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[a006]

2-NITROBENZOFURAN AS DIENOPHILE IN DIELS-ALDER REACTIONS. A SIMPLE DIBENZOFURANS SYNTHESIS.

Claudia Della Rosa, Maria Kneeteman, Pedro Mancini*

Área Química Orgánica- Departamento de Química- Facultad de Ingeniería Química, Universidad Nacional del Litoral. Santiago del Estero 2829. (3000) Santa Fe, Argentina.
FAX: +54-342-4571162. *e-mail:pmancini@fiq.unl.edu.ar

Abstract. 2-nitrobenzofuran is studied in Diels-Alder reactions under thermal conditions. A concise synthesis of dibenzofurans has been developed via cycloaddition reactions.

Keywords: 2-nitrobenzofuran, dienophiles, Diels-Alder

Introduction

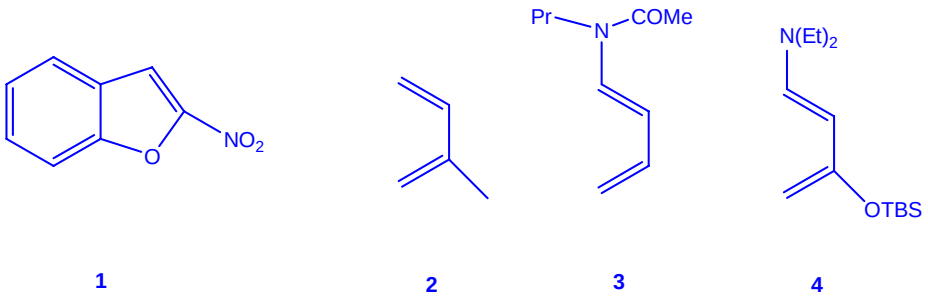
Dibenzofurans are important heteroaromatic compounds, which display a wide variety of biological activities. The dibenzofuran-containing phytoalexins show manifold biological activities, eliciting a strong interest from chemists and biologists.[1] Considerable effort has been devoted to the development of efficient methods for the construction of these ring system. [2,3,4] Most of the present procedures involve several steps, and the overall yields usually are not very good.

Herein, we report a simple, economical and efficient one-step procedure to synthesize the dibenzofuran ring systems in good to excellent yields through the Diels-Alder reaction of 2-nitrobenzofuran and diverse dienes.

We have reported that aromatic nitroheterocyclic act as dienophiles in Diels-Alder reactions.[5,6,7,8] A very strong electron-acceptor group, such as nitro group, push the dienophilic character of these heterocyclics and owing to this substituent is easily extrused under thermal conditions makes this reaction sequence a simple method of organic compound´s families with heteroatom rings preparation.

Results and discussion

This research was carried out using 2-nitrobenzofuran (1) as dienophile. Isoprene (2), 1-*N*-acetyl-*N*-propyl-1,3-butadiene (3) and 1-diethyl-amino-3-*tert*-butyldimethyl-siloxy-1,3-butadiene (Rawal´s diene) (4) were chosen as the diene partners (Scheme 1).

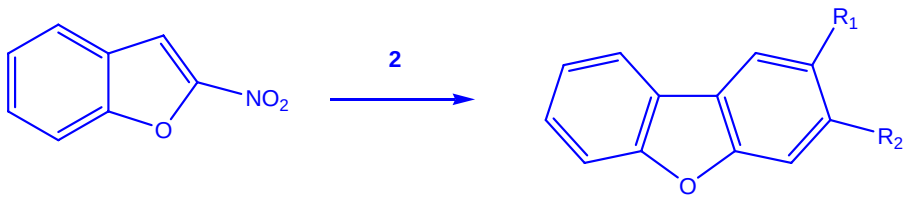


1 **2** **3** **4**

Scheme 1

When 2-nitrobenzofuran was reacted with the above-mentioned dienes under different reaction conditions, it showed its dienophilic character taking part in DA cycloaddition reactions.

The thermal reactions of 2-nitrobenzofuran 1 with 2 in a sealed ampoule at 150 ºC or 200 ºC for 72 h using benzene as solvent afforded the mixture of isomeric cycloadducts **5a** and **5b** with reasonable yield (Scheme 2, Table 1).



5a R_1=Me, R_2=H
b R_1=H, R_2=Me

Scheme 2

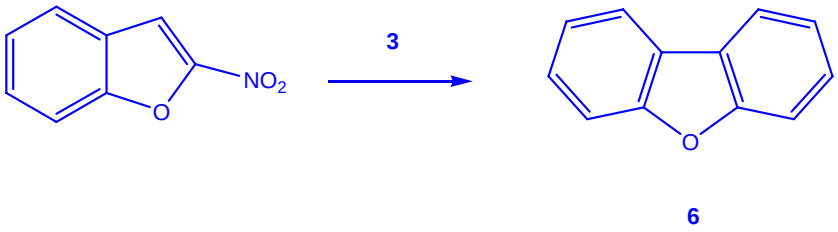
Table 1. Diels-Alder reactions of 2-nitrobenzofuran with isoprene

D:D[a]	T (ºC)	Time	Product	Yield[b]
12:1	200	72 h	**5a, 5b**	70%
12:1	150	72 h	**5a, 5b**	70%

[a] Diene/Dienophile ratio

[b] Based on consumed dienophile

On the other hand, reactions of 1 with 1-*N*-acetyl-*N*-propyl-1,3-butadiene 3 afforded dibenzofuran 6 with loss of *N*-acetyl-*N*-propyl and nitro groups (Scheme 3, Table 2).



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Scheme 3

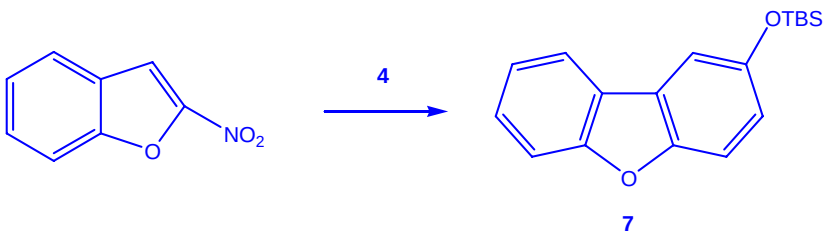
Table 2. Diels-Alder reactions of 2-nitrobenzofuran with 1-*N*-acetyl-*N*-propyl-1,3-butadiene

D:D[a]	T (ºC)	Time	Product	Yield[b]
3:1	140	72 h	6	65%
3:1	120	72 h	6	70%

[a] Diene/Dienophile ratio

[b] Based on consumed dienophile

In the same way, in the reactions with Rawal´s diene cycloadduct 7 was obtained with good yield and complete regioselectivity (Scheme 4, Table 3). This product resulted from the expected aromatization of the nitro-adduct promoted by the loss of the nitro and diethylamine groups, respectively.



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Scheme 4

Table 3. Diels-Alder reactions of 2-nitrobenzofuran with Rawal´s diene

D:D[a]	T (ºC)	Time	Product	Yield[b]
2:1	Reflux Tol.	48 h	7	75%
2:1	Reflux Tol.	72 h	7	85%

[a] Diene/Dienophile ratio

[b]Based on consumed dienophile

By analogy, the reactions of nitrobenzofurans with dienes 2,3 and 4 could be considered a domino process that is initialized by a polar DA reaction; the latter concerted elimination of nitrous acid from the [2+4] cycloadduct yields the corresponding dibenzofurans.

Conclusion

In conclusion, we have developed a simple, economical and efficient one-step procedure to synthesize the dibenzofuran ring systems in good to excellent yields through the Diels-Alder reaction of 2-nitrobenzofuran and diverse dienes.

This route should be applicable for the preparation of many biologically interesting molecules.

Acknowledgement

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