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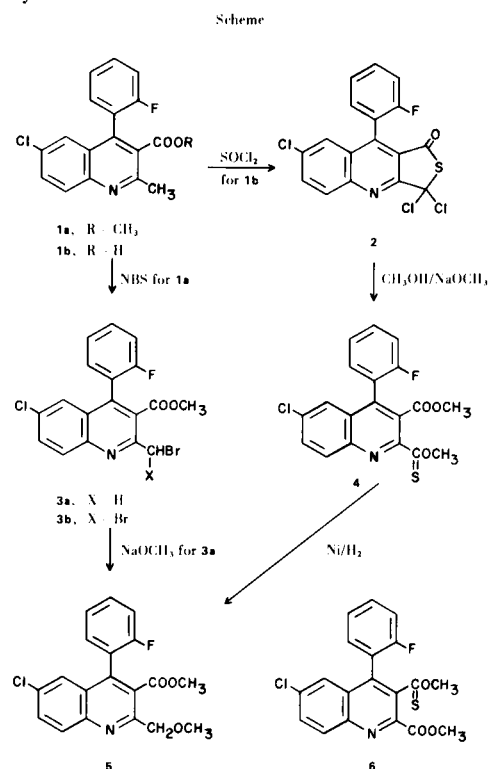
The reaction of the 2-methylquinoline-3-carboxylic acid **1b** with thionyl chloride gave the dichlorothiolactone **2**, the structure of which was confirmed by chemical transformations.

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The conversion of a carboxylic acid to its acid chloride with thionyl chloride is generally a straightforward procedure. However in some cases oxidation of the substrate with formation of sulfur-containing products occurs (1).

We wish to report another example of such a reaction emanating from our study of polynuclear aromatics (2). Thus treating the 2-methylquinoline-3-carboxylic acid **1b** with thionyl chloride gave a crystalline compound which was assigned the dichlorothiolactone structure **2** on the basis of spectral and analytical data. The structure was further confirmed by the following chemical transformations.

Reaction of the lactone **2** with methanol and sodium methoxide led to the thioester **4** which was desulfurized with Raney nickel in dioxane to afford the methoxymethyl derivative **5**. In order to eliminate the alternate structure **6** for the thioester, compound **5** was also prepared from **1a** via the bromide **3a**. This compound was obtained together with the dibromide **3b** by treatment of **1a** with *N*-bromosuccinimide. The formation of **2** from **1b** is analogous to the reaction of 4-methylnicotinic acid with thionyl chloride reported by Wenkert, *et al.*, (3) and can be rationalized in terms of the mechanistic scheme proposed by these authors.



EXPERIMENTAL

Melting points were determined in capillary melting point apparatus or on a Reichert hot stage microscope. The uv spectra were measured in 2-propanol on a Cary Model 14 spectrophotometer. Nmr spectra were recorded on a Varian A-60 instrument with TMS as internal standard. Ir spectra were determined on a Beckman 112-9 spectrometer and mass spectra on a CEC-110 B instrument. Silica gel Merck (70-325 mesh) was used for chromatography and anhydrous sodium sulfate for drying purposes.

6-Chloro-4-(2-fluorophenyl)-2-methylquinoline-3-carboxylic Acid Methyl Ester (**1a**).

A mixture of 49.9 g. (0.2 mole) of 4-chloro-2-(2-fluorobenzoyl)aniline (**4**), 49.9 ml. of methyl acetoacetate, 5 g. of zinc chloride and 400 ml. of benzene was stirred and refluxed for 18 hours. After cooling to room temperature, the mixture was diluted with 300 ml. of benzene, washed with water, dried and evaporated. The crystals were triturated with hexane and collected by filtration to yield 58.4 g. of crude product with m.p. 129-133°. This material was recrystallized from dichloromethane/methanol to give 51.7 g. (78.4%) of product with m.p. 139-142°. The analytical sample was prepared by recrystallization from methanol and had the same m.p.; nmr (deuteriochloroform): δ 2.8 (s, 3, CH₃), 3.63 (s, 3, COOCH₃), 7.0-8.0 (m, 6, aromatic H), 8.1 ppm (d, 1, J = 8.5 Hz, C₈-H).

Anal. Calcd. for C₁₈H₁₃ClFNO₂: C, 65.6; H, 4.0; N, 4.3. Found: C, 65.8; H, 4.0; N, 4.4.

6-Chloro-4-(2-fluorophenyl)-2-methylquinoline-3-carboxylic Acid (**1b**).

This acid was prepared by alkaline hydrolysis of **1a** in 85% yield, m.p. 289-291° dec., after crystallization from methanol/acetone.

Anal. Calcd. for C₁₇H₁₁ClFNO₂: C, 64.6; H, 3.5; N, 4.4. Found: C, 64.5; H, 3.5; N, 4.3.

9-(2-Fluorophenyl)-3,3,7-trichlorothieno[3,4-*b*]quinolin-1(3*H*)one (**2**).

A mixture of 100 g. (0.32 mole) of **1b** and 1 l. of thionyl chloride was heated to reflux for 2 hours with stirring. The reagent was evaporated under reduced pressure and at the end azeotropically removed with benzene. The solid residue was slurried with ether, collected, and washed with ether to yield 76 g. (60%) of yellowish product with m.p. 195-198°. For analysis the material was recrystallized from dichloromethane/hexane, m.p. 205-208°; uv: λ sh 220 ($\epsilon = 19,000$), max 259 (48,500), 306 (9,100), inflection 316 (8,650), inflection 355 nm (2,200); ir (chloroform): 1720 cm⁻¹ (C=O); nmr (deuteriochloroform): δ 7.1-8.1 (m, 6, aromatic H), 8.37 ppm (d, 1, J = 9 Hz, C₅-H); ms: m/e 397 (M⁺), 362 (M⁺-Cl).

Anal. Calcd. for C₁₇H₇Cl₃FNOS: C, 51.2; H, 1.8; N, 3.5; Cl, 26.7; S, 8.0. Found: C, 51.2; H, 1.7; N, 3.4; Cl, 26.9; S, 8.1.

2-Bromomethyl-6-chloro-4-(2-fluorophenyl)quinoline-3-carboxylic Acid Methyl Ester (**3a**), and 6-Chloro-2-dibromomethyl-4-(2-fluorophenyl)quinoline-3-carboxylic Acid Methyl Ester (**3b**).

A mixture of 3.3 g. (.01 mole) of **1a**, 5.34 g. (.03 mole) of *N*-bromosuccinimide, 5 ml. of glacial acetic acid and 125 ml. of chloroform was stirred and refluxed for 18 hours. The mixture was then cooled, washed with saturated aqueous sodium bicarbonate solution, dried and evaporated. The residue was chromatographed over a column of 60 g. of silica gel using dichloromethane. The fractions containing the less polar component were combined and evaporated. Crystallization from ether/hexane yielded 1.09 g. (22.4%) of the dibromo compound **3b** with m.p. 112-115°. Recrystallization for analysis from ether/hexane did not change the m.p.; uv: λ max 248 ($\epsilon = 50,500$), sh 290 (5,700), max 319 (3,600), 344 nm (2,850); ir (chloroform): 1730 cm^{-1} (COOCH₃); nmr (deuteriochloroform): δ 3.62 (s, 3, COOCH₃), 7.0-8.1 (m, 7, aromatic H and -CHBr₂), 8.26 ppm (d, 1, J = 8.5 Hz, C₈-H).

Anal. Calcd. for C₁₈H₁₁Br₂ClFNO₂: C, 44.3; H, 2.3; N, 2.9. Found: C, 44.4; H, 2.6; N, 2.9.

Fractions from the column containing the more polar product gave, after crystallization from petroleum ether, 0.93 g. (22.7%) of compound **3a** with m.p. 147-150°. The analytical sample was recrystallized from dichloromethane/petroleum ether, m.p. unchanged; nmr (deuteriochloroform): δ 3.64 (s, 3, COOCH₃), 4.93 (s, 2, CH₂Br), 7.0-8.0 (m, 6, aromatic H), 8.1 ppm (d, 1, J = 8.5 Hz, C₈-H).

Anal. Calcd. for C₁₈H₁₂BrClFNO₂: C, 52.9; H, 3.0; N, 3.4. Found: C, 52.9; H, 2.9; N, 3.6.

6-Chloro-4-(2-fluorophenyl)-2-thiocarbomethoxyquinoline-3-carboxylic Acid Methyl Ester (**4**).

A solution of 5 g. (0.208 mole) of sodium in 200 ml. of methanol was added to a solution of 20 g. (0.05 mole) of **2** in 200 ml. of methanol cooled to 0°. After stirring for 1 hour at room temperature, the reaction mixture was acidified with glacial acetic acid and the product was crystallized by addition of water. The crystals were collected and washed with water and methanol to yield 14 g. (71.5%) of yellow material which was crystallized from methanol for analysis, m.p. 131-134°; uv: λ inflection 215 ($\epsilon = 29,000$), max 249 (37,400), inflection 310 (6,950), inflection 340 (3,100), max 400/415 nm (580); ir (chloroform): 1735 cm^{-1} (COOCH₃); nmr (deuteriochloroform): δ 3.56 (s, 3, COOCH₃) 4.35 (s, 3, CSOCH₃), 7.1-8.1 (m, 6, aromatic H), 8.3 ppm (d, 1, J = 9 Hz, C₈-H); ms: m/e 389 (M⁺).

Anal. Calcd. for C₁₉H₁₃ClFNO₃S: C, 58.5; H, 3.4; N, 3.5; S, 8.2. Found: C, 58.4; H, 3.5; N, 3.6; S, 8.6.

6-Chloro-4-(2-fluorophenyl)-2-methoxymethylquinoline-3-carboxylic Acid Methyl Ester (**4**).

A) From Compound **4**.

A suspension of 10 g. of Raney nickel in 25 ml. of dioxane was combined with a solution of 1 g. of **4** in 25 ml. of dioxane. The mixture was stirred at room temperature for 14 minutes, filtered and evaporated. The residue was crystallized from ether/hexane to yield 0.49 g. (53%) of colorless crystals with m.p. 100-103°. The analytical sample was recrystallized from the same solvents; m.p. 105-107°; uv: λ max 210 ($\epsilon = 32,600$), 235 (54,500), 268 (6,000), 313 (2,900), 327 nm (3,200); ir (chloroform): 1730 cm^{-1} (COOCH₃); nmr (deuteriochloroform): δ 3.42 (s, 3, OCH₃), 3.61 (s, 3, COOCH₃), 4.89 (s, 2, CH₂-), 7.0-7.8 (m, 6, aromatic H), 8.13 ppm (d, 1, J = 8 Hz, C₈-H).

B) From Compound **3a**.

A mixture of 0.16 g. (0.4 mmole) of **3a**, 0.16 g. (1.4 mmole) of potassium *t*-butoxide and 5 ml. of methanol was heated to reflux for 5 minutes. After neutralization with glacial acetic acid, the mixture was evaporated and the residue was partitioned between water and dichloromethane. The organic layer was dried and evaporated. Crystallization of the residue from ether/hexane gave 65 mg. (46%) of crystals with m.p. and mixed m.p. identical with the product described above.

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