IUCrData

ISSN 2414-3146

6-Bromo-2-(4-methoxyphenyl)-3-methyl-3*H*-imidazo[4,5-*b*]pyridine

Selma Bourichi,[a]* Youssef Kandri Rodi,[a] Jerry P. Jasinski,[b] Manpreet Kaur,[b] El Mestafa El Hadrami[a] and El Mokhtar Essassi[c]

[a]Laboratoire de Chimie Organique Appliquée, Faculté des Sciences et Techniques, Université Sidi Mohammed Ben Abdellah, Fès, Morocco, [b]Department of Chemistry, Keene State College, 229 Main Street, Keene, NH 03435-2001, USA, and [c]Laboratoire de Chimie Organique Hétérocyclique URAC 21, Pôle de Compétence Pharmacochimie, Av. Ibn Battouta, BP 1014, Faculté des Sciences, Université Mohammed V, Rabat, Morocco. *Correspondence e-mail: bourichiselma@hotmail.com

Received 13 July 2017
Accepted 20 July 2017

Edited by J. Simpson, University of Otago, New Zealand

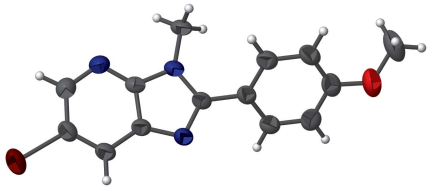
Keywords: crystal structure; imidazo[4,5-*b*]pyridine; alkylation.

CCDC reference: 1563558

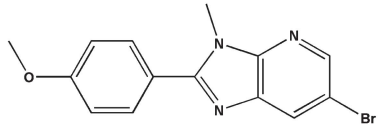
Structural data: full structural data are available from iucrdata.iucr.org

In the title compound, $C_{14}H_{12}BrN_3O$, the dihedral angle between the mean planes of the imidazo[4,5-*b*]pyridine ring system and the methoxyphenyl ring is 41.53 (12)°. In the crystal, weak C—H···N hydrogen bonds link the molecules into chains along the *c*-axis direction. Weak π–π stacking interactions involving the imidazole and the methoxyphenyl rings further stabilize the crystal packing.

3D view



Chemical scheme



Structure description

Derivatives of imidazopyridine exhibit several remarkable pharmacological activities. For example they are used as antiviral (Scribner *et al.* 2007), antibacterial (Liang *et al.* 2007) and anti-neuroinflammatory agents (Ock *et al.*, 2010). As a continuation of our research on the development of substituted imidazo[4,5-*b*]pyridine derivatives (Bourichi *et al.*, 2017), we report here the synthesis and structure of a new imidazo[4,5-*b*]pyridine derivative synthesized by the reaction of methyl iodide and 6-bromo-2-(4-methoxyphenyl)-3*H*-imidazopyridine in the presence of a catalytic quantity of tetra-*n*-butylammonium bromide under phase transfer catalysis conditions.

The title compound crystallizes with one independent molecule in the asymmetric unit (Fig. 1). The molecule is slightly twisted, as is evident from the dihedral angle of 41.53 (12)° between the mean planes of the imidazo[4,5-*b*]pyridine ring system and the methoxyphenyl ring. In the crystal, a single weak C13—H13*C*···N1 intermolecular interaction links the molecules into chains along the *c*-axis direction (Table 1, Fig. 2). In addition, weak π–π stacking interactions involving the imidazole and the methoxyphenyl rings further stabilize the crystal packing [intercentroid distance, $Cg1\cdots Cg3^{ii}$ =

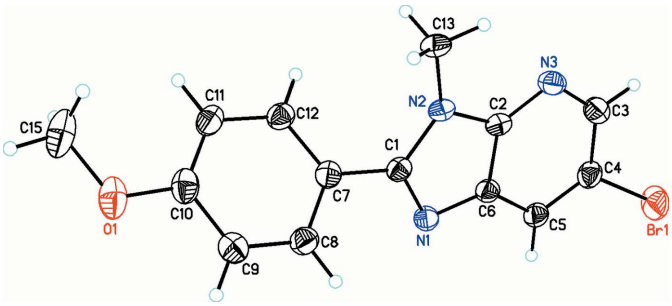


Figure 1
Structure of the title compound, showing the atom-numbering scheme and ellipsoids drawn at the 30% probability level.

3.8289 (2) Å, symmetry code: (ii) = $1 - x, -\frac{1}{2} + y, \frac{1}{2} - z$; *Cg*1 and *Cg*3 are the centroids of the N1/C1/N2/C2/C6 and C7–C12 rings, respectively].

Synthesis and crystallization

To a solution of 6-bromo-2-(4-methoxyphenyl)-3*H*-imidazopyridine (0.2 g, 0.65 mmol) in DMF (25 ml) was added potassium carbonate (0.12 g, 0.9 mmol). The mixture was stirred magnetically for 5 min and then tetra-*n*-butylammonium bromide (0.032 g, 0.1 mmol) and methyl iodide (0.10 ml, 0.78 mmol) were added. Stirring was continued at room temperature for 6 h. After removing the salts by filtration, the DMF was evaporated under reduced pressure and the residue obtained was dissolved in dichloromethane. The remaining salts were extracted with distilled water and the resulting mixture was chromatographed on a silica-gel column (eluent: ethyl acetate/hexane, 1:3). Colourless crystals were isolated when the solvent was allowed to evaporate (yield 67%, m.p. 164–165° C).

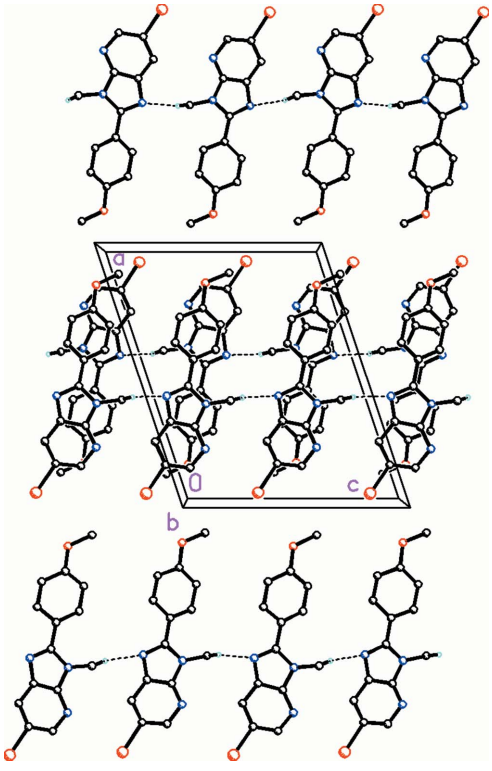


Figure 2
Molecular packing for the title compound, viewed along the *b* axis. Hydrogen bonds are drawn as dashed lines and H atoms not involved in these interactions have been omitted for clarity.

Table 1
Hydrogen-bond geometry (Å, °).

D—H···A	D—H	H···A	D···A	D—H···A
C13—H13*C*···N1^{i}	0.96	2.53	3.480 (3)	169

Symmetry code: (i) $x, -y + \frac{1}{2}, z - \frac{1}{2}$.

Table 2
Experimental details.

Crystal data	
Chemical formula	$C_{14}H_{12}BrN_3O$
M_r	318.18
Crystal system, space group	Monoclinic, $P2_1/c$
Temperature (K)	293
a, b, c (Å)	14.8643 (6), 7.6795 (4), 12.0690 (5)
β (°)	108.465 (4)
V (Å^3)	1306.75 (11)
Z	4
Radiation type	Cu $K\alpha$
μ (mm^{-1})	4.25
Crystal size (mm)	0.26 × 0.24 × 0.12
Data collection	
Diffractometer	Rigaku Oxford Diffraction
Absorption correction	Multi-scan (*CrysAlis PRO*; Rigaku Oxford Diffraction, 2015)
T_{min}, T_{max}	0.354, 1.000
No. of measured, independent and observed [$I > 2\sigma(I)$] reflections	4519, 2477, 2015
R_{int}	0.026
(sin $\theta/\lambda)_{max}$ (Å^{-1})	0.614
Refinement	
$R[F^2 > 2\sigma(F^2)]$, $wR(F^2)$, S	0.039, 0.107, 1.05
No. of reflections	2477
No. of parameters	175
H-atom treatment	H-atom parameters constrained
$\Delta\rho_{max}$, $\Delta\rho_{min}$ (e Å^{-3})	0.39, −0.37

Computer programs: *CrysAlis PRO* (Rigaku Oxford Diffraction, 2015), *SHELXT* (Sheldrick, 2015*a*), *SHELXL2014* (Sheldrick, 2015*b*) and *OLEX2* (Dolomanov *et al.*, 2009).

Refinement

Crystal data, data collection and structure refinement details are summarized in Table 2.

Acknowledgements

JPJ acknowledges the NSF–MRI program (grant No. CHE-1039027) for funds to purchase the X-ray diffractometer.

References

Bourichi, S., Kandri Rodi, Y., Jasinski, J. P., Kaur, M., Ouzidan, Y. & Essassi, E. M. (2017). *IUCrData*, **2**, x170899.
Dolomanov, O. V., Bourhis, L. J., Gildea, R. J., Howard, J. A. K. & Puschmann, H. (2009). *J. Appl. Cryst.* **42**, 339–341.

Liang, G. B., Qian, X., Feng, D., Fisher, M., Brown, C. M., Gurnett, A., Leavitt, P. S., Liberator, P. A., Misura, A. S., Tamas, T., Schmatz, D. M., Wyvratt, M. & Biftu, T. (2007). *Bioorg. Med. Chem. Lett.* **17**, 3558–3561.
Ock, J., Kim, S., Yi, K. Y., Kim, N. J., Han, H. S., Cho, J. Y. & Suk, K. (2010). *Biochem. Pharmacol.* **79**, 596–609.
Rigaku Oxford Diffraction (2015). *CrysAlis PRO*. Rigaku Americas, The Woodlands, Texas, USA.
Scribner, A., Dennis, R., Hong, J., Lee, S., McIntyre, D., Perrey, D., Feng, D., Fisher, M., Wyvratt, M., Leavitt, M., Liberator, P., Gurnett, A., Brown, C., Mathew, J., Thompson, D., Schmatz, D. & Biftu, T. (2007). *Eur. J. Med. Chem.* **42**, 1334–1357.
Sheldrick, G. M. (2015*a*). *Acta Cryst.* A**71**, 3–8.
Sheldrick, G. M. (2015*b*). *Acta Cryst.* C**71**, 3–8.

full crystallographic data

IUCrData (2017). **2**, x171071 [https://doi.org/10.1107/S2414314617010719]

6-Bromo-2-(4-methoxyphenyl)-3-methyl-3*H*-imidazo[4,5-*b*]pyridine

Selma Bourichi, Youssef Kandri Rodi, Jerry P. Jasinski, Manpreet Kaur, El Mestafa El Hadrami and El Mokhtar Essassi

6-Bromo-2-(4-methoxyphenyl)-3-methyl-3*H*-imidazo[4,5-*b*]pyridine

Crystal data

$C_{14}H_{12}BrN_3O$
M_r = 318.18
Monoclinic, $P2_1/c$
a = 14.8643 (6) Å
b = 7.6795 (4) Å
c = 12.0690 (5) Å
β = 108.465 (4)°
V = 1306.75 (11) Å^3
Z = 4
$F(000)$ = 640
D_x = 1.617 Mg m^{-3}
Cu $K\alpha$ radiation, λ = 1.54184 Å
Cell parameters from 1624 reflections
θ = 3.8–71.4°
μ = 4.25 mm^{-1}
T = 293 K
Prism, colourless
0.26 × 0.24 × 0.12 mm

Data collection

Rigaku Oxford diffraction diffractometer
Radiation source: fine-focus sealed X-ray tube, Enhance (Cu) X-ray Source
Graphite monochromator
Detector resolution: 16.0416 pixels mm^{-1}
ω scans
Absorption correction: multi-scan (CrysAlis PRO; Rigaku Oxford Diffraction, 2015)
T_{min} = 0.354, T_{max} = 1.000
4519 measured reflections
2477 independent reflections
2015 reflections with $I > 2\sigma(I)$
R_{int} = 0.026
θ_{max} = 71.3°, θ_{min} = 6.3°
h = −17→18
k = −9→7
l = −14→12

Refinement

Refinement on F^2
Least-squares matrix: full
$R[F^2 > 2\sigma(F^2)]$ = 0.039
$wR(F^2)$ = 0.107
S = 1.05
2477 reflections
175 parameters
0 restraints
Primary atom site location: dual
Hydrogen site location: inferred from neighbouring sites
H-atom parameters constrained
$w = 1/[\sigma^2(F_o^2) + (0.0523P)^2 + 0.0898P]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{max}$ = 0.001
$\Delta\rho_{max}$ = 0.39 e Å^{-3}
$\Delta\rho_{min}$ = −0.37 e Å^{-3}
Extinction correction: SHELXL2014 (Sheldrick, 2015b), $Fc^*=kFc[1+0.001xFc^2\lambda^3/\sin(2\theta)]^{-1/4}$
Extinction coefficient: 0.0104 (5)

Special details

Geometry. All esds (except the esd in the dihedral angle between two l.s. planes) are estimated using the full covariance matrix. The cell esds are taken into account individually in the estimation of esds in distances, angles and torsion angles; correlations between esds in cell parameters are only used when they are defined by crystal symmetry. An approximate (isotropic) treatment of cell esds is used for estimating esds involving l.s. planes.

Fractional atomic coordinates and isotropic or equivalent isotropic displacement parameters (Å²)

	x	*y*	*z*	U_{iso}*/U_{eq}
Br1	0.95243 (2)	0.30457 (6)	0.64922 (3)	0.0757 (2)
O1	0.14946 (16)	0.3891 (4)	0.0701 (2)	0.0741 (7)
N1	0.57950 (16)	0.3218 (3)	0.41193 (19)	0.0418 (5)
N2	0.60882 (15)	0.4032 (3)	0.24692 (17)	0.0367 (5)
N3	0.77969 (16)	0.4084 (3)	0.31660 (19)	0.0468 (5)
C1	0.54200 (18)	0.3648 (3)	0.3004 (2)	0.0371 (5)
C2	0.69556 (18)	0.3826 (3)	0.3305 (2)	0.0372 (5)
C3	0.8520 (2)	0.3820 (4)	0.4124 (3)	0.0506 (7)
H3	0.9130	0.3978	0.4088	0.061*
C4	0.8416 (2)	0.3316 (4)	0.5193 (2)	0.0476 (6)
C5	0.7541 (2)	0.3027 (4)	0.5315 (2)	0.0441 (6)
H5	0.7472	0.2658	0.6017	0.053*
C6	0.67646 (19)	0.3320 (3)	0.4325 (2)	0.0386 (6)
C7	0.43977 (18)	0.3688 (4)	0.2376 (2)	0.0403 (6)
C8	0.3766 (2)	0.4354 (4)	0.2917 (2)	0.0470 (6)
H8	0.3997	0.4782	0.3675	0.056*
C9	0.2809 (2)	0.4381 (4)	0.2341 (3)	0.0542 (7)
H9	0.2397	0.4818	0.2714	0.065*
C10	0.2451 (2)	0.3758 (4)	0.1202 (3)	0.0521 (7)
C11	0.3059 (2)	0.3046 (4)	0.0662 (3)	0.0499 (7)
H11	0.2822	0.2589	−0.0088	0.060*
C12	0.4027 (2)	0.3022 (3)	0.1251 (2)	0.0446 (6)
H12	0.4436	0.2551	0.0885	0.053*
C13	0.5959 (2)	0.4800 (4)	0.1325 (2)	0.0442 (6)
H13A	0.6519	0.5435	0.1341	0.066*
H13B	0.5425	0.5576	0.1131	0.066*
H13C	0.5846	0.3893	0.0749	0.066*
C15	0.1094 (3)	0.3397 (6)	−0.0496 (4)	0.0848 (13)
H15A	0.1385	0.4059	−0.0964	0.127*
H15B	0.0424	0.3621	−0.0749	0.127*
H15C	0.1202	0.2179	−0.0578	0.127*

Atomic displacement parameters (Å²)

	U^{11}	U^{22}	U^{33}	U^{12}	U^{13}	U^{23}
Br1	0.0492 (2)	0.1056 (4)	0.0576 (3)	−0.01003 (18)	−0.00400 (16)	0.0134 (2)
O1	0.0440 (11)	0.0872 (17)	0.0781 (16)	−0.0058 (12)	0.0008 (11)	0.0013 (15)
N1	0.0420 (11)	0.0494 (13)	0.0327 (10)	−0.0049 (9)	0.0100 (9)	0.0067 (9)
N2	0.0451 (11)	0.0371 (11)	0.0284 (9)	0.0023 (9)	0.0123 (8)	0.0014 (8)

N3	0.0477 (12)	0.0560 (14)	0.0403 (11)	0.0020 (11)	0.0190 (10)	0.0032 (11)
C1	0.0437 (13)	0.0341 (13)	0.0319 (11)	−0.0015 (10)	0.0097 (10)	0.0027 (10)
C2	0.0457 (13)	0.0356 (13)	0.0310 (11)	0.0022 (10)	0.0133 (10)	−0.0011 (10)
C3	0.0449 (14)	0.0584 (18)	0.0505 (15)	−0.0022 (13)	0.0179 (12)	0.0009 (14)
C4	0.0438 (14)	0.0534 (17)	0.0393 (13)	−0.0015 (12)	0.0040 (11)	0.0009 (12)
C5	0.0487 (14)	0.0497 (16)	0.0318 (12)	−0.0059 (12)	0.0095 (11)	0.0031 (11)
C6	0.0447 (13)	0.0389 (14)	0.0323 (12)	−0.0045 (10)	0.0124 (10)	0.0019 (10)
C7	0.0429 (13)	0.0383 (13)	0.0371 (12)	−0.0017 (11)	0.0091 (10)	0.0075 (11)
C8	0.0507 (15)	0.0496 (16)	0.0400 (13)	−0.0034 (12)	0.0134 (11)	−0.0010 (12)
C9	0.0485 (15)	0.0588 (18)	0.0569 (17)	−0.0002 (14)	0.0190 (13)	−0.0031 (15)
C10	0.0460 (15)	0.0474 (16)	0.0561 (17)	−0.0068 (12)	0.0067 (13)	0.0070 (14)
C11	0.0547 (16)	0.0498 (17)	0.0388 (13)	−0.0116 (13)	0.0058 (12)	0.0007 (12)
C12	0.0521 (15)	0.0422 (15)	0.0390 (13)	−0.0050 (12)	0.0136 (12)	0.0002 (12)
C13	0.0535 (14)	0.0510 (16)	0.0296 (11)	0.0045 (12)	0.0153 (10)	0.0041 (11)
C15	0.061 (2)	0.086 (3)	0.080 (3)	−0.012 (2)	−0.016 (2)	0.001 (2)

Geometric parameters (Å, º)

Br1—C4	1.892 (3)	C7—C8	1.399 (4)
O1—C10	1.361 (4)	C7—C12	1.392 (4)
O1—C15	1.428 (5)	C8—H8	0.9300
N1—C1	1.325 (3)	C8—C9	1.371 (4)
N1—C6	1.385 (3)	C9—H9	0.9300
N2—C1	1.377 (3)	C9—C10	1.393 (4)
N2—C2	1.371 (3)	C10—C11	1.383 (5)
N2—C13	1.457 (3)	C11—H11	0.9300
N3—C2	1.328 (3)	C11—C12	1.388 (4)
N3—C3	1.321 (4)	C12—H12	0.9300
C1—C7	1.468 (3)	C13—H13A	0.9600
C2—C6	1.404 (3)	C13—H13B	0.9600
C3—H3	0.9300	C13—H13C	0.9600
C3—C4	1.402 (4)	C15—H15A	0.9600
C4—C5	1.372 (4)	C15—H15B	0.9600
C5—H5	0.9300	C15—H15C	0.9600
C5—C6	1.392 (4)		
C10—O1—C15	118.2 (3)	C7—C8—H8	119.6
C1—N1—C6	104.3 (2)	C9—C8—C7	120.8 (3)
C1—N2—C13	129.2 (2)	C9—C8—H8	119.6
C2—N2—C1	106.3 (2)	C8—C9—H9	119.8
C2—N2—C13	123.7 (2)	C8—C9—C10	120.4 (3)
C3—N3—C2	113.8 (2)	C10—C9—H9	119.8
N1—C1—N2	113.3 (2)	O1—C10—C9	115.6 (3)
N1—C1—C7	124.3 (2)	O1—C10—C11	124.5 (3)
N2—C1—C7	122.4 (2)	C11—C10—C9	119.9 (3)
N2—C2—C6	105.8 (2)	C10—C11—H11	120.3
N3—C2—N2	126.4 (2)	C10—C11—C12	119.3 (3)
N3—C2—C6	127.7 (2)	C12—C11—H11	120.3

N3—C3—H3	118.2	C7—C12—H12	119.3
N3—C3—C4	123.5 (3)	C11—C12—C7	121.4 (3)
C4—C3—H3	118.2	C11—C12—H12	119.3
C3—C4—Br1	118.2 (2)	N2—C13—H13A	109.5
C5—C4—Br1	120.0 (2)	N2—C13—H13B	109.5
C5—C4—C3	121.9 (3)	N2—C13—H13C	109.5
C4—C5—H5	122.0	H13A—C13—H13B	109.5
C4—C5—C6	116.0 (2)	H13A—C13—H13C	109.5
C6—C5—H5	122.0	H13B—C13—H13C	109.5
N1—C6—C2	110.3 (2)	O1—C15—H15A	109.5
N1—C6—C5	132.7 (2)	O1—C15—H15B	109.5
C5—C6—C2	117.1 (2)	O1—C15—H15C	109.5
C8—C7—C1	120.3 (2)	H15A—C15—H15B	109.5
C12—C7—C1	121.4 (3)	H15A—C15—H15C	109.5
C12—C7—C8	118.2 (3)	H15B—C15—H15C	109.5

Hydrogen-bond geometry (Å, º)

D—H···*A*	*D*—H	H···*A*	*D*···*A*	*D*—H···*A*
C13—H13*C*···N1^{i}	0.96	2.53	3.480 (3)	169

Symmetry code: (i) $x, -y+1/2, z-1/2$.