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PHOSPHORYLATION OF 2,8-DIMETHYL-5,6-DIHYDRO-PYRROLO[1,2-*a*;2',1'-*c*]PYRAZINE

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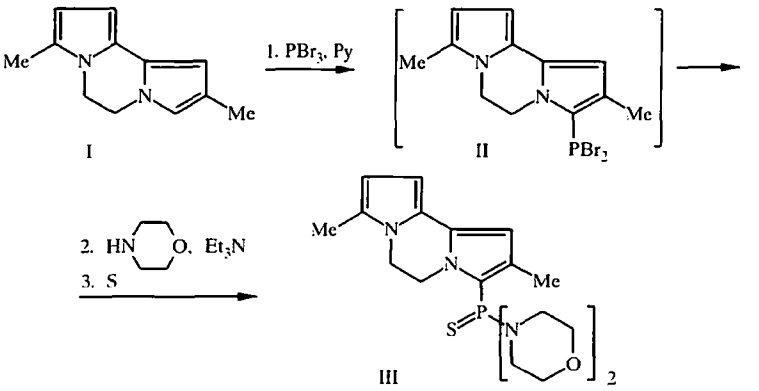
Alkylpyrroles are phosphorylated with phosphorus tribromide under basic conditions by the electrophilic substitution mechanism [1,2]. We were interested in the possibility of phosphorylation of such little studied class of heterocycles as dipyrrolopyrazines for which electrophilic substitution in nitration, aminomethylation, and azo coupling reactions has been shown to occur predominantly at the α-position of the pyrrole ring [1, 2].

It was observed that 2,8-dimethyl-5,6-dihydropyrrolo[1,2-*a*;2',1'-*c*]pyrazine (I) reacted with phosphorus tribromide to give dibromophosphine II which was converted to thiophosphonic acid diamide III in 40% yield by treatment with morpholine and sulfur:



2,8-Dimethyl-5,6-dihydropyrrolo[1,2-*a*;2',1'*c*]pyrazin-3-yl(dimorpholino)phosphine Sulfide. Solution of phosphorus tribromide (1 mmol) in benzene (2ml) was added to ice-cooled solution of dipyrrolopyrazine I (1 mmol) and pyridine (1 mmol) in benzene (2 ml) under stirring. The mixture was kept at this temperature for 1 h. Heptane (5 ml) was added, the precipitate was filtered off, and solution of morpholine (2 mmol) and triethylamine (3 mmol) in heptane (5 ml) was added to the filtrate and the mixture was kept at room temperature for 2 h. The precipitate was filtered off, sulfur (1 mmol) was added to the filtrate and the mixture was heated for 1 h at 80°C. The solution was evaporated to dryness, and the dry residue was chromatographed (1:3 ethyl acetate-petroleum ether (70-100°)) on silica gel (100/160); R_f 0.44. The product was recrystallized from heptane. Yield 40%; mp 163°C (heptane). ^{31}P NMR spectrum ($CDCl_3$): 63.32 ppm, external standard 85% H_3PO_4. ^{1}H NMR spectrum ($CDCl_3$, TMS): 2.23 (3H, br. s, 2-CH_3); 2.32 (3H, d, $J_{CH_3,H}$ = 0.8 Hz, 8-CH_3); 3.03-3.26 (8H, m, CH_2N); 3.61-3.70 (8H, m. CH_2O); 4.02 (2H, m, 6-CH_2); 4.85 (2H, m 5-CH_2); 5.92 (1H, dq, $J_{9,10}$ = 3.5 Hz, J_{H,CH_3} = 0.8 Hz, 9-H); 6.08 (1H, d, $J_{H,P}$ = 3.4 Hz, 1-H); 6.24 ppm (1H, d, $J_{10,9}$ = 3.6, 10-H).

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REFERENCES

1. A. A. Tolmachev, S. P. Ivonin, A. V. Kharchenko, and E. S. Kozlov, *Zh. Org. Khim.*, **62**, 465 (1992).
2. A. A. Tolmachev, S. P. Ivonin, A. A. Chaikovskaya, and T. E. Terikovskaya, *Zh. Org. Khim.*, **65**, 2059 (1995).
3. V. I. Terenin, E. L. Ruchkina, K. V. Karapetyan, V. M. Mamaev, and Yu. G. Bundel', *Khim. Geterotsikl. Soedin.*, No. 11, 1566 (1995).
4. V. I. Terenin, E. L. Ruchkina, I. F. Leshcheva, A. P. Pleshkova, and Yu. G. Bundel', *Khim. Geterotsikl. Soedin.*, No. 1, 52 (1997).