Chemistry of Heterocyclic Compounds, Vol. 44, No. 2, 2008

SYNTHESIS OF 1,3-DIAZAPYRENES FROM BENZO[*f*]QUINAZOLINES

I. V. Aksenova[1], A. V. Aksenov[1], A. A. Zamorkin[1], and V. I. Goncharov[2]

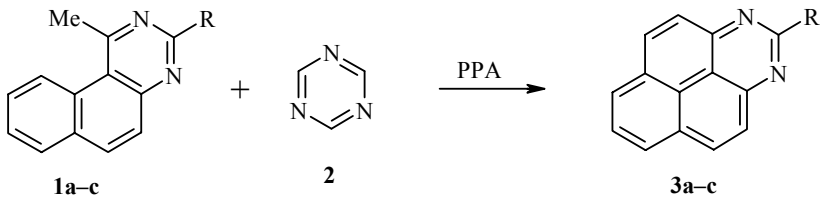
Methods have been developed for the synthesis of 1,3-diazapyrenes based on the reactions of 1-methylbenzo[f]quinazolines with DMF dimethyl acetal or with 1,3,5-triazine in PPA.

Keywords: benzo[*f*]quinazolines, 1,3-diazapyrenes, DMF dimethyl acetal, PPA (polyphosphoric acid), 1,3,5-triazine, condensation, cyclization.

We have previously developed methods for the synthesis of 1,3-diazapyrenes **3** based on the annelation of a carbocyclic *peri*-ring to perimidines [1-3], of a heterocyclic *peri*-ring [3, 4], or closing of a heterocyclic ring with simultaneous annelation of a carbocyclic *peri*-ring [3, 5]. Methods based on the formation of a C(4)–C(5) bond were previously not known hence we propose a series of such methods in this work.

We have chosen the available 1-methylbenzo[*f*]quinazolines **1** as precursors of the diazapyrenes **3**.

It has been shown that the reaction of compound **1** with 1,3,5-triazine (**2**) in PPA* gives the diazapyrenes **3** in 22-31% yield.



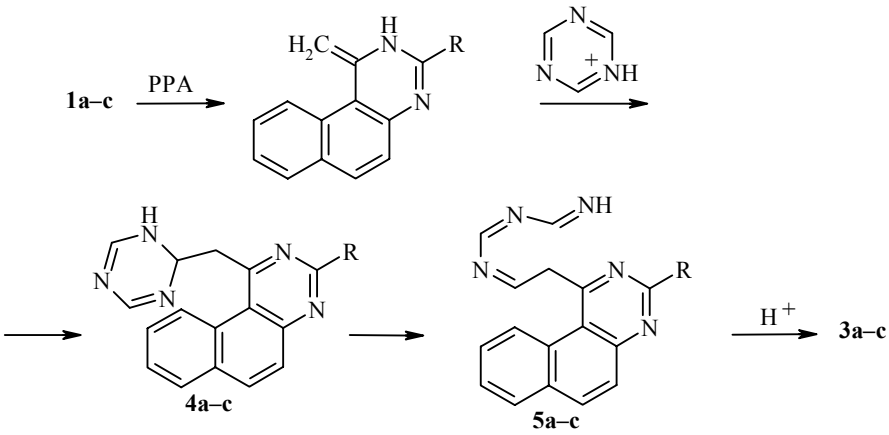
1a–c **2** **3a–c**

1, 3 a R = H, **b** R = Me, **c** R = Ph

The reaction probably includes the formation of the dihydrotriazine **4**, subsequent opening of the ring to give compound **5**, and cyclization of the latter to the diazapyrenes **3**. Attempts to carry out this reaction with substituted triazines were not successful, probably because of steric hindrances to nucleophilic attack.

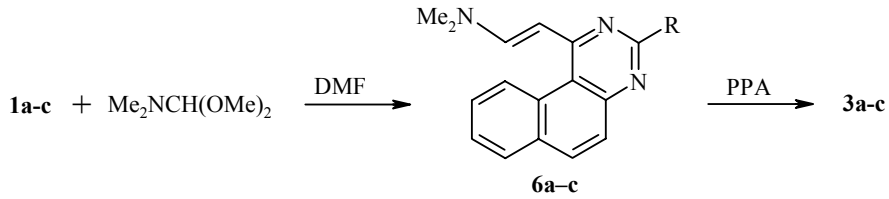
* PPA with an 86% content of P_2O_5 was obtained as in method [6]

[1]Stavropol State University, Stavropol 355009, Russia; e-mail: k-biochem-org@stavsu.ru. [2]Stavropol State Medical Academy, Stavropol 355017, Russia; e-mail: sgma@statel.stavropol.ru. Translated from Khimiya Geterotsiklicheskikh Soedinenii. No. 2, pp. 260-262, February, 2009. Original article submitted June 20, 2007.



4, 5 a R = H, **b** R = Me, **c** R = Ph

An intermediate compound similar to **5** can be prepared using DMF dimethyl acetal and was used by us in the following part of the work for synthesis of **3**. We have shown that refluxing compound **1** with DMF dimethyl acetal in DMF and subsequent work up without purification of the intermediate products **6** with PPA gives the diazapyrenes **3** in 42-68% yield.



6 a R = H, **b** R = Me, **c** R = Ph

EXPERIMENTAL

NMR spectra were obtained on a Bruker WP-200 instrument (200 MHz) using TMS as internal standard. Monitoring of the reaction course and purity of the synthesized compounds was carried out on Silufol UV-154 plates with ethyl acetate as solvent. Flash chromatography was performed by method [7] (column: *d* = 60 mm, *l* = 50 mm) using benzene as the low polarity and ethyl acetate as the polar solvent.

Synthesis of 1,3-diazapyrenes 3a-c (General Method). A. *Use of 1,3,5-triazine in* PPA. A mixture of the corresponding benzo[*f*]quinazoline **1** (1 mmol), 1,3,5-triazine (0.12 g, 1.5 mmol), and PPA (4 g) was stirred for 6 h at 100°C. The reaction mixture was poured into water (30 ml), basified with ammonia solution to pH ~ 7-8, extracted with ethyl acetate (3×30 ml), and the solvent was evaporated. The residue was separated by flash chromatography.

B. *Use of DMF dimethyl acetal*. A mixture of the corresponding benzo[*f*]quinazoline **1** (1 mmol) and DMF dimethyl acetal (0.238 g, 2 mmol) in absolute DMF (3 ml) was heated for 60 h at 130ºC and the DMF and residual dimethyl acetal were distilled of *in vacuo*. The reaction mixture was worked up as in method A.

1,3-Diazapyrene (3a). Yield by method A 0.055 g (27%), yield by method B 0.124 g (61%); mp 179-181°C (octane) (mp 179-181°C [1]). A sample mixed with a known sample did not show a melting point depression. The ^{1}H NMR spectrum was identical to that given in [1].

2-Methyl-1,3-diazapyrene (3b). Yield by method A 0.048 g (22%), by method B 0.092 g (42%); mp 178-179ºC (octane) (mp 180-180.5ºC [5]). The ^{1}H NMR spectrum was identical to that given in [5].

2-Phenyl-1,3-diazapyrene (3c). Yield by method A 0.087 g (31%), by method B 0.19 g (68%); mp 224-226ºC (octane) (mp 226ºC [4]). The ^{1}H NMR spectrum was identical to that given in [4].

REFERENCES

1. I. V. Borovlev, O. P. Demidov, and A. F. Pozharskii, *Khim. Geterotsikl. Soedin.*, 1109 (2002). [*Chem. Heterocycl. Comp.*, **38**, 968 (2002)].
2. I. V. Borovlev, A. V. Aksenov, and A. F. Pozharskii, *Khim. Geterotsikl. Soedin.*, 1579 (1997). [*Chem. Heterocycl. Comp.*, **33**, 1367 (1997)].
3. I. V. Borovlev and O. P. Demidov, *Khim. Geterotsikl. Soedin.*, 1612 (2003). [*Chem. Heterocycl. Comp.*, **39**, 1417 (2003)].
4. R. Neidlein and Z. Behzadi, *Chem. Ztg.*, **102**, 199 (1978).
5. A. Edel, P. A. Marnot, and J. P. Sauvage, *Tetrahedron Lett.*, **26**, 727 (1985).
6. F. Uhlig, *Angew. Chem.*, **66**, 435 (1954).
7. J. T. T. Sharp, I. Cosney, and A. G. Rowley, *Practical Organic Chemistry, A Handbook Guide* [Russian translation], Mir, Moscow (1993), p. 193.