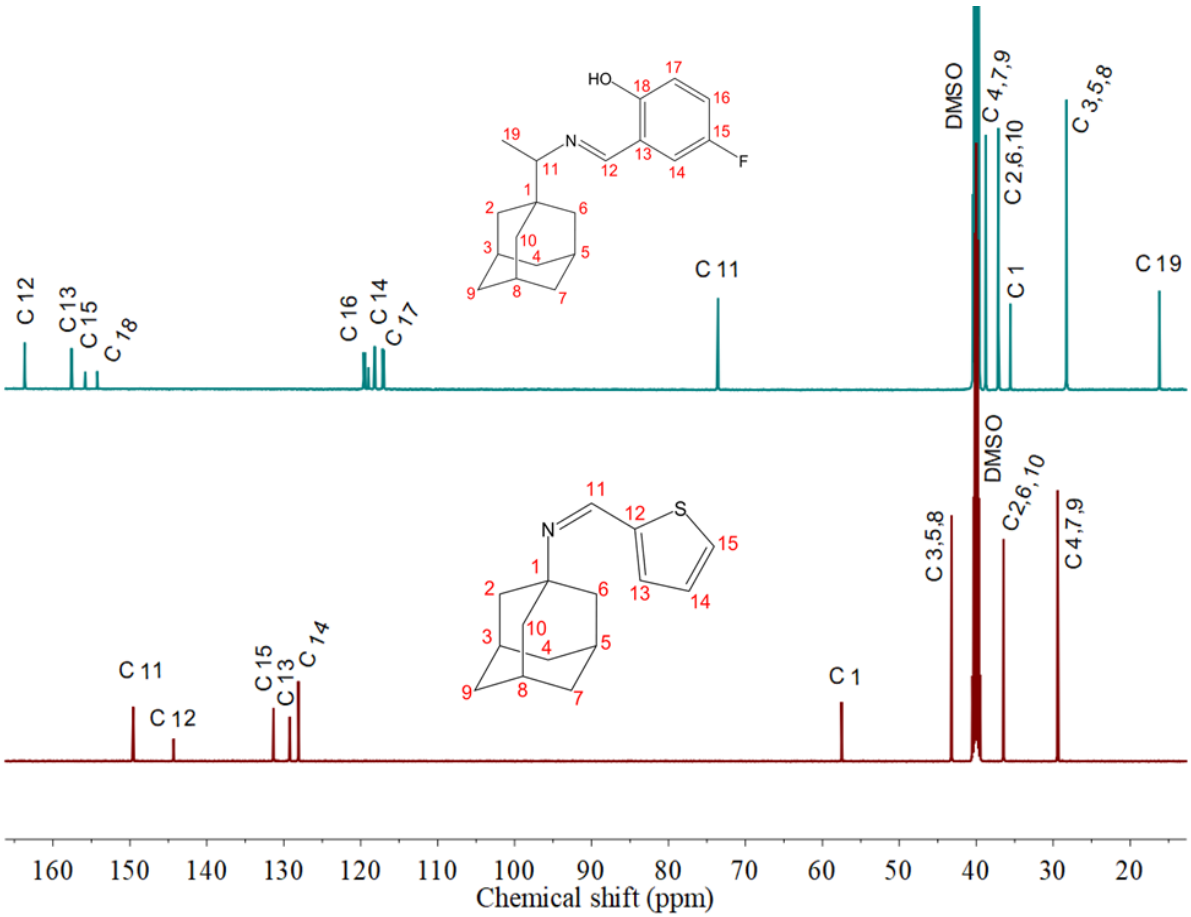

Figure S2. ^{13}C NMR spectra for the Schiff Bases rtdFhba and atdTiof, respectively.

Table S3. ^{13}C NMR signal assignments for rtdFhba and atdTiof

	Label	δ / ppm
rtdFhba	C19	16.2
	C3, C5, C8	28.3
	C1	35.6
	C2, C6, C10	37.1
	C4, C7, C9	38.8
	C11	73.6
	C17	117.2
	C14	118.2
	C16	119.5
	C18	154.1
	C15	156.0
	C13	157.6
	C12	163.7
atdTiof	C4, C7, C9	29.4
	C2, C6, C10	36.7
	C3, C5, C8	43.4
	C1	57.7
	C14	128.1
	C13	129.3
	C15	131.5
	C12	144.5
	C11	149.6

atdTiof: (adamantan-1-yl)-1-(thiophen-2-yl)methanimine, rtdFhba: 2-{[1-(adamantan-l-yl)ethyl]iminomethyl}-4-fluorophenol.

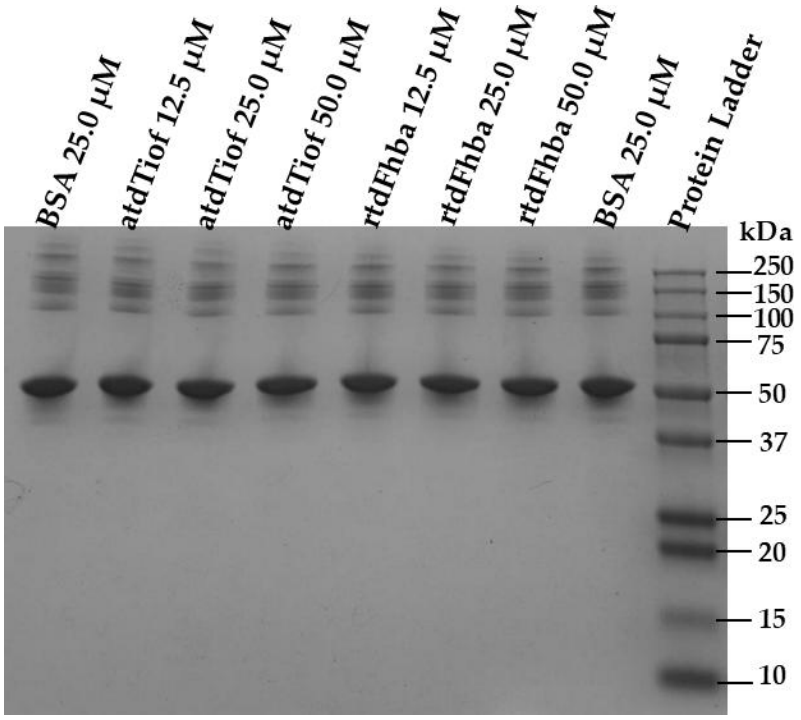

Figure S3. Gel electrophoresis of free BSA and BSA in the presence of atdTiof and rtdFhba. rtdFhba refers to rimantadine with 5-fluoro-2-hydroxybenzaldeyde, while atdTiof refers to amantadine with 2-thiophenecarboxaldehyde. BSA refers to bovine serum albumin.

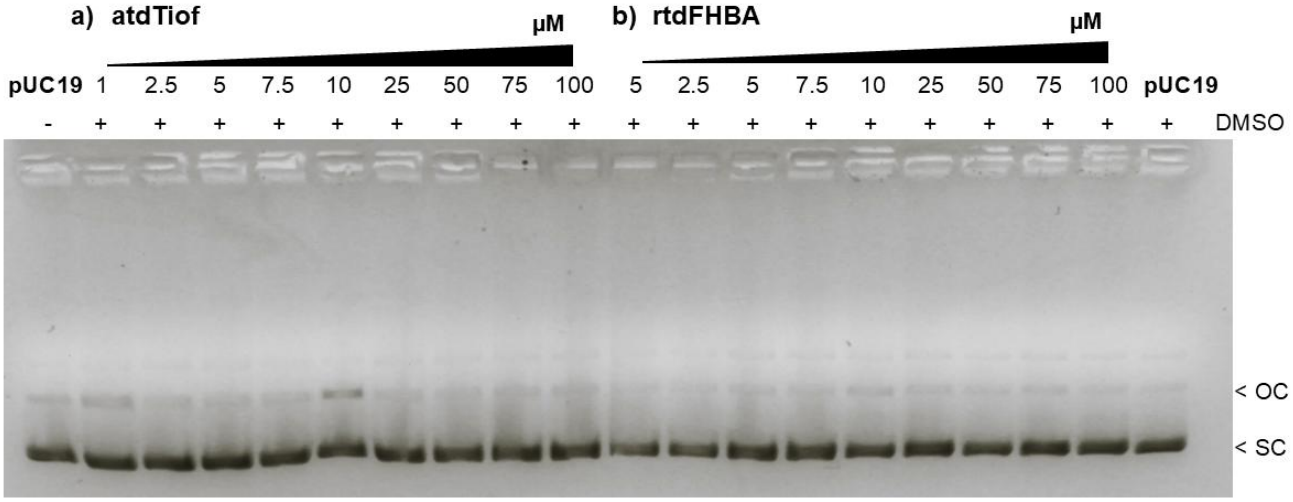

Figure S4. Gel electrophoresis of pUC19 plasmid DNA in the presence of (a) atdTiof and (b) rtdFhba in different concentrations ranging from 1 to 100 µM. Open circular (OC) and super coiled (SC) forms of DNA are highlighted.

checkCIF/PLATON report

Structure factors have been supplied for datablock(s) ALB-53_a

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No syntax errors found. CIF dictionary Interpreting this report

Datablock: ALB-53_a

Bond precision: C-C = 0.0026 A Wavelength=0.71073

Cell: a=6.458(1) b=7.0782(11) c=14.173(2)
alpha=90 beta=99.617(4) gamma=90
Temperature: 120 K

	Calculated	Reported
Volume	638.76(17)	638.78(17)
Space group	P 21	P 21
Hall group	P 2yb	P 2yb
Moiety formula	C15 H19 N S	C15 H19 N S
Sum formula	C15 H19 N S	C15 H19 N S
Mr	245.37	245.37
Dx,g cm-3	1.276	1.276
Z	2	2
Mu (mm-1)	0.230	0.230
F000	264.0	264.0
F000'	264.32	
h,k,lmax	8,8,17	8,8,17
Nref	2706[1466]	2666
Tmin,Tmax	0.946,0.961	0.726,0.746
Tmin'	0.946	

Correction method= # Reported T Limits: Tmin=0.726 Tmax=0.746
AbsCorr = MULTI-SCAN

```
Data completeness= 1.82/0.99        Theta(max)= 26.725

R(reflections)= 0.0223( 2636)                    wR2(reflections)=
                                                 0.0612( 2666)
S = 1.074                    Npar= 154
```

```
The following ALERTS were generated. Each ALERT has the format
      test-name_ALERT_alert-type_alert-level.
Click on the hyperlinks for more details of the test.
```

Alert level G

```
PLAT969_ALERT_5_G The 'Henn et al.' R-Factor-gap value .....      4.036 Note
            Predicted wR2: Based on SigI**2  1.52 or SHELX Weight  5.69
PLAT978_ALERT_2_G Number C-C Bonds with Positive Residual Density.         16 Info
```

```
   0 ALERT level A - Most likely a serious problem - resolve or explain
   0 ALERT level B - A potentially serious problem, consider carefully
   0 ALERT level C - Check. Ensure it is not caused by an omission or oversight
   2 ALERT level G - General information/check it is not something unexpected

   0 ALERT type 1 CIF construction/syntax error, inconsistent or missing data
   1 ALERT type 2 Indicator that the structure model may be wrong or deficient
   0 ALERT type 3 Indicator that the structure quality may be low
   0 ALERT type 4 Improvement, methodology, query or suggestion
   1 ALERT type 5 Informative message, check
```

It is advisable to attempt to resolve as many as possible of the alerts in all categories. Often the minor alerts point to easily fixed oversights, errors and omissions in your CIF or refinement strategy, so attention to these fine details can be worthwhile. It is up to the individual to critically assess their own results and, if necessary, seek expert advice.

PLATON version of 26/09/2025; check.def file version of 20/09/2025

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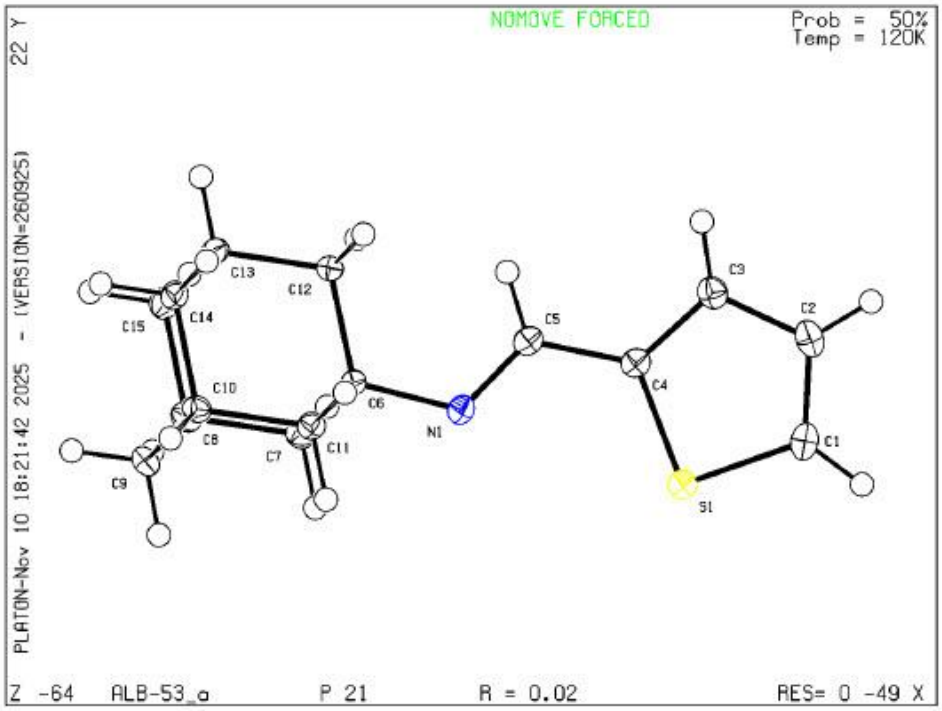
duplicate check

No duplication found

Datablock ALB-53_a - ellipsoid plot



checkCIF/PLATON report

Structure factors have been supplied for datablock(s) AFR-11_a

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No syntax errors found. CIF dictionary Interpreting this report

Datablock: AFR-11_a

Bond precision: C-C = 0.0020 A Wavelength=0.71073

Cell: a=6.518(1) b=11.4248(17) c=11.7282(18)
alpha=66.642(3) beta=89.341(3) gamma=80.828(3)
Temperature: 120 K

	Calculated	Reported
Volume	790.3(2)	790.2(2)
Space group	P -1	P -1
Hall group	-P 1	-P 1
Moiety formula	C19 H24 F N O	C19 H24 F N O
Sum formula	C19 H24 F N O	C19 H24 F N O
Mr	301.39	301.39
Dx,g cm-3	1.267	1.267
Z	2	2
Mu (mm-1)	0.085	0.085
F000	324.0	324.0
F000'	324.15	
h,k,lmax	7,13,14	7,13,14
Nref	3015	2998
Tmin,Tmax	0.990,0.993	0.943,1.000
Tmin'	0.974	

Correction method= # Reported T Limits: Tmin=0.943 Tmax=1.000
AbsCorr = NUMERICAL

Data completeness= 0.994 Theta(max)= 25.750

R(reflections)= 0.0392(2553) wR2(reflections)= 0.1085(2998)

S = 1.030 Npar= 203

The following ALERTS were generated. Each ALERT has the format
test-name_ALERT_alert-type_alert-level.
Click on the hyperlinks for more details of the test.

Alert level C

PLAT911_ALERT_3_C Missing FCF Refl Between Thmin & STh/L= 0.600 8 Report
-6 -8 1, -6 -8 2, -6 -7 2, -5 -7 2, -6 -7 3, -5 -7 3,
-6 -7 4, -5 -6 6,

Alert level G

PLAT154_ALERT_1_G The s.u.'s on the Cell Angles are Equal ..(Note) 0.003 Degree
PLAT793_ALERT_4_G Model has Chirality at C8 (Centro SpGr) R Verify
PLAT912_ALERT_4_G Missing # of FCF Reflections Above STh/L= 0.600 9 Note
PLAT969_ALERT_5_G The 'Henn et al.' R-Factor-gap value ..... 6.438 Note
Predicted wR2: Based on SigI**2 1.69 or SHELX Weight 10.53
PLAT978_ALERT_2_G Number C-C Bonds with Positive Residual Density. 18 Info

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0 **ALERT level A =** Most likely a serious problem - resolve or explain
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5 **ALERT level G =** General information/check it is not something unexpected

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1 ALERT type 3 Indicator that the structure quality may be low
2 ALERT type 4 Improvement, methodology, query or suggestion
1 ALERT type 5 Informative message, check

It is advisable to attempt to resolve as many as possible of the alerts in all categories. Often the minor alerts point to easily fixed oversights, errors and omissions in your CIF or refinement strategy, so attention to these fine details can be worthwhile. It is up to the individual to critically assess their own results and, if necessary, seek expert advice.

PLATON version of 26/09/2025; check.def file version of 20/09/2025

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duplicate check

No duplication found

Datablock AFR-11_a - ellipsoid plot