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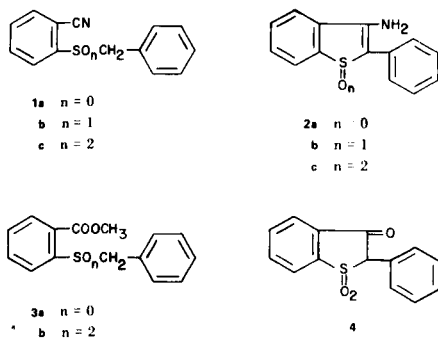
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A rapid synthesis of 2-phenylbenzo[*b*]thiophene-3-amine and its *S*-oxides from *o*-nitrobenzonitrile is described. Also reported is the preparation of 2-phenylbenzo[*b*]thiophene-3-(2*H*)one, 1,1-dioxide from methyl *o*-nitrobenzoate.

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In previous reports the author has described the synthesis of benzo[*b*]thiophene-3-amines substituted at the 2-position with carboxylic acid ester (1), carboxamide (2-3), cyano (3), acetyl (3), and benzoyl (3) functions. The starting material in each case was an *o*-nitrobenzonitrile, and the process involved nitro displacement by a suitable thiol anion followed ultimately by cyclization to the desired product. This reaction has now been extended to the synthesis of 2-phenylbenzo[*b*]thiophene-3-amine and its *S*-oxide derivatives.

Treatment of *o*-nitrobenzonitrile with benzylmercaptan anion in cold aqueous DMF yielded the thioether **1a** (78%) (4). Cyclization of **1a** with potassium *t*-butoxide in refluxing benzene gave 2-phenylbenzo[*b*]thiophene-3-amine (**2a**, 64%). Oxidation of **1a** with one molar equivalent of *m*-chloroperoxybenzoic acid produced the sulfoxide **1b** (80%), which was cyclized with sodium methoxide in refluxing methanol to yield the *S*-oxide derivative **2b** (72%). The sulfone **1c** (88%) was formed by oxidation of **1a** with two molar equivalents of *m*-chloroperoxybenzoic acid. Cyclization of **1c** with sodium methoxide in methanol gave the *S,S*-dioxide derivative **2c** (91%). This compound was previously synthesized by Sauter and Jordis (5) by amination of the corresponding 3-bromo derivative.



Treatment of methyl *o*-nitrobenzoate with benzylmercaptan anion (lithium salt) in anhydrous DMF yielded the thioether **3a** (59%). Conditions could not be found for the cyclization of **3a** to form 3-hydroxy-2-phenylbenzo[*b*]thiophene. Oxidation of **3a** yielded the sulfone **3b** (73%), which readily underwent ring closure with sodium methoxide in methanol to give 2-phenylbenzo[*b*]thiophene-3-(2*H*)one, 1,1-dioxide (**4**, 92%). Cohen and

Smiles (6) reported the same reaction using sodium ethoxide and a yield of 60%. In their case, **3b** was prepared by a different route and was not fully characterized.

## EXPERIMENTAL (7)

*o*-(Benzylthio)benzonitrile (**1a**).

To a cold solution (ice bath) containing 14.8 g. of *o*-nitrobenzonitrile (0.1 mole) and 12.4 g. of benzylmercaptan (0.1 mole) in 100 ml. of DMF was added dropwise a solution containing 10 g. of potassium hydroxide in 25 ml. of water. The mixture was stirred in the cold for 2 hours and then poured into ice water.

The solid was collected and crystallized from alcohol to yield 17.5 g. (78%) of product, m.p. 62-64°; lit. (4) m.p. 65-66°.

*Anal.* Calcd. for  $C_{14}H_{11}NS$ : C, 74.63; H, 4.92; N, 6.22. Found: C, 74.37; H, 5.05; N, 5.97.

*o*-(Benzylsulfinyl)benzonitrile (**1b**).

*m*-Chloroperoxybenzoic acid (85% purity, 4.1 g.; 20.2 mmoles) was added portionwise to a solution of 4.5 g. of **1a** (20 mmoles) in 100 ml. of chloroform. The mixture was stirred at room temperature for 2 hours and then heated to reflux for 0.5 hour. The solution was extracted with dilute sodium hydroxide, washed with water, dried, and evaporated. The crude product was crystallized from alcohol-water to yield 3.85 g. (80%) of **1b**, m.p. 115-116.5°.

*Anal.* Calcd. for  $C_{14}H_{11}NOS$ : C, 69.68; H, 4.59; N, 5.80. Found: C, 69.39; H, 4.72; N, 6.04.

*o*-(Benzylsulfonyl)benzonitrile (**1c**).

A solution of 4.5 g. of **1a** (20 mmoles) and 9.0 g. of *m*-chloroperoxybenzoic acid (85% purity; 44.3 mmoles) in 100 ml. of chloroform was refluxed for 2 hours. The product was isolated as in the preparation of **1b** with crystallization from alcohol to yield 4.5 g. (88%) of **1c**, m.p. 142-143°.

*Anal.* Calcd. for  $C_{14}H_{11}NO_2S$ : C, 65.35; H, 4.31; N, 5.44. Found: C, 65.13; H, 4.31; N, 5.29.

2-Phenylbenzo[*b*]thiophene-3-amine (**2a**).

A mixture containing 4.5 g. of **1a** (20 mmoles) and 2.5 g. of potassium *t*-butoxide (22.3 mmoles) in 100 ml. of benzene was refluxed for 1 hour. The solution was extracted with water, and the aqueous layer was extracted with ethyl acetate. The combined organic extracts were washed with saturated brine, dried, and evaporated. The crude product was crystallized from alcohol-water to yield 2.9 g. (64%) of **2a**, m.p. 109-110°.

*Anal.* Calcd. for  $C_{14}H_{11}NS$ : C, 74.63; H, 4.92; N, 6.22; S, 14.23. Found: C, 74.53; H, 5.19; N, 6.48; S, 14.20.

2-Phenylbenzo[*b*]thiophene-3-amine, 1-Oxide (**2b**).

A solution containing 3.6 g. of **1b** (14.9 mmoles) and 0.9 g. of sodium methoxide (16.7 mmoles) in 50 ml. of methanol was

refluxed for 2 hours. The mixture was poured into ice water, and the crude solid was collected and crystallized from ethyl acetate-hexane to yield 2.6 g. (72%) of **2b**, m.p. 156-158°. An analytical sample, m.p. 158.5-160°, was recrystallized.

*Anal.* Calcd. for C<sub>14</sub>H<sub>11</sub>NOS: C, 69.68; H, 4.59; N, 5.80; S, 13.29. Found: C, 69.40; H, 4.57; N, 5.61; S, 13.19.

2-Phenylbenzo[*b*]thiophene-3-amine, 1,1-Dioxide (**2c**).

A solution of 4.5 g. of **1c** (17.5 mmoles) and 1.0 g. of sodium methoxide (18.5 mmoles) in 70 ml. of methanol was refluxed for 2 hours. The mixture was poured into ice water and then acidified with hydrochloric acid. The product crystallized to yield 4.1 g. (91%) of **2c**, m.p. 217-218°; Lit. (5) m.p. 215-218°.

*Anal.* Calcd. for C<sub>14</sub>H<sub>11</sub>NO<sub>2</sub>S: C, 65.35; H, 4.31; N, 5.44; S, 12.46. Found: C, 65.61; H, 4.50; N, 5.56; S, 12.49.

*o*-(Benzylthio)benzoic Acid, Methyl Ester (**3a**).

To a cold solution of 18.1 g. of methyl *o*-nitrobenzoate (0.1 mole) and 14.9 g. of benzylmercaptan (0.12 mole) in 100 ml. of DMF (under nitrogen) was added 2.9 g. of finely powdered lithium hydroxide (0.12 mole). The mixture was stirred at room temperature for 2 hours and then poured into ice water. The solid was collected and crystallized from alcohol to yield 18.9 g. of impure product, m.p. 47-60°. Recrystallization from benzene-hexane yielded 15.3 g. (59%) of **3a**, m.p. 65.5-67°; Lit. (8) m.p. 67°.

*Anal.* Calcd. for C<sub>15</sub>H<sub>14</sub>O<sub>2</sub>S: C, 69.74; H, 5.46; S, 12.41. Found: C, 69.76; H, 5.75; S, 12.60.

*o*-(Benzylsulfonyl)benzoic Acid, Methyl Ester (**3b**).

To a solution of 14.9 g. of **3a** (58 mmoles) in 150 ml. of chloroform was added portionwise 24.0 g. of *m*-chloroperoxybenzoic acid (85% purity; 118 mmoles). The mixture was refluxed for 2 hours. The solution was washed first with dilute sodium hydroxide and then saturated brine. The organic layer

was dried and evaporated, and the crude product was crystallized from benzene-hexane to yield 12.35 g. (73%) of **3b**, m.p. 80-81°.

*Anal.* Calcd. for C<sub>15</sub>H<sub>14</sub>O<sub>4</sub>S: C, 62.05; H, 4.86; S, 11.04. Found: C, 62.28; H, 4.78; S, 11.11.

2-Phenylbenzo[*b*]thiophene-3-(2*H*)one, 1,1-Dioxide (**4**).

A solution containing 8.7 g. of **3b** (30 mmoles) and 2.0 g. of sodium methoxide (37 mmoles) in 75 ml. of methanol was refluxed for 0.5 hour, and then poured into ice water. The mixture was acidified with hydrochloric acid. The solid was collected and crystallized from alcohol to yield 7.1 g. (92%) of product, m.p. 177-178°; Lit. (6) m.p. 174°.

*Anal.* Calcd. for C<sub>14</sub>H<sub>10</sub>O<sub>3</sub>S: C, 65.10; H, 3.90; S, 12.41. Found: C, 65.24; H, 4.14; S, 12.39.

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