Crystal Structure of 2-(4,7-Dimethylquinolin-2-yl)-3-(4-methoxyphenyl)-1,3-thiazolidin-4-one

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The title compound, $C_{21}H_{20}N_2O_2S$, consists of planar quinoline, phenyl and thiazole rings. The quinoline ring is oriented with respect to the phenyl and thiazole rings at dihedral angles of $87.22(5)^\circ$ and $81.05(4)^\circ$, respectively. It belongs to the space group $P\bar{1}$ with cell parameters $a = 7.9709(4)\text{Å}$, $b = 9.7038(3)\text{Å}$, $c = 12.8167(5)\text{Å}$, $\alpha = 78.484(2)^\circ$, $\beta = 76.584(3)^\circ$ and $\gamma = 78.126(4)^\circ$. In the crystal structure, intermolecular C-H...N hydrogen bonds link the molecules into $R_2^2(14)$ centrosymmetric dimers.

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Thiazolidinone ring systems are an important class of natural pharmaceutical products exhibiting a broad spectrum of antibacterial, antifungal, antiviral, antituberculosis, anticonvulsant, and analgesic activities.¹ Therefore, the chemistry of this kind of compound has been the subject of many studies. Thus, in recent years, interest for medical applications is strongly increasing, and attention has been focused on the synthesis of various substituted thiazolidin-4-ones.

For preparing the title compound, a solution of mercaptoacetic acid (138 mg, 1.5 mmol) in anhydrous benzene (10 ml) was added to a solution of (*E*)-*N*-[(4,7-dimethylquinolin-2-yl)methylene]-4-methoxybenzeneamine² (290 mg, 1.0 mmol) in anhydrous benzene (10 ml), and the mixture was heated under reflux. After completion of the reaction, the mixture was treated with NaHCO_3 (50 ml, 10%), benzene layer was dried with CaCl_2 , filtered and the solvent was removed under reduced pressure. The crude product was recrystallized from petroleum ether (yield, 55%, m.p. 420 K).

The X-ray analysis results are given in Tables 1 – 4. Methyl H atoms were positioned geometrically and a riding model was used during the refinement process; the remaining ones were located by a difference synthesis and refined isotropically.

Fig. 1 Structural chemical diagram.

The title compound (Fig. 2) is a (4-methoxyphenyl)-1,3-

Table 1 Crystal and experimental data

Formula: $C_{21}H_{20}N_2O_2S$
Formula weight: 364.45
Crystal system: orthorhombic
Space group: $P\bar{1}$ $Z = 2$
$a = 7.9709(4)\text{Å}$
$b = 9.7038(3)\text{Å}$
$c = 12.8167(5)\text{Å}$
$\alpha = 78.484(2)^\circ$
$\beta = 76.584(3)^\circ$
$\gamma = 78.126(4)^\circ$
$V = 931.57(7)\text{Å}^3$
$D_x = 1.299\text{ g/cm}^3$
$\mu(\text{Mo } K\alpha) = 0.191\text{ mm}^{-1}$
$T = 294(2)\text{K}$
Crystal color: yellow
Crystal size: $0.10 \times 0.25 \times 0.35\text{ mm}$
$\lambda(\text{Mo } K\alpha) = 0.71073\text{ Å}$
$R = 0.0676$ $wR = 0.1321$
No. of reflections measured = 5663
No. of reflections used = 3292 [$I > 2\sigma(I)$]
No. of parameters = 282
Goodness-of-fit = 1.047
$(\Delta/\sigma)_{\text{max}} = 0.000$
$(\Delta\rho)_{\text{max}} = 0.158\text{ eÅ}^{-3}$
$(\Delta\rho)_{\text{min}} = -0.303\text{ eÅ}^{-3}$
$2\theta_{\text{max}} = 61.08^\circ$
Measurements: Rigaku R-Axis RAPID-S diffractometer
Program system: CrystalClear
Structure determination: SHELXS-97
Refinement: full matrix

CCDC 679139 contains the supplementary crystallographic data for this paper. These data can be obtained free of charge from the Cambridge Crystallographic Data Centre via www.ccdc.cam.ac.uk/data_request/cif.

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Fig. 2 Molecular structure of the title compound with the atom-numbering scheme. The thermal ellipsoids are drawn at the 50% probability level.

Table 2 Final atomic coordinates and equivalent isotropic thermal parameters

Atom	x	y	z	$U_{eq}(\text{\AA}^2)$
S1	0.36906(9)	0.36281(7)	0.10709(6)	0.0794(2)
O1	0.1174(2)	0.29602(18)	0.40244(14)	0.0804(5)
O2	-0.6160(2)	0.68246(19)	0.39125(14)	0.0798(5)
N1	0.0769(2)	0.44181(17)	0.24325(13)	0.0521(4)
N2	0.1437(2)	0.67039(17)	-0.01548(13)	0.0513(4)
C1	0.1502(3)	0.4721(2)	0.12758(17)	0.0519(5)
C2	0.3505(3)	0.2852(3)	0.2458(2)	0.0705(7)
C3	0.1709(3)	0.3399(2)	0.30707(19)	0.0586(5)
C4	0.1638(2)	0.6274(2)	0.08548(16)	0.0489(4)
C5	0.2066(3)	0.7142(2)	0.14791(19)	0.0542(5)
C6	0.2358(2)	0.8494(2)	0.10298(18)	0.0552(5)
C7	0.2186(2)	0.8989(2)	-0.00665(17)	0.0532(5)
C8	0.1711(3)	0.8056(2)	-0.06248(17)	0.0517(5)
C9	0.1521(3)	0.8518(2)	-0.17136(19)	0.0621(6)
C10	0.1768(3)	0.9845(2)	-0.22491(19)	0.0669(6)
C11	0.2227(3)	1.0774(3)	-0.1683(2)	0.0686(7)
C12	0.2427(3)	1.0370(3)	-0.0638(2)	0.0645(6)
C13	-0.0988(3)	0.5070(2)	0.28287(16)	0.0499(5)
C14	-0.2282(3)	0.5142(2)	0.22497(18)	0.0535(5)
C15	-0.3977(3)	0.5743(2)	0.26340(18)	0.0590(5)
C16	-0.4429(3)	0.6276(2)	0.36048(17)	0.0590(5)
C17	-0.3139(3)	0.6228(3)	0.41740(18)	0.0626(6)
C18	-0.1425(3)	0.5638(2)	0.37805(17)	0.0589(5)
C19	-0.6669(4)	0.7523(3)	0.4841(2)	0.0921(9)
C20	0.1536(4)	1.0334(3)	-0.3407(2)	0.0984(10)
C21	0.2864(3)	0.9426(3)	0.1678(2)	0.0747(7)

$$U_{eq} = (1/3)\sum_i \sum_j U_{ij} a_i^* a_j^* (a_i \cdot a_j).$$

thiazole derivative. The bond lengths and angles (Table 3) in the thiazole ring are highly different from the corresponding values in 2-amino-4-(4-methoxyphenyl)-1,3-thiazole,³ probably due to the quinoline moiety. The N1-C1 [1.456(2) Å], C1-S1 [1.837(2) Å], S1-C2 [1.772(3) Å], C2-C3 [1.510(3) Å], C3-N1 [1.366(3) Å] bond lengths and C1-S1-C2 [94.02(11)°], S1-C2-C3 [108.90(16)°], S1-C1-N1 [105.99(13)°], C1-N1-C3 [118.40(18)°], N1-C3-C2 [112.4(2)°] bond angles are reported as 1.310(7) Å, 1.733(6) Å, 1.728(7) Å, 1.336(8) Å, 1.395(7) Å and 88.4(3)°, 111.3(5)°, 115.0(4)°, 110.2(5)°, 114.9(5)°, respectively, in 2-amino-4-(4-methoxyphenyl)-1,3-thiazole.³ In the title compound, the 4-methoxyphenyl group withdraws an electron pair of the N-atom (N1) of the thiazole ring. In addition, an increase in the thiazole/quinoline dihedral angle [81.05(4)°] may be due to a steric hindrance between the thiazole H atom (H1) and the phenyl H atom (H14) [where H1...H14 and H5...H18 distances are 2.24(2) Å and 3.08(2) Å, respectively]. This steric hindrance may result in a reduced electrostatic field effect from

Table 3 Selected bond distances (Å), bond angles (°) and torsion angles (°)

C1	S1	1.837(2)	C3	N1	1.366(3)
C1	N1	1.456(2)	N1	C13	1.433(2)
C1	C4	1.513(3)	N2	C4	1.314(2)
C2	S1	1.772(3)	N2	C8	1.368(2)
C2	C3	1.510(3)	O2	C16	1.368(3)
C3	O1	1.217(3)	O2	C19	1.423(3)
N1-C1-S1	105.99(13)		C1-C4-N2	114.44(17)	
N1-C1-C4	114.29(17)		C1-C4-C5	121.96(18)	
S1-C1-C4	109.75(14)		N2-C4-C5	123.46(19)	
S1-C2-C3	108.90(16)		C1-N1-C3	118.40(18)	
O1-C3-C2	123.1(2)		C1-N1-C13	118.65(15)	
O1-C3-N1	124.5(2)		C3-N1-C13	122.50(17)	
N1-C3- C2	112.4(2)		C1-S1-C2	94.02(11)	
C1-S1-C2-C3	2.4(2)		C3-N1-C1-S1	-4.3(2)	
C2-S1-C1-N1	0.75(17)		N1-C3-C2-S1	-5.2(3)	
C1-N1-C3-C2	6.3(3)				

Table 4 Hydrogen bonding geometry (Å, °)

D-H...A	D-H	H...A	D...A	D-H...A
C14-H14...N2 ¹	0.96(2)	2.45(2)	3.385(3)	164.0(2)

Symmetry codes: (i) $-x, 1-y, -z$.

the N-atom (N2) lone pair of the quinoline ring.

An examination of the deviations from the least-squares planes shows that all of the rings are planar. The quinoline ring system is planar, with a puckering amplitude, Q_T , of 0.048(5) Å, and the dihedral angle between the two rings is 0.14(7)°. The orientations of the phenyl and thiazole rings with respect to the quinoline ring system may be described by dihedral angles of 87.22(5)° and 81.05(4)°, respectively. The dihedral angle between the thiazole and phenyl rings is 45.66(7)°. The thiazole ring has a pseudo-mirror plane passing through atom C3 and the mid-point of the S1-C1 bond. In the crystal structure, intermolecular C-H...N hydrogen bonds (Table 4) link the molecules into centrosymmetric $R_2^2(14)$ dimers,⁵ in which they seem to be effective in stabilizing the structure.

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