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SHORT COMMUNICATIONS

Spiro-Heterocyclization of 1*H*-Pyrrole-2,3-dione at the Treatment with 3-Arylamino-1*H*-inden-1-ones

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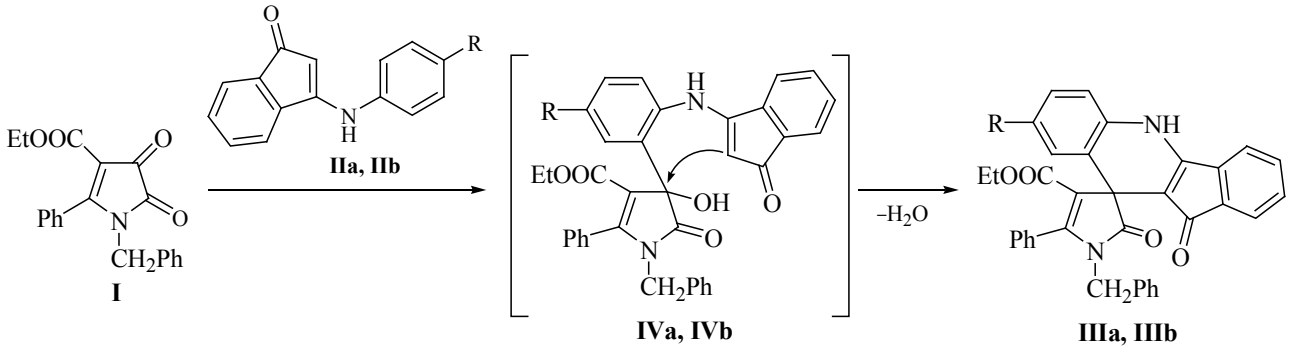
The [3+3]-nucleophilic addition [1] and spiro-heterocyclization [2] of substituted 1*H*-pyrrole-2,3-diones were described effected by cyclic enamines involved into the reactions in both cases as CH,NH 1,3-binucleophiles.

In the reaction of equimolar amounts of 1-benzyl-5-phenyl-4-ethoxycarbonyl-1*H*-pyrrole-2,3-dione (**I**) [3] and 3-arylamino-1*H*-inden-1-ones **IIa, IIb** by boiling the reagents in anhydrous *m*-xylene solution at 139–140°C over 5–6 h we obtained ethyl 1'-benzyl-2',7-dioxo-5'-phenyl-1,6-dihydro-1'*H*-spiro(indeno[1,2-*b*]quinoline-6,3'-pyrrole)-4'-carboxylates **IIIa, IIIb** whose structure was established by means of XRD analysis.



R = H (a), OMe (**b**).

The formation of compounds **IIIa, IIIb** evidently proceeded through initial addition of the activated CH group located in the *ortho*-position of the aryl substituent of cyclic enamines **IIa, IIb** to the carbon atom in the position *3* of pyrroledione **I**, the formation of intermediate compounds **IVa, IVb** followed by the intramolecular cyclization involving the β-CH group of the enamine fragment of reagents **IIa, IIb**.

This reaction is the second example of the direct spiro-heterocyclization of the substituted 1*H*-pyrrole-2,3-dione under the action of N-aryl-substituted enamines involved into the reaction as CH,CH 1,5-binucleophiles [4], and also of the synthesis of difficultly accessible heterocyclic system of spiro(indeno[1,2-*b*]quinoline-6,3'-pyrrole).

Ethyl 1'-benzyl-2',7-dioxo-5'-phenyl-1,6-dihydro-1'*H*-spiro(indeno[1,2-*b*]quinoline-6,3'-pyrrole)-4'-carboxylate (IIa). A solution of 1.0 mmol of pyrroledione **I** and 1.0 mmol of enamine **IIa** in 15 ml of anhydrous *m*-xylene was boiled for 5 h, cooled, the formed orange precipitate was filtered off. Yield 54%,

mp 239–241°C (ethyl acetate). IR spectrum, ν, cm^{-1}: 3252, 1694, 1688, 1626. ^{1}H NMR spectrum, δ, ppm: 0.60 t (3H, $CH_2C\underline{H}_3$, *J* 7.1 Hz), 3.58 q (2H, $C\underline{H}_2CH_3$, *J* 7.1 Hz), 4.51 d, 4.67 d (2H, $C\underline{H}_2Ph$, *J* 16.3 Hz), 7.08–7.67 group of signals ($18H_{arom}$), 11.02 s (1H, NH). Found, %: C 77.98; H 4.84; N 5.15. $C_{35}H_{26}N_2O_4$. Calculated, %: C 78.05; H 4.87; N 5.20.

Ethyl 1'-benzyl-4-methoxy-2',7-dioxo-5'-phenyl-1,6-dihydro-1'*H*-spiro(indeno[1,2-*b*]quinoline-6,3'-pyrrole)-4'-carboxylate (IIb) was similarly obtained. Yield 59%, mp 293–294°C (ethyl acetate). IR spectrum, ν, cm^{-1}: 3195, 1686, 1622. ^{1}H NMR spectrum, δ, ppm: 0.61 t (3H, $CH_2C\underline{H}_3$, *J* 7.0 Hz), 3.58 m (2H, $C\underline{H}_2CH_3$), 3.69 s (3H, OMe), 4.57 d, 4.61 d (2H, $C\underline{H}_2Ph$, *J* 16.1 Hz), 6.50–7.64 group of signals ($17H_{arom}$), 11.02 s (1H, NH). Found, %: C 75.97; H 4.91; N 4.90. $C_{36}H_{28}N_2O_5$. Calculated, %: C 76.04; H 4.96; N 4.93.

IR spectra of compounds obtained were recorded on a spectrophotometer FSM -1201 from mulls in mineral oil. ^{1}H NMR spectra were registered on a spectrometer Bruker AM-400 (operating frequency 400 MHz) in DMSO-d_6, internal reference TMS.

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