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SHORT COMMUNICATIONS

Regioselective [4+2]-Cycloaddition of Styrene to 4-Isopropoxalyl-1*H*-pyrrole-2,3-diones

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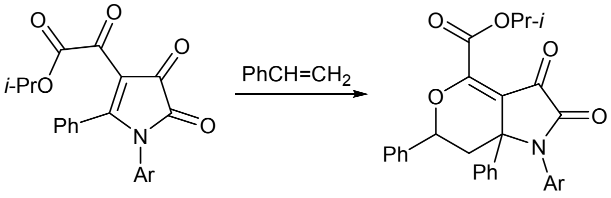
Reactions of 4-alkoxalyl-1*H*-pyrrole-2,3-diones with alkenes were not reported previously. We have found that isopropyl (1-aryl-4,5-dioxo-2-phenyl-4,5-dihydro-1*H*-pyrrol-3-yl)oxoacetates **Ia** and **Ib** react with styrene at a molar ratio of 1:1.5 on heating in boiling anhydrous *m*-xylene (reaction time 15–16 h; until disappearance of bright orange color typical of initial pyrrolediones **I**) to give isopropyl 1-aryl-1,2,3,6,7,7a-hexahydro-2,3-dioxo-6,7a-diphenyl-pyrano[4,3-*b*]pyrrole-4-carboxylates **IIa** and **IIb**.



Ia, **Ib** → **IIa**, **IIb**

Ar = Ph (**a**), 4-MeOC$_6$H$_4$ (**b**).

Presumably, compounds **IIa** and **IIb** are formed as a result of thermally initiated [4+2]-cycloaddition of the conjugated O=C–C=C bond system in pyrroles **Ia** and **Ib** to the polarized exocyclic C=C bond in styrene molecule.

Isopropyl 2,3-dioxo-1,6,7a-triphenyl-1,2,3,6,7,7a-hexahydropyrano[4,3-*b*]pyrrole-4-carboxylate (IIa). A solution of 1.5 mmol of styrene was added to a solution of 1.0 mmol of compound **Ia** in 25 ml of anhydrous *m*-xylene, and the mixture was heated for 15 h under reflux. The mixture was cooled, and the precipitate was filtered off and recrystallized from ethyl acetate. Yield 87%, mp 240–242°C. IR spectrum, ν, cm^{-1}: 1728, 1701. ^{1}H NMR spectrum, δ, ppm: 1.19 d (3H, Me, J = 6.3 Hz), 1.28 d (3H, Me, J = 6.3 Hz), 2.62 t (1H, 7-H, J = 12.9 Hz), 2.69 d.d (1H, 7-H, J = 12.9, 3.6 Hz), 5.07 m (1H, C**H**Me$_2$), 5.67 d.d (1H, 6-H, J = 12.9, 3.6 Hz), 7.28–7.79 m (15H, H$_{\text{arom}}$). Found, %: C 74.41; H 5.35; N 2.97. C$_{29}$H$_{25}$NO$_5$. Calculated, %: C 74.50; H 5.39; N 3.00.

Isopropyl 1-(4-methoxyphenyl)-2,3-dioxo-6,7a-diphenyl-1,2,3,6,7,7a-hexahydropyrano[4,3-*b*]pyrrole-4-carboxylate (IIb) was synthesized in a similar way. Yield 84%, mp 217–219°C (from toluene). IR spectrum, ν, cm^{-1}: 1725, 1700. ^{1}H NMR spectrum, δ, ppm: 1.20 d (3H, Me, J = 6.2 Hz), 1.30 d (3H, Me, J = 6.2 Hz), 2.62 t (1H, 7-H, J = 12.9 Hz), 2.63 m (1H, 7-H), 3.77 s (3H, OMe), 5.06 m (1H, C**H**Me$_2$), 5.63 m (1H, 6-H), 7.03–7.80 m (14H, H$_{\text{arom}}$). Found, %: C 72.35; H 5.43; N 2.80. C$_{30}$H$_{27}$NO$_6$. Calculated, %: C 72.42; H 5.47; N 2.82.

The IR spectra were recorded on FSM-1201 (**IIa**) and Specord 75IR spectrometers (**IIb**) from samples dispersed in mineral oil. The ^{1}H NMR spectra were obtained on a Bruker AM-400 instrument at 400 MHz using DMSO-d_6 as solvent and tetramethylsilane as internal reference.

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