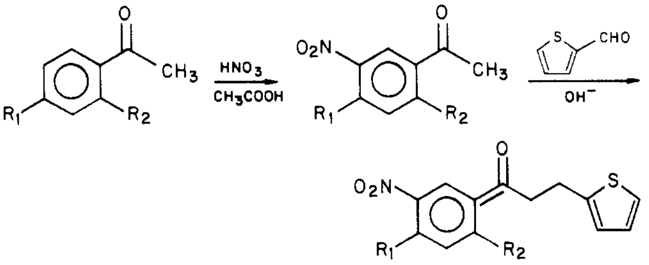
Two New Thia Chalcones

Thomas Széll,* Andrea Brand, and Siriwan Ratanathanawongs
United Nations International School, New York, New York 10010

4-Hydroxy-3-nitro- and 2-hydroxy-5-nitroacetophenone (1 and 3), both obtained by nitrating the parent hydroxy ketone, were condensed with thiophene-α-carboxaldehyde in the presence of dilute NaOH to give the appropriate yellow thia chalcones 2, mp 147 °C, and 4, mp 190–191 °C, with yields of 72.5% and 71%, respectively. The chalcones ($C_{13}H_9NSO_4$) were characterized by elemental analysis as well as by their IR and ^1H NMR spectra.

Relatively few thia chalcones are known (*1*). It has been known that furan-2-carboxaldehyde (furfural), similar to benzaldehyde, readily undergoes aldol reactions with hydroxynitroacetophenones (*2*); therefore, similar behavior was expected for the thiophene analogue. This proved to be correct, but pyrrole-2-carboxaldehyde under the same conditions failed to react.



In **1** and **2**, R_1 is OH and R_2 is H; in **3** and **4**, R_1 is H and R_2 is OH.

Experimental Section

Melting points are uncorrected. A Perkin-Elmer 677 spectrophotometer and KBr pellets were used. ^1H NMR spectra were prepared by using a Varian XL-100 FT 100 MHz apparatus, $CDCl_3$ as solvent, and Me_4Si as an internal reference. Carbons in the benzene ring have been numbered in the NMR evaluation.

Preparation of 4-Hydroxy-3-nitroacetophenone (1). Commercial 4-hydroxyacetophenone (20 mmol, 2.7 g) was nitrated in 10 mL of glacial acetic acid with 2.5 mL of 10 N nitric acid under ice cooling and gentle shaking. Overnight in a refrigerator, crystallization started. Water (10 mL) was added to the heterogeneous mixture; it was cooled in crushed ice for 0.5 h and filtered, and the crystals were washed with water and dried at room temperature to give 2.55 g of bright yellow 4-hydroxy-3-nitroacetophnenone (**1**): mp, 128–130 °C; yield, 70%. The melting point rose to 132–133 °C after one recrystallization from ethanol, which is the same as observed earlier (*2*).

Synthesis of 4-Hydroxy-3-nitro-ω-thiophenylideneacetophenone (2). Compound **1** (2 mmol, 0.37 g) was dissolved in 22 mL of 1 M NaOH (22 mmol) at ~90 °C. The light-yellow solution turned to dark orange. To the hot solution, 0.45 g of commercial thiophenone-α-carboxaldehyde (4 mmol) was added. In ~15 min of shaking time, the precipitation of the yellow sodium salt of the chalcone began, and after 1 h it was complete. The salt was filtered, washed with 2 × 2 mL of ice water, suspended in 15 mL of 1 M H_2SO_4, and heated to 55–60 °C. The yellow thia chalcone (**2**) was then filtered, washed with 2 × 2 mL of water, and dried at room temperature to give 0.4 g (mp, 144–145 °C; yield, 72.5%). On its recrystallization from propanol–acetic acid (1:1), the melting point rose to 147 °C. Anal. Calcd for $C_{13}H_9NSO_4$ (275.2): S, 11.6. Found: S, 11.5. IR 1650 (C = O), 1565, 1330, 820 (NO_2), 3250 (OH) cm^{-1}. ^1H NMR 420–450 Hz, multiplet, for five hydrogens (three in thiophene, α-olefin, 5′-CH); 8.20 ppm (2 d, J = 11, 2.5 Hz) for 6′-CH, 8.75 ppm (d, J = 2.5 Hz) for 2′-CH; 10.9 ppm for OH (chelate). The spectrum clearly showed a trans structure.

Preparation of 2-Hydroxy-5-nitroacetophenone (3). Compound **3** was prepared either by the Fries rearrangement of 4-nitrophenyl acetate (*3*) or more conveniently, although with only 45% yield, by the direct nitration of 2-hydroxyacetophenone as in the case of **1**: mp, 97 °C; **3** was identical with an authentic sample.

Preparation of 2-Hydroxy-5-nitro-ω-thiophenylideneacetophenone (4). The method, using **3** as starting material, was identical with the one described for the preparation of **2**. The resulting brown-yellow thia chalcone **4** was obtained in a 71% yield and its melting point after recrystallization was 190–191 °C from propanol–acetic acid (1:1). Anal. Calcd for $C_{13}H_9NSO_4$ (275.2): S, 11.6. Found: S, 11.5. IR 1635 (C = O chelated), 1565, 1340, 850 (NO_2) cm^{-1}, double bond probably combined with one of NO_2 frequencies ca. 1560 cm^{-1}. ^1H NMR 8.83 ppm (d, J = 2.7 Hz) for 6′-CH, 8.36 ppm (2 d, J = 9.2 and 2.7 Hz) for 4′-CH, 8.16 ppm (J = 15 Hz) for β-CH, 7.45 ppm (J = 15.1 Hz) for α-CH, 7.16 ppm (2d, J = 4 and 4.8 Hz) for 4-CH, 7.52 ppm (d, J = 5 Hz) for 3-CH, 7.56 ppm (d, J = 5 Hz) for 5-CH, 13.4 ppm for OH (chelate). The structure is a trans one.

Acknowledgment

Thanks are due to Professor P. Sohár of EGYT Pharmacochemical Works at Budapest for the spectral analyses.

Literature Cited

(1) Adams, R., et al., Eds. "Organic Reactions; Aldol Condensation"; Wiley: New York, 1975.
(2) Széll, T. *Chem. Ber.* **1960**, *93*, 1928.
(3) Széll, T. *Chem. Ber.* **1958**, *91*, 2609; cf. ref *8* of this paper on p 2611.

Received for review October 6, 1980. Accepted December 22, 1980. Financial support was provided by the Camille and Henry Dreyfus Foundation (New York).

0021-9568/81/1726-0230$01.25/0