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# 4-{5-[3,4-Dimethyl-5-(3,4,5-trimethoxyphenyl)-thiophen-2-yl]-2-methoxyphenyl}morpholine

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**Key indicators**

Single-crystal X-ray study
$T$ = 293 K
Mean $\sigma$(C–C) = 0.003 Å
$R$ factor = 0.050
$wR$ factor = 0.119
Data-to-parameter ratio = 16.7

For details of how these key indicators were automatically derived from the article, see http://journals.iucr.org/e.

The title compound, $C_{26}H_{31}NO_5S$, was synthesized by the palladium-catalyzed coupling reaction of 2-(3-bromo-4-methoxyphenyl)-3,4-dimethyl-5-(3,4,5-trimethoxyphenyl)-thiophene and morpholine. This molecule is composed of four rings. Two benzene rings are linked by a thiophene moiety which is planar. The morpholine group has a chair conformation.

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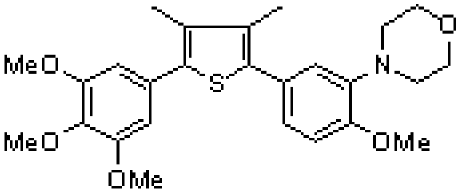
## Comment

Much attention have been drawn to diaryl-substituted heterocycles (Khanna *et al.*, 1997; Penning *et al.*, 1997; Wu-Wong *et al.*, 2001). Research findings indicate that the diaryl–heterocycle moiety is associated with high biological activities as selective COX-2 inhibitors (Portevin *et al.*, 2000) and antitumor agents (Szczepankieeicz *et al.*, 2001). In view of this, we have recently focused on the preparation of diaryl-substituted thiophenes and their derivatives. A new compound, namely 4-{2-methoxy-5-[3,4-dimethyl-5-(3,4,5-trimethoxyphenyl)thiophen-2- yl]phenyl}morpholine, (I), has been synthesized by the reaction of 2-(3-bromo-4-methoxyphenyl)-3,4-dimethyl-5-(3,4,5-trimethoxyphenyl)thiophene and morpholine in the presence of 1,1′-bis(diphenylphosphino)-ferrocene (DPPF) and the palladium reagent [1,1′-bis(diphenylphosphino)ferrocene]dichloropalladium(II), [$PdCl_2$-(dppf)] (Driver & Hartwig, 1996). An X-ray crystal structure determination of (I) was carried out in order to elucidate the structure and the results are presented here.



(I)

The molecular structure of (I) is illustrated in Fig. 1. The molecule is composed of four rings. Two benzene rings are linked by a thiophene moiety which is planar. The morpholine group has a chair conformation. The C1–C6 (*A*) and C16–C21 (*B*) aromatic rings make dihedral angles of 122.2 (3) and 135.4 (3)°, respectively, with the thiophene moiety; rings *A* and *B* are inclined at an angle of 149.2 (3)° to each other. Because of the $\pi$ conjugation of atom N1 with the benzene ring, the bond distance C20—N1 [1.422 (3) Å] is obviously shorter than both C23—N1 [1.457 (3) Å] and C26—N1 [1.459 (3) Å]. A similar effect is found in C19—O4

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[1.367 (3) Å], C2—O1 [1.364 (3) Å] and C4—O3 [1.370 (3) Å].

## Experimental

Morpholine (23 mg, 0.27 mmol) was added to a solution of 2-(3-bromo-4-methoxyphenyl)-3,4-dimethyl-5-(3,4,5-trimethoxyphenyl)-thiophene (100 mg, 0.22 mmol), $PdCl_2$(dppf) (8 mg, 0.01 mmol), DPPF (18 mg, 0.03 mmol) and $^t$BuONa (28 mg, 0.29 mmol) in anhydrous tetrahydrofuran (6 ml) under an $N_2$ atmosphere. The reaction mixture was refluxed with stirring for about 5 h. The solvent was then removed under reduced pressure and the residue was purified by flash chromatography (chloroform–petroleum ether). A white powder was obtained (yield 85.2%) and single crystals suitable for crystallographic analysis were obtained by slow evaporation of an ethyl acetate solution (m.p. 410–412 K). Spectroscopic analysis, $^1$H NMR (DMSO, p.p.m.): 7.00–6.66 (*m*, 5H), 3.79 (*s*, 3H), 3.78 (*s*, 6H), 3.71–3.69 (*t*, 4H), 3.67 (*s*, 3H), 2.96 (*t*, 4H), 2.17 (*s*, 3H), 2.14 (*s*, 3H).

### *Crystal data*

$C_{26}H_{31}NO_5S$
$M_r = 469.59$
Monoclinic, $P2_1/n$
$a = 11.434$ (4) Å
$b = 7.820$ (3) Å
$c = 27.782$ (10) Å
$\beta = 95.306$ (6)°
$V = 2473.5$ (16) Å$^3$
$Z = 4$

$D_x = 1.261$ Mg m$^{-3}$
Mo K$\alpha$ radiation
Cell parameters from 886 reflections
$\theta = 3.2$–25.3°
$\mu = 0.17$ mm$^{-1}$
$T = 293$ (2) K
Block, colorless
0.26 × 0.22 × 0.18 mm

### *Data collection*

Bruker SMART CCD area-detector diffractometer
$\varphi$ and $\omega$ scans
Absorption correction: multi-scan (*SADABS*; Sheldrick, 1996)
$T_{\min} = 0.926$, $T_{\max} = 0.970$
13795 measured reflections

5073 independent reflections
3223 reflections with $I > 2\sigma(I)$
$R_{\rm int} = 0.040$
$\theta_{\max} = 26.4°$
$h = -14 \rightarrow 13$
$k = -4 \rightarrow 9$
$l = -34 \rightarrow 32$

### *Refinement*

Refinement on $F^2$
$R[F^2 > 2\sigma(F^2)] = 0.050$
$wR(F^2) = 0.119$
$S = 1.01$
5073 reflections
304 parameters
H-atom parameters constrained

$w = 1/[\sigma^2(F_o^2) + (0.0462P)^2 + 0.8247P]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{\max} = 0.001$
$\Delta\rho_{\max} = 0.19$ e Å$^{-3}$
$\Delta\rho_{\min} = -0.20$ e Å$^{-3}$

**Table 1**
Selected bond lengths (Å).

| | | | |
|---|---|---|---|
| O1—C2 | 1.364 (3) | O4—C19 | 1.367 (3) |
| O2—C3 | 1.384 (3) | N1—C20 | 1.422 (3) |
| O3—C4 | 1.370 (3) | | |

All H atoms were positioned geometrically and refined as riding (C—H = 0.93–0.97 Å). For CH and $CH_2$ groups, $U_{\rm iso}$(H) values were set equal to $1.2U_{\rm eq}$(carrier atom) and for the methyl groups they were set equal to $1.5U_{\rm eq}$(carrier atom).

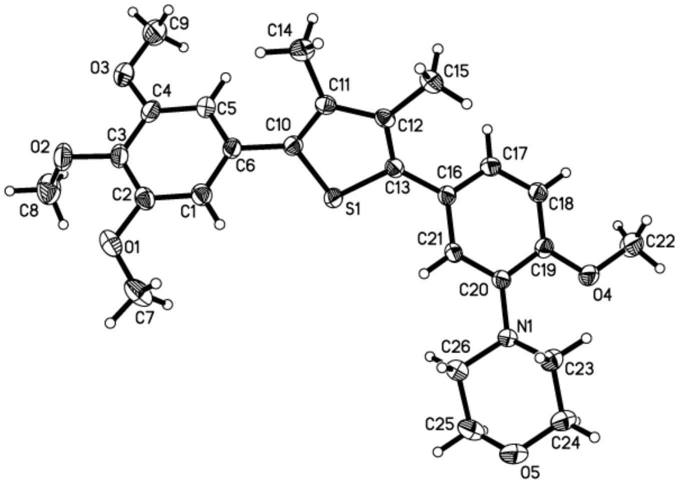

**Figure 1**
View of the molecule of (I), showing the atom-labeling scheme. Displacement ellipsoids are drawn at the 30% probability level.

Data collection: *SMART* (Bruker, 1997); cell refinement: *SAINT* (Bruker, 1997);; data reduction: *SAINT*; program(s) used to solve structure: *SHELXS*97 (Sheldrick, 1997); program(s) used to refine structure: *SHELXL*97 (Sheldrick, 1997); molecular graphics: *SHELXTL* (Bruker, 1997); software used to prepare material for publication: *SHELXTL*.

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