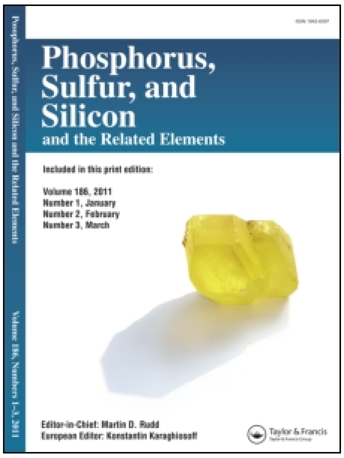


Phosphorus, Sulfur, and Silicon and the Related Elements
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713618290

NOVEL HETEROCYCLIC COMPOUNDS VIA AZA- AND BIS-AZA-WITTIG REACTIONS

Hamad Z. Alkhathlan[a]; Hamad A. Al-lohedan[a]
[a] Department of Chemistry, King Saud University, Riyadh, Saudi Arabia

To cite this Article Alkhathlan, Hamad Z. and Al-lohedan, Hamad A.(1991) 'NOVEL HETEROCYCLIC COMPOUNDS VIA AZA- AND BIS-AZA-WITTIG REACTIONS', Phosphorus, Sulfur, and Silicon and the Related Elements, 63: 3, 301 — 305
To link to this Article: DOI: 10.1080/10426509108036833
URL: http://dx.doi.org/10.1080/10426509108036833

Phosphorus, Sulfur, and Silicon, 1991, Vol. 63, pp. 301–305
Reprints available directly from the publisher
Photocopying permitted by license only

NOVEL HETEROCYCLIC COMPOUNDS VIA AZA- AND BIS-AZA-WITTIG REACTIONS

HAMAD Z. ALKHATHLAN and HAMAD A. AL-LOHEDAN
Department of Chemistry, King Saud University, P.O. Box 2455, Riyadh-11451, Saudi Arabia

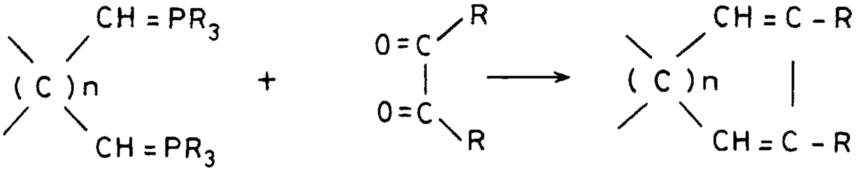
(Received May 22, 1991; in final form July 18, 1991)

Two quinoxaline derivatives, **1** and **2**, were prepared via a bis-aza-Wittig reaction when the suitable aromatic diamine was treated with $(MeO)_3PBr_2/Et_3N$ followed by the addition of benzil. Also, two additional novel heterocyclic compounds, **4** and **6** were prepared via an intramolecular aza-Wittig reaction.

Key words: Quinoxaline; bis-aza-Wittig; heterocycles.

INTRODUCTION

The Wittig reaction and all of its modifications, have always been used with great utility in the field of organic synthesis. Two of its modifications, with interest to us, are the aza- and the bis-Wittig reactions. The latter one has previously been applied for the synthesis of a variety of cyclic compounds with different ring sizes (Equation 1).[1] On the other hand the aza-Wittig reaction has also been used, with different approaches, for the synthesis of many types of heterocyclic compounds.[2]



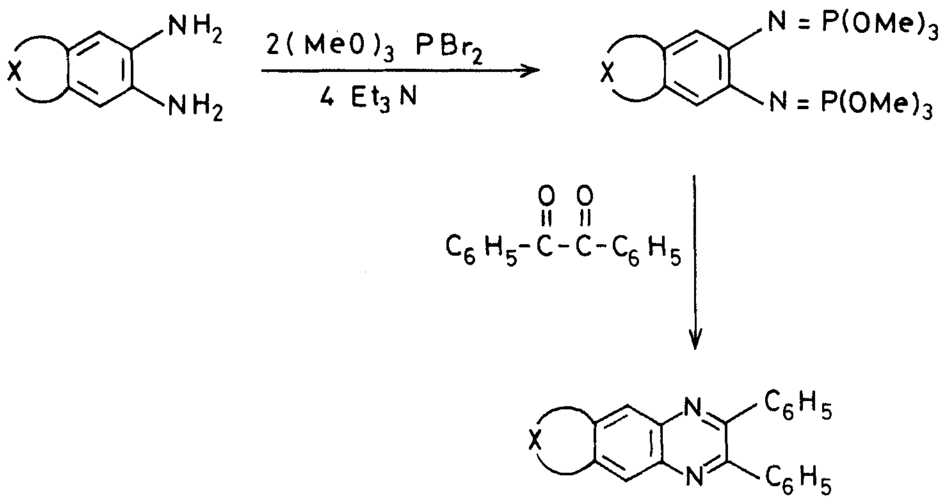
(1)

Recently, we investigated the ability of a variety of reagents to promote an intramolecular aza-Wittig reaction.[3] It was found then that trimethylphosphite-dibromide was the best reagent, among the ones tested, in giving the highest yields and the most convenient reaction conditions.

We now wish to report the application of this reagent in a new modification of the Wittig reaction, which we call the bis-aza-Wittig reaction. Furthermore, some more examples of the intramolecular version are also reported.

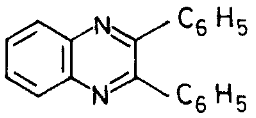
RESULTS AND DISCUSSION

The general approach for the bis-aza-Wittig reaction is the treatment of a suitable diamino compound with two equivalents of $(MeO)_3PBr_2$ and four equivalents of triethylamine. After refluxing this reaction mixture for about an hour, one equivalent of benzil is added and reflux is continued. After the addition of water the

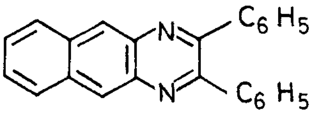


SCHEME I

heterocyclic compounds can be obtained by extracting with an organic solvent (Scheme I). The heterocyclic compounds prepared via this method are the quinoxaline derivatives **1** and **2**. These types of compounds have previously been prepared by the condensation of diamines with dicarbonyl compounds in acidic media.[4,5] Although the yields of the previously known method are compatible with our yields, the present method allows milder conditions for the preparation of these types of compounds.



1



2

The two quinoxaline derivatives **1** and **2** showed somewhat simple and similar spectra in the ^{13}C NMR. This is probably due to the symmetry present in both of them. The signal for the C=N was at 153.3 ppm for compound **1** and at 153.8 ppm for compound **2**. The detailed NMR studies of these compounds are shown in Tables I and II.

TABLE I

^1H-NMR data for compounds **1**, **2**, **4**, and **6**

Compound	Chemical shift (δ, ppm from TMS)
1(a)	7.5 (m, 10H); 7.8 (m, 2H); 8.2 (m, 2H)
2(a)	7.5 (m, 10H); 8.7 (m, 4H); 9.7 (s, 2H)
4(a)	7.6 (m, 5H); 7.8 (m, 4H); 8.1 (d, J = 5.2 Hz, 1H)
6(b)	7.7 (m, 4H); 8.6 (m, 6H)

a: In $CDCl_3$.
b: In $CDCl_3$/DMSO-d_6.

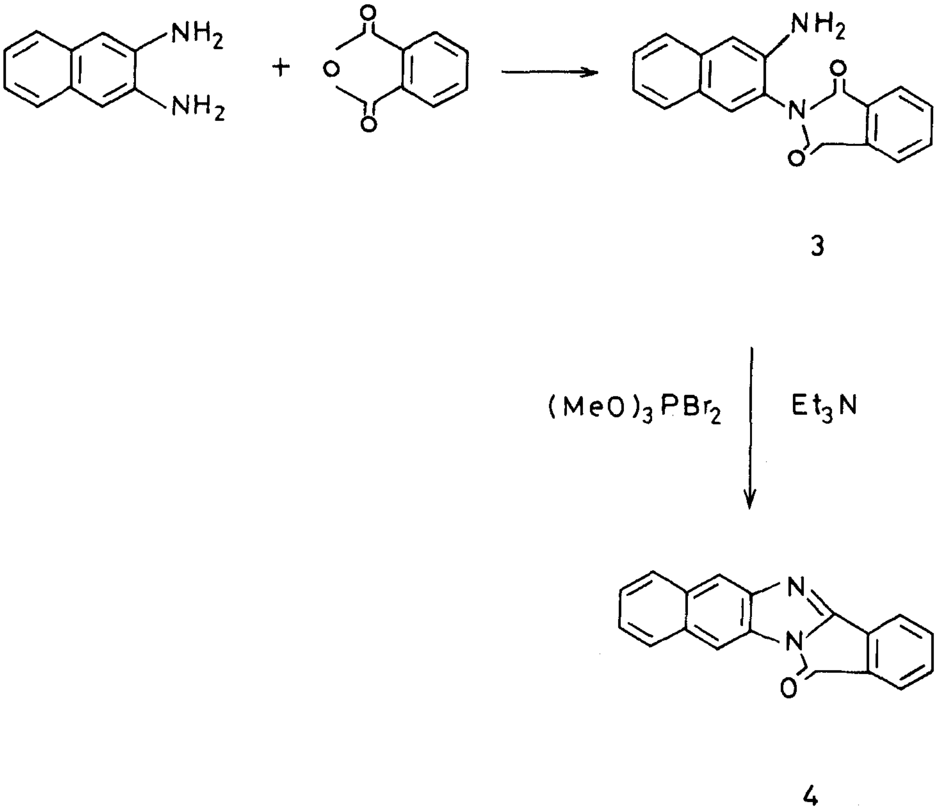
TABLE II

^{13}C-NMR data for compounds **1**, **2**, **4**, and **6**

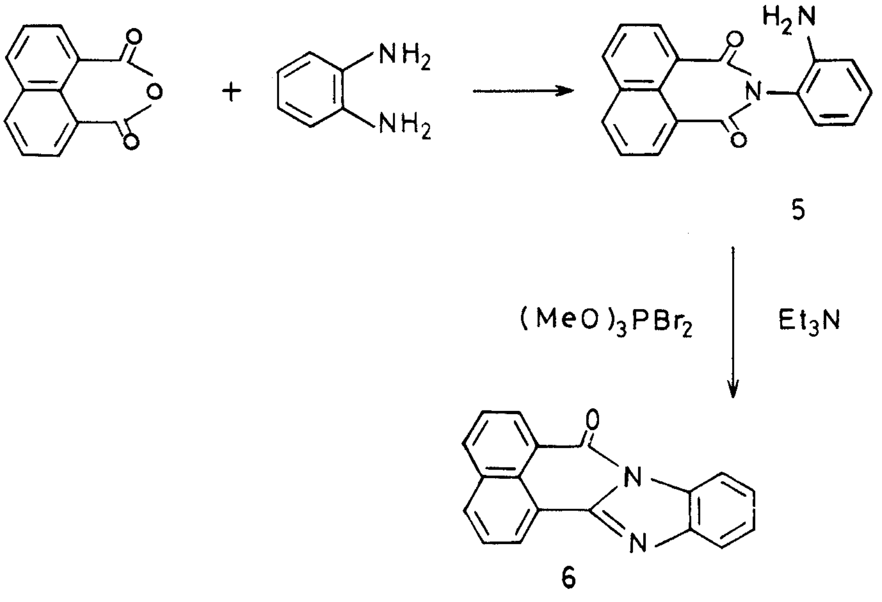
Compound	Chemical shift (δ, ppm from TMS)
1(a)	128.2; 128.8; 129.2; 129.8; 130; 138.9; 139.1; 141.1; 153.3
2(a)	126.8; 127.4; 128.2; 128.5; 129.1; 130; 134.2; 137.7; 138.8; 153.8
4(a)	110; 118; 123; 125.5; 126; 126.5; 128; 129; 132; 132.5; 133; 135; 137; 142.5; 150; 165
6(b)	118; 118.5; 119; 120; 123; 123.2; 127; 127.5; 129; 130; 131; 131.5; 133; 134; 135.5; 141; 147; 163.3

a: In $CDCl_3$.
b: In $CDCl_3$/DMSO-d_6.

In addition to the bis-aza-Wittig reaction, the $(MeO)_3PBr_2/Et_3N$ method was used to prepare two novel heterocyclic compounds according to Schemes II and III. The spectral data of compounds **1**, **2**, **4**, and **6** are shown in Tables I and II. Further applications of these types of reactions are still being investigated in our laboratory.



SCHEME II



SCHEME III

EXPERIMENTAL

All melting points are uncorrected. NMR spectra were obtained on a Jeol FX 100 (100 MHz) instrument with TMS as an internal standard in the indicated solvents.

General procedure for the bis-aza-Wittig reaction. A dichloromethane solution of two equivalents of $(MeO)_3PBr_2$ was added to a stirred solution of one equivalent of the diamine in CH_2Cl_2. Four equivalents of triethylamine were then added dropwise and the mixture was refluxed for one hour. To this solution, one equivalent of benzil was added followed by reflux for 12 hours. Addition of water followed by extraction with chloroform affored the desired product.

2,3-Diphenylquinoxaline, **1**. This compound was obtained according to the above procedure from 1,2-phenylenediamine and benzil. 57% yield, mp 120°C (mp 124°C).[4]

Anal. Calc. for $C_{20}H_{14}N_2$: C, 85.08; H, 4.99, N, 9.92.
Found: C, 85.35; H, 4.99; N, 10.01.

2,3-Diphenylbenzo[g]quinoxaline, **2**. This compound was obtained analogously from 2,3-diaminonaphthalene and benzil. 60% yield, mp 183°C (mp 185°C).[5]

Anal. Calc. for $C_{24}H_{16}N_2$: C, 86.72; H, 4.85, N, 8.42.
Found: C, 86.66; H, 4.91; N, 8.27.

N-[2-(3-Aminonaphthyl)]phthalimide, **3**. This compound was prepared by refluxing 2,3-diaminonaphthalene with an equimolar amount of phthalic anhydride in THF. 38% yield, mp 284–286°C. ^{1}H-NMR (DMSO-d_6): δ 7.4 (m, 2H); 7.7 (m, 2H); 8.0 (m, 6H).

Anal. Calc. for $C_{18}H_{12}N_2O_2$: C, 74.98; H, 4.19; N, 9.71.
Found: C, 75.19; H, 4.31; N, 9.92.

13H-naphtho[2',3':4,5]imidazo[2,1-a]isoindolo-13-one, **4**. A dichloromethane solution of $(MeO)_3PBr_2$ was added to a suspension of an equimolar amount of **3** in the same solvent. Two equivalents of triethylamine were added dropwise and the mixture was then refluxed for 10 hours. Water was added and the mixture was extracted with $CHCl_3$. The combined organic layers were dried, and the solvent was evaporated to obtain the product in pure form. 50% yield, mp 286–288°C.

Anal. Calc. for $C_{18}H_{10}N_2O$: C, 79.98; H, 3.70; N, 10.37.
Found: C, 79.98; H, 3.69; N, 10.57.

N-[2-Aminophenyl]-1,8-naphthimide, **5**. A solution of 1,8-naphthoic anhydride in DMSO was heated at 80°C with an equimolar amount of 1,2-phenylenediamine. Water was added and the resulting solid was filtered off and washed with hot ethanol. 75% yield, mp 225–226°C. ^{1}H NMR (DMSO-d_6): δ 5.2 (b, 2H); 6.7 (m, 2H); 7.1 (m, 2H); 7.8 (m, 2H); 8.5 (m, 4H). ^{13}C-NMR: δ 115; 119; 120.5; 123; 127; 127.5; 128; 129; 129.5; 130; 131; 132; 132.5; 134; 135; 146; 163.5.

Anal. Calc. for $C_{18}H_{12}N_2O_2$: C, 74.98; H, 4.19; N, 9.71.
Found: C, 75.38; H, 4.09; N, 10.01.

12H-Naphtho[1',8',8'a-3,4,5]pyrido[1,2-a]benzimidazole-12-one, **6**. This compound was obtained according to the procedure outlined for compound **4**. 34% yield, mp 215–218°C.

Anal. Calc. for $C_{18}H_{10}N_2O$: C, 79.98; H, 3.70; N, 10.37.
Found: C, 80.41; H, 3.85; N, 10.47.

ACKNOWLEDGEMENT

We would like to acknowledge the financial support of King Saud University, College of Science Research Center, Project No. Chem/1409/01 and Chem/1409/14.

REFERENCES

1. For a review see: K. Peter and C. Vollhardt, *Synthesis*, 765 (1967).
2. See for example: a) H. Alkhathlan and H. Zimmer, *J. Heterocyclic Chem.*, **25**, 1407 (1988); b) L. Bruche, L. Garauti and G. Zecchi, *Synthesis*, 304 (1985); C. H. B. Stegmann, D. Klotz, and J. E. Weiss, *Chem. Ber.*, **118**, 4632 (1985); d) H. Takeuchi and S. Eguchi, *Tetrahedron Lett.*, 3313 (1989); e) P. Molina, M. Alajarin and A. Vidal, *Ibid*, 3849 (1988).
3. H. Alkhathlan and H. Al-Lohedan, *Phosphorus, Sulfur, and Silicon*, in press, 1991.
4. R. W. Bost and E. E. Towell, *J. Am. Chem. Soc.*, **70**, 904 (1948).
5. H. Goldstein and M. Streuli, *Helv. Chem. Acta.*, **20**, 650 (1937).