SHORT PAPER

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One pot synthesis of 2,2-dichloro-1, 1-bis(4-dialkylaminophenyl)ethylenes by Friedel–Crafts acylation†

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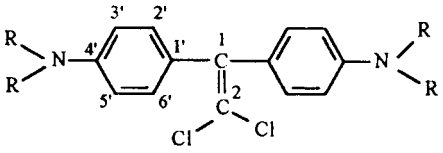
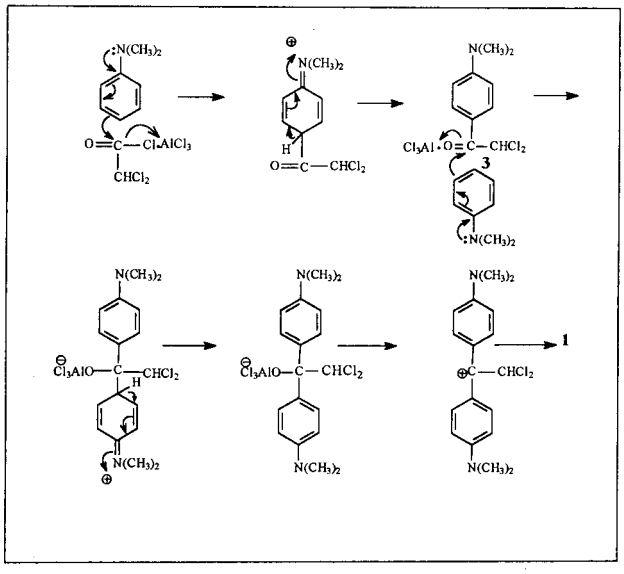
A simple method is described for the preparation of 2,2-dichloro-1,1-bis(4-dialkylaminophenyl)ethylenes from dialkyl anilines by Friedel-Crafts reaction using $AlCl_3$ as Lewis acid and dichloroacetyl chloride as acylating agent.

The Friedel-Crafts reaction has been studied extensively for a long time for the preparation of a broad spectrum of compounds by alkylation, acylation, cyclisation and other reactions. The reported preparative methods involved the use of stoichiometric amounts of the substrates, reactants and catalysts. Though excess reagents have been used by various workers[1,2] both for the alkylation and acylation of aromatic compounds, we first reported[3–5] the formation of bi- or polynuclear compounds using excess amounts of arenes as substrates and higher temperatures in some specific cases. Similar results have also been reported by Roberts[6,7] *et al*. The formation of these uncommon products depends on the nucleophilicity of the substrates and electrophilicity of the acyl carbonyl groups of the initially formed acylated products. In continuation of our work on the Friedel-Crafts reactions,[3–5,8,9] an attempt has been made to develop a convenient and suitable method for the preparation of substituted amino derivatives of binuclear compounds of potential therapeutic interest employing Friedel-Crafts acylation. For this purpose, three substrates have been selected, *viz.* acetanilide, N,N-dimethylaniline and N,N-diethylaniline. Dichloroacetyl chloride and anhydrous $AlCl_3$ were used as acylating agent and catalyst respectively. Acetanilide either in unimolar or higher proportions furnished only the normal 4-acylated product in refluxing carbon disulphide. However, when dimethyl- and diethylaniline were used in bimolar or higher molar proportions in the absence of solvent at the same temperature, they afforded 2,2-dichloro-1, 1-bis (4-dimethylaminophenyl) ethylene **(1)** and 2,2-dichloro-1,1-bis (4- diethylaminophenyl) ethylene **(2)** respectively. Both the compounds were characterised from their spectroscopic and elemental analysis. The assignment of ^{13}C NMR signals is in accordance with the proposed structures. The mechanism of formation of binuclear compounds has been rationalised in Scheme 1 for **1**. Exclusive acylation at the *para* position to $–N(CH_3)_2$ group led to the formation of the acylated product **3**. The formation of intermediate was ascertained by its isolation from the reaction product after an interval of 2 hours (monitored by TLC) and also by using it as a substrate to yield **1**.

The difference in behaviour towards the formation of binuclear compounds can be ascribed to the unequal nucleophilicity of the arenes. The dialkylamino group is highly activating whereas the $–NHCOCH_3$ is less so, and therefore acetanilide cannot act as a substrate for acylation by **3**.



1. R = CH_3
2. R = - CH_2-CH_3



Scheme 1

Experimental

All m.p.s are uncorrected. EI mass spectra were recorded on a JEOL-AX-500 mass spectrometer. ^1H and ^{13}C NMR spectra were recorded in $CDCl_3$ on a JEOL-FX-100 spectrometer operating at 99.6 and 25.05 MHz respectively with TMS as internal standard. All reactions were performed under nitrogen. Column chromatography was performed using silica gel (Merck).

General procedure: Two or higher molar proportion of the substrates, 1.5-2 molar proportion of anhydrous $AlCl_3$ and one molar proportion of dichloroacetyl chloride were used. To the mixture of the substrate and the catalyst (0–10ºC) dichloroacetyl chloride was added drop-wise with constant stirring for a period of 1 hour. As both the substrates were liquids no other solvent was used in the reaction. After complete addition of the acylating agent the reaction mixture was heated at 70–80ºC for 5 hours cooled to room temperature (25ºC), poured into crushed ice and extracted with ethyl acetate, washed with water, dried over anhydrous sodium sulphate and solvent was removed under reduced pressure to furnish the binuclear compounds.

2,2-Dichloro-1,1-bis (4- dimethylaminophenyl) ethylene **(1)**: Compound **1** was crystallised from methanol as pale yellow crystals (yield 47%), m.p. 142ºC; ^1H NMR: δ 2.96 (s, 12H, NCH_3), 6.66 (d, *J* 8 Hz, 4 H C-3′, 5′-*H*), 7.18 (d, *J* 8 Hz, 4 H, C-2′, 6′-*H*); ^{13}C NMR: δ 40.2 q (CH_3), 111.8 d (C-3′, 5′), 114.9 s (C-2), 127.8 (C-1′). 130.4 d (C-2′, 6′), 140.6 s (C-1), 149.7 s (C-4′); *m/z* (%) 336 (M^++2, 65), 334 (M^+, 100), 300 (8), 264 (48), 204 (5), 176 (7) and 167 (22). (Found: C, 64.60; H, 6.0; N, 8.32. $C_{18}H_{20}N_2Cl_2$ requires C, 64.48; H, 6.01; N, 8.36%).

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† This is a Short Paper, there is therefore no corresponding material in *J Chem. Research (M).*

2,2-Dichloro-1,1-bis (4- diethylaminophenyl) ethylene **(2)**: It was crystallised from ethyl acetate as light yellow crystals (yield 52%), m.p. 140ºC; ^{1}H NMR: δ 1.16 (t, *J* 6 Hz, 12H, NCH_2CH_3), 3.36 (q, *J* 6 Hz, 8H, NCH_2CH_3), 6.62 (d, *J* 8 Hz, 4H, C-3′-*H*,C-5′-*H*), 7.16 (d, *J* 8 Hz, 4H, C-2′-*H*, C-6′-*H*); ^{13}C NMR: 12.65 q (CH_3), 22.18 t (CH_2), 110.5 (d, C-3′, 5′), 112.8 s (C-2), 126.8 s (C-1′), 130.9 d (C-2′, 6′), 140.7 s (C-1) and 147.1 s (C-4′); MS, *m/z* (%) 392 (M^++2, 65), 390 (M^+, 100), 375 (90), 345 (6), 331 (25), 246 (5) and 180 (30). (Found: C, 67.45; H, 7.20; N, 7.3. $C_{22}H_{28}N_2Cl_2$ requires C, 67.51; H, 7.21; N, 7.16%).

4-Acetamino-ω-ω-dichloroacetophenone was crystallised from menthol, m.p. 164ºC (lit.[10] m.p. 161–162ºC).

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