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LETTERS TO THE EDITOR

Reaction of 2,3-Bis(benzotriazol-1-yl)-1,4-naphthoquinone

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Proceeding with our studies [1], we reacted 2,3-bis-(benzotriazol-1-yl)-1,4-naphthoquinone (**I**) with thiophenol. This reaction may involve both mono- and disubstitution to give 2-(benzotriazol-1-yl)-3-phenylthio-1,4-naphthoquinone (**II**) and 2,3-bis(phenylthio)-1,4-naphthoquinone (**III**), respectively.



The reaction of compound **II** with *tert*-butylamine affords two products: 3-(benzotriazol-1-yl)-1,4naphthoquinone (**IV**) and disulfide **III** in a ~1:1 ratio. The formation of compound **III** can be explained in the following way: Compound **II** reacts with *tert*butylamine to give compound **IV** and thiophenol, and the latter reacts with sulfide **II**, yielding disulfide **III**.



2-(Benzotriazol-1-yl)-3-phenylthio-1,4-naphthoquinone (II). Thiophenol, 1.1 ml, was added to a suspension of 3.92 g of quinone **I** in 25 ml of ethanol. The reaction mixture was heated under reflux for 1 h and then cooled. The precipitate that formed was washed with alcohol and recrystallized from ethanol– water (1:2) to obtain 2.57 g (67%) of a brown crystalline substance, mp 172–173°C. ¹H NMR spectrum, δ , ppm: 8.13 m (2H), 7.94 m (3H), 7.65 d (1H), 7.54 t (1H), 7.38 m (2H), 7.09 d (2H), 6.92 m (2H). Found, %: N 10.72; S 8.41. C₂₂H₁₃N₃O₂S. Calculated, %: N 10.97; S 8.35.

2,3-Bis(phenylthio)-1,4-naphthoquinone (III). Thiophenol, 2.4 ml, was added to a suspension of 3.92 g of quinone **I** in 25 ml of ethanol. The reaction mixture was heated under reflux for 30 min and then cooled. The precipitate that formed was filtered off and recrystallized from ethanol–water (1:3) to obtain 2.75 g (73%) of a red crystalline substance, mp 149–150°C. ¹H NMR spectrum, δ , ppm: 7.89 m (2H), 7.84 m (2H), 7.39 m (4H), 7.29 m (6H). Found S, %: 17.05. C₂₂H₁₄O₂S₂. Calculated S, %: 17.11.

Reaction of sulfide II with *tert*-butylamine. *tert*-Butylamine, 0.5 ml, was added to a suspension of 1.15 g of compound **II** in 15 ml of ethanol. The reaction mixture was heated under reflux for 1 h and then cooled. The precipitate that formed was filtered off and recrystallized first from ethanol–water, 1:2, and then from ethanol. The resulting substance, 0.15 g, mp 146–148°C, gave no melting point depression with disulfide **III** and had the same ¹H NMR spectrum.

The filtrate obtained after the first recrystallization was diluted three times with water, the precipitate that formed was filtered off and recrystallized from ethanol to obtain 0.15 g of a yellow crystalline substance, mp 165–166°C. ¹H NMR spectrum, δ , ppm: 8.15 m (2H), 7.88 m (2H), 7.95 d (1H), 7.65 d (1H), 7.54 t (1H), 7.44 t (1H), 0.93 s (9H).

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The ¹H NMR spectra were recorded on a Varian VXR-300 spectrometer (300 MHz), solvent DMSO- d_6 , external reference HMDS. The purity of the synthesized compounds was established by TLC on Silufol UV-254 plates, eluent benzene–acetone (1:1).

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