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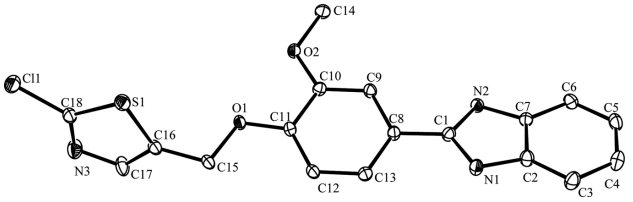
Crystal structure of 5-((4-(1*H*-benzo[*d*]imidazol-2-yl)-2-methoxyphenoxy) methyl)-2-chlorothiazole - trichloromethane - methanol (1/1/1), $C_{20}H_{19}Cl_4N_3O_3S$



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Abstract

$C_{20}H_{19}Cl_4N_3O_3S$, monoclinic, $P2_1/c$ (no. 14), $a = 14.2134(9)$ Å, $b = 21.4083(13)$ Å, $c = 7.6709(5)$ Å, $\beta = 99.260(6)°$, $V = 2303.7(2)$ Å^3, $Z = 4$, $R_{gt}(F) = 0.0659$, $wR_{ref}(F^2) = 0.1682$, $T = 180$ K.

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Tables 1 and 2 contain details on crystal structure and measurement conditions and a list of the atoms including atomic coordinates and displacement parameters.

Source of material

The title compound was prepared according to the literature method [3–6]. A mixture of 2-(4-hydroxy-3-methoxyphenyl)-(1*H*)-benzimidazole (5 mmol), 2-chloro-5-chloromethylthiazole (7.5 mmol) and sodium hydroxide (10 mmol) in ethanol (25 mL) was refluxed for 2 h. Ethanol was evaporated and the residue was poured into ice cold water and extracted with ethyl acetate. The title compound

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Table 1: Data collection and handling.

Crystal:	Yellow block
Size:	0.15 × 0.1 × 0.1 mm
Wavelength:	Mo $K\alpha$ radiation (0.71073 Å)
μ:	0.63 mm^{-1}
Diffractometer, scan mode:	XtaLAB Pro, ω-scans
$2\theta_{max}$, completeness:	25°, >99%
$N(hkl)_{measured}$, $N(hkl)_{unique}$, R_{int}:	21040, 4537, 0.035
Criterion for I_{obs}, $N(hkl)_{gt}$:	$I_{obs} > 2\ \sigma(I_{obs})$, 4146
$N(param)_{refined}$:	287
Programs:	CrysAlis^{PRO} [1], SHELX [2], OLEX2 [3]

Table 2: Fractional atomic coordinates and isotropic or equivalent isotropic displacement parameters (Å^2).

Atom	*x*	*y*	*z*	U_{iso}*/U_{eq}
S1	0.17167(6)	0.18474(4)	0.32197(11)	0.0301(2)
Cl1	−0.00451(7)	0.10788(4)	0.30692(12)	0.0370(2)
Cl2	0.67863(11)	0.28270(16)	0.2568(2)	0.1407(12)
Cl3	0.81331(16)	0.34423(9)	0.0764(3)	0.1015(6)
Cl4	0.84389(11)	0.33899(7)	0.4571(2)	0.0770(4)
O1	0.29934(15)	0.30957(10)	0.4898(3)	0.0242(5)
O2	0.40726(16)	0.30557(11)	0.7963(3)	0.0285(5)
O3	0.6467(3)	0.47183(14)	0.0945(3)	0.0507(8)
N1	0.6898(2)	0.46525(14)	0.4646(4)	0.0275(6)
N2	0.69270(18)	0.45658(12)	0.7559(3)	0.0243(5)
N3	0.0034(2)	0.23116(15)	0.3072(5)	0.0394(7)
C1	0.6452(2)	0.44342(14)	0.5975(4)	0.0236(6)
C2	0.7727(2)	0.49437(15)	0.5415(4)	0.0268(7)
C3	0.8449(3)	0.52375(17)	0.4703(5)	0.0339(8)
C4	0.9206(2)	0.54730(17)	0.5902(5)	0.0346(8)
C5	0.9229(2)	0.54245(16)	0.7718(5)	0.0311(7)
C6	0.8502(2)	0.51352(15)	0.8423(4)	0.0283(7)
C7	0.7737(2)	0.48876(14)	0.7238(4)	0.0232(6)
C8	0.5538(2)	0.40997(14)	0.5636(4)	0.0227(6)
C9	0.5268(2)	0.37287(15)	0.6984(4)	0.0230(6)
C10	0.4410(2)	0.34145(14)	0.6716(4)	0.0222(6)
C11	0.3807(2)	0.34506(14)	0.5060(4)	0.0217(6)
C12	0.4072(2)	0.38215(16)	0.3744(4)	0.0265(7)
C13	0.4931(2)	0.41483(16)	0.4032(4)	0.0278(7)
C14	0.4668(3)	0.30177(18)	0.9655(4)	0.0336(8)
C15	0.2421(2)	0.30846(16)	0.3163(4)	0.0267(7)
C16	0.1611(2)	0.26497(15)	0.3189(4)	0.0263(7)
C17	0.0661(2)	0.27947(17)	0.3129(6)	0.0381(9)
C18	0.0498(2)	0.17987(16)	0.3136(4)	0.0282(7)
C19	0.7976(3)	0.3003(2)	0.2607(6)	0.0525(11)

Table 2 (continued)

Atom	*x*	*y*	*z*	U_{iso}*/U_{eq}
C20	0.6277(4)	0.5345(3)	0.0790(6)	0.0656(15)
H1	0.675(3)	0.4587(18)	0.365(6)	0.026(10)*
H3	0.8429	0.5275	0.3490	0.041*
H3A	0.6623	0.4589	0.0027	0.076*
H4	0.9708	0.5668	0.5478	0.042*
H5	0.9745	0.5590	0.8478	0.037*
H6	0.8521	0.5106	0.9637	0.034*
H9	0.5671	0.3695	0.8062	0.028*
H12	0.3674	0.3853	0.2660	0.032*
H13	0.5099	0.4401	0.3144	0.033*
H14A	0.5242	0.2795	0.9542	0.050*
H14B	0.4335	0.2801	1.0466	0.050*
H14C	0.4826	0.3431	1.0089	0.050*
H15A	0.2804	0.2947	0.2298	0.032*
H15B	0.2184	0.3501	0.2841	0.032*
H17	0.0456	0.3207	0.3128	0.046*
H19	0.8325	0.2609	0.2570	0.063*
H20A	0.6272	0.5520	0.1941	0.098*
H20B	0.5667	0.5408	0.0071	0.098*
H20C	0.6761	0.5547	0.0251	0.098*

was obtained by column chromatography. The title compound was dissolved in a mixed solvent of chloroform, methanol and petroleum ether at room temperature. Yellow blocks were obtained through slow evaporation after two weeks.

Experimental details

All hydrogen atoms were placed at calculated positions.

Discussion

The title compound, 5-((4-(1*H*-benzo[*d*]imidazol-2-yl)-2-methoxyphenoxy)methyl)-2-chlorothiazole and other benzimidazole derivatives are important antifungal candidates [7–9]. It is important to determine the structure of unknown synthetic compounds by X-ray single crystal diffraction before the study of the biological activity. The molecule consists of a substituted (1*H*)-benzimidazol ring and a 2-chloro thiazole moiety, both rings are connected by an aryl moiety. The asymmetric unit of the title compound contains one title molecules, one chloroform molecule and one methanol molecule. In the figure the sovent molecules are omitted for clarity.

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References

1. Agilent Technologies: CrysAlis^{Pro} Software system, version 1.171.39.7e, Rigaku OD, (2015).
2. Sheldrick, G.: Crystal structure refinement with SHELXL. Acta Crystallogr. **C71** (2015) 3–8.
3. Dolomanov, O.; Bourhis, L.; Gildea, R.; Howard, J. A.; Puschmann, H.: OLEX2: a complete structure solution, refinement and analysis program. J. Appl. Crystallogr. **42** (2009) 339–341.
4. Alpan, A.; Gunes, H.; Topcu, Z.: 1*H*-Benzimidazole derivatives as mammalian DNA topoisomerase I inhibitors. Acta. Biochim. Pol. **54** (2007) 561–565.
5. Coban, G.; Zencir, S.; Zupko, I.; Rethy, B.; Gunes, S. H.; Topcu, Z.: Synthesis and biological activity evaluation of 1*H*-benzimidazoles *via* mammalian DNA topoisomerase I and cytostaticity assaysy. Eur. J. Med. Chem.**44** (2009) 2280–2285.
6. Alpan, A.; Yilmaz, O.; Kilickaya, O.; Kara, P.: Synthesis and voltammetric detection of 1*H*-benzimidazole derivatives on the interaction with DNA. Mar. Pharm. J. **16** (2012) 48–55.
7. Akpa, S.; Zoakouma, R.; Say, V.; Ouattara, M.; Kone, M.; Sissouma, D.; Adjou, A.: Synthesis and in vitro antifungal evaluation of 2-thioalkylaryl-benzimidazoles derivatives against Candida albicans. Int. J. Biol. Chem. Sci. **10** (2016) 1403–1412.
8. Chandrika, N.; Shrestha, S.; Ngo, H.; Garneau-Tsodikova, S.: Synthesis and investigation of novel benzimidazole derivatives as antifungal agents. Bioorg. Med. Chem. **24** (2016) 3680–3686.
9. Keller, P.; Mueller, C.; Engelhardt, I.; Hiller, E.; Lemuth, K.; Eickhoff, H.; Rupp, S.: An antifungal benzimidazole derivative inhibits ergosterol biosynthesis and reveals novel sterols. Antimicrob. Agent. Ch. **C59** (2015) 6296–6307.