

# A convenient synthesis of benz-1,2-oxazine derivatives

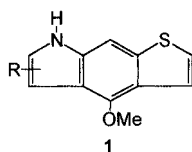
Sukhen Chandra Ghosh and Asish De\*

Department of Organic Chemistry, Indian Association for the Cultivation of Science, Jadavpur Calcutta-700032, India. E-mail: ocad@mahendra.iacs.res.in

Received (in Cambridge, UK) 29th March 2000, Accepted 27th April 2000

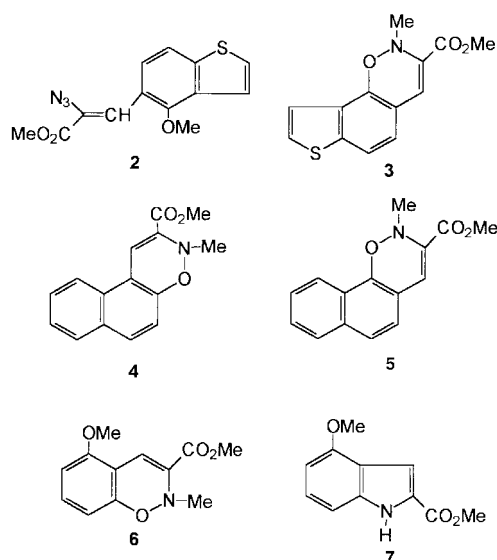
An expedient synthesis of benz-1,2-oxazine derivatives involving nitrene insertion on a methoxy group is described.

Our findings<sup>1,2</sup> in the course of synthesis of novel photoconducting materials consisting of electron donor and acceptor molecules linked by polymethylene spacers induced us to synthesize the linear tricyclic system **1**, which is expected to be



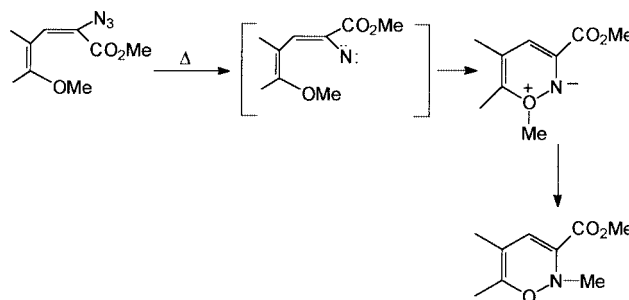
a good electron donor. This system can be conveniently accessed by annelation of a pyrrole ring to the 4-methoxy-1-benzothiophene core, through insertion of vinyl nitrene, incipiently liberated by thermolysis of the corresponding vinyl azide. We have previously used this methodology developed by Rees and coworkers<sup>3</sup> in the synthesis of angular thienoindoles.<sup>4</sup>

The vinyl azide **2** obtained from 4-methoxy-1-benzothiophene-5-carbaldehyde and methyl azido acetate, afforded upon heating for 2.5 h in xylene, a mixture of two compounds, separable by careful chromatography over silica gel. The desired 2-methoxycarbonylthieno[3,2-*f*]indole **1** (R = 2-CO<sub>2</sub>Me) was eluted with light petroleum (bp 60–80 °C)–ethyl



acetate (23:2) while the second compound, eluted with ethyl acetate–light petroleum (bp 60–80 °C) (1:9) was found to be 2-methyl-3-methoxycarbonylthieno[2,3-*h*]benz-1,2-oxazine **3** the structure of which was confirmed from elemental analysis and spectral data.<sup>†</sup>

Thermolysis of vinyl azides derived from 2-methoxy-1-naphthaldehyde, 1-methoxy-2-naphthaldehyde and 2,6-di-



Scheme 1

methoxybenzaldehyde afforded the corresponding condensed 1,2-oxazines **4**, **5** and **6**, respectively,<sup>†</sup> showing the general applicability of this methodology. However, the vinyl azide derived from 2-methoxybenzaldehyde afforded 2-carbo-methoxy-4-methoxyindole **7**<sup>†</sup> as the exclusive product.

Insertion of nitrene on to the adjacent methoxy group followed by rearrangement plausibly leads to benz-1,2-oxazine (Scheme 1).

The methyl migration most likely involves a radical pathway since a concerted pathway appears unlikely.<sup>5</sup>

In summary, a simple method is reported which accesses benzo-1,2-oxazines, little reported in the literature, presumably owing to the absence of expedient synthetic routes.<sup>6</sup> Further work is in progress to establish the general nature and mechanism of this reaction by thermolysis of vinyl azides derived from other *o*-methoxyarylaldehydes.

We thank Professor Charles W. Rees for helpful discussion. S. C. G. thanks the Council of Scientific and Industrial Research (New Delhi) for a Senior Research Fellowship.

## Notes and references

<sup>†</sup> Selected data: for compound **1**: yield 55%, mp 170–172 °C;  $\delta_{\text{H}}$ (300 MHz, CDCl<sub>3</sub>) 8.73 (br s, 1H, NH), 7.56 (s, 1H, Ar), 7.51 (s, 1H, Ar), 7.49–7.47 (d, 1H, *J* 5.7 Hz, Ar), 7.18–7.16 (d, 1H, *J* 5.7 Hz, Ar), 4.28 (s, 3H, CO<sub>2</sub>CH<sub>3</sub>), 3.96 (s, 3H, OCH<sub>3</sub>);  $\delta_{\text{C}}$ (300 MHz, CDCl<sub>3</sub>) 53.76 (OCH<sub>3</sub>), 62.14 (CO<sub>2</sub>Me), 106.64 (CH), 118.03 (C), 120.06 (CH), 122.52 (CH), 125.90 (C), 127.11 (C), 127.37 (CH), 138.18 (C), 143.23 (C), 152.73 (C), 165.76 (C). Anal. Calc. for C<sub>13</sub>H<sub>10</sub>O<sub>3</sub>NS: C, 59.77; H, 4.21; N, 5.36. Found: C, 59.81; H, 4.15; N, 5.26%.

For compound **3**: yield 45%,  $\delta_{\text{H}}$ (300 MHz, CDCl<sub>3</sub>) 7.69–7.66 (d, 1H, *J* 8.7 Hz, Ar), 7.51–7.49 (d, 1H, *J* 5.7 Hz, Ar), 7.49–7.47 (d, 1H, *J* 5.7 Hz, Ar), 5.22 (s, 1H), 4.08 (s, 3H, CO<sub>2</sub>CH<sub>3</sub>), 3.83 (s, 3H, NCH<sub>3</sub>);  $\delta_{\text{C}}$ (300 MHz, CDCl<sub>3</sub>) 37.52 (CH), 52.01 (NMe), 60.99 (CO<sub>2</sub>Me), 98.48 (CH), 116.04 (C), 118.86 (CH), 120.31 (CH), 122.8 (C), 124.65 (CH), 132.84 (C), 140.09 (C), 148.71 (C), 162.09 (C). Anal. Calc. for C<sub>13</sub>H<sub>10</sub>O<sub>3</sub>NS: C, 59.77; H, 4.21; N, 5.35. Found: C, 59.50; H, 4.20; N, 5.40%.

For compound **4**: yield 77%, mp 52–54 °C;  $\delta_{\text{H}}$ (300 MHz, CDCl<sub>3</sub>) 7.90–7.88 (d, 1H, *J* 8.4 Hz, Ar), 7.83–7.81 (d, 1H, *J* 5.7 Hz, Ar), 7.80–7.78 (d, 1H, *J* 4.8 Hz, Ar), 7.51–7.46 (m, 1H, Ar), 7.39–7.34 (m, 1H, Ar), 7.31–7.28 (d, 1H, *J* 8.7 Hz, Ar), 6.84 (s, 1H), 3.99 (s, 3H, CO<sub>2</sub>CH<sub>3</sub>), 3.85 (s, 3H, NCH<sub>3</sub>);  $\delta_{\text{C}}$ (300 MHz, CDCl<sub>3</sub>) 52.46 (NMe), 56.65 (CO<sub>2</sub>Me), 103.00 (CH), 113.4 (CH), 123.81 (CH), 124.77 (CH), 126.51 (CH), 128.21 (CH), 129.39 (CH), 112.82 (C), 117.72 (C), 129.10 (C), 133.60 (C), 153.99 (C), 165.83 (C). Anal. Calc. for C<sub>15</sub>H<sub>13</sub>O<sub>3</sub>N: C, 70.57; H, 5.13; N, 5.48. Found: C, 70.50; H, 5.20; N, 5.00%.

For compound **5**: yield 74%, mp 76–78 °C;  $\delta_{\text{H}}$ (300 MHz, CDCl<sub>3</sub>) 8.11–8.07 (m, 1H, Ar), 7.88–7.85 (m, 1H, Ar), 7.70–7.67 (d, 1H, *J* 8.7 Hz,

Ar), 7.59–7.53 (m, 2H, Ar), 7.52–7.49 (d, 1H,  $J$  8.4 Hz, Ar), 5.37 (s, 1H), 4.04 (s, 3H, CO<sub>2</sub>CH<sub>3</sub>), 3.86 (s, 3H, NCH<sub>3</sub>);  $\delta_{\text{C}}$ (300 MHz, CDCl<sub>3</sub>) 37.44 (CH), 53.82 (NMe), 62.98 (CO<sub>2</sub>Me), 115.90 (C), 119.14 (C), 122.40 (CH), 125.00 (CH), 125.35 (CH), 126.7 (CH), 127.18 (CH), 127.40 (C), 128.33 (CH), 135.35 (C), 153.98 (C), 165.62 (C). Anal. Calc. for C<sub>15</sub>H<sub>13</sub>O<sub>3</sub>N: C, 70.57; H, 5.13; N, 5.48. Found: C, 70.50, H 5.21, N, 5.35%.

For compound **6**: yield 45%, mp 90–94 °C;  $\delta_{\text{H}}$ (300 MHz, CDCl<sub>3</sub>) 7.35–7.26 (dd, 1H,  $J$  8.49 Hz, Ar), 6.60–6.57 (d, 2H,  $J$  8.4 Hz, Ar), 5.38 (s, 1H), 3.86 (s, 6H, CO<sub>2</sub>CH<sub>3</sub>, OCH<sub>3</sub>), 3.80 (s, 3H, NCH<sub>3</sub>);  $\delta_{\text{C}}$ (300 MHz, CDCl<sub>3</sub>) 31.98 (CH), 53.48 (NCH<sub>3</sub>), 56.09 (CO<sub>2</sub>Me, OCH<sub>3</sub>), 104.06 (CH), 115.99 (C), 128 (C) 130.85 (2 CH), 132.4 (C), 166.45 (C), 157.65 (C). Anal. Calc. for C<sub>12</sub>H<sub>13</sub>O<sub>4</sub>N: C, 61.27; H, 5.56; N 5.95. Found: C, 61.07; H, 5.90; N 5.89%.

For compound **7**: yield 90%, mp 135–136 °C;  $\delta_{\text{H}}$ (300 MHz, CDCl<sub>3</sub>) 9.12 (br s, 1H, NH), 7.34 (s, 1H, Ar), 7.25–7.20 (m, 1H, Ar), 7.02–7.00 (d, 1H,  $J$  8.1 Hz, Ar), 6.51–6.48 (d, 1H,  $J$  7.8 Hz, Ar), 3.94 (s, 3H, CO<sub>2</sub>CH<sub>3</sub>), 3.91 (s, 3H, OCH<sub>3</sub>);  $\delta_{\text{C}}$ (300 MHz, CDCl<sub>3</sub>) 51.88 (OMe), 55.25 (CO<sub>2</sub>Me), 99.66 (CH), 104.75 (CH), 106.43 (CH), 118.88 (C), 125.69 (C), 138.21 (C),

154.53 (C), 162.43 (C). Anal. Calc. for C<sub>11</sub>H<sub>10</sub>O<sub>3</sub>N: C, 64.69; H, 4.93; N, 6.85. Found: C, 64.70; H 4.90; N, 6.90%.

- 1 M. Maiti, S. Sinha, C. Deb, A. De and T. Ganguly, *J. Lumin.*, 1999, **82**, 259.
- 2 C. Deb, A. De, M. Maiti and T. Ganguly, Paper presented in *The XVIIIth European Colloquium on Heterocyclic Chemistry*, 4–7 October, 1998, Rouen, France.
- 3 L. Henn, D. M. B. Hickey, C. J. Moody and C. W. Rees, *J. Chem. Soc., Perkin Trans. 1*, 1984, 2189.
- 4 S. Datta and A. De, *J. Chem. Soc., Perkin Trans. 1*, 1989, 603; S. S. Samanta, S. C. Ghosh and A. De, *J. Chem. Soc., Perkin Trans. 1*, 1997, 3673.
- 5 We thank one of the referees for pointing out such a possibility.
- 6 M. Sainsbury, in *Comprehensive Heterocyclic Chemistry*, ed. A. J. Boulton and A. McKillop, Pergamon Press, Oxford, 1984, vol. 8, p. 995.