Chinese Chemical Letters Vol. 15, No. 1, pp 5 – 6, 2004
http://www.imm.ac.cn/journal/ccl.html

Synthesis of Large-ring Cycloalkanediones from Bis-Grignard Reagent and Dinitriles

Bing Qin YANG*, Ju Li JIANG, Yin Juan BAI, Jun LU, Zhen SHI

Department of Chemistry, Northwest University, Xi' an 710069

Abstract: 1, 6-Cyclododecanedione and 1, 8-cyclotetradecanedione were prepared from bis-Grignard reagent and dinitriles. This is a convenient synthetic method for large-ring cycloalkanediones.

Keywords: Large-ring cycloalkanediones, dinitriles, bis-Grignard reagent, synthesis.

Synthesis of some cycloalkanedione compounds are extremely difficult. 1, 6-Cyclododecanedione was prepared previously by Fonken *et al*[1]. *via* microbiological hydroxylation of monocyclic alcohols and by Niles *et al*[2]. *via* ozonolysis of bicyclic olefin which was obtained by a treatment of cyclododecatriene with sulfuric acid. 1, 4-Cycloalkanediones were prepared by Kulkowit *et al*[3]. *via* the reduction of 1, 4-cycloalkenediones obtained by intramolecular coupling of bis-diazoketones in the presence of bisacetyl-acetonatocopper. It provided a useful procedure for the preparation of 1, 4-cycloalkanediones. Blomquist[4] reported that acid chlorides were dehydrohalogenated by tertiary aliphatic amines to form the bifunctional ketene derivatives. Under the conditions of high dilution, cyclic ketene derivatives were obtained. Hydrolysis and decarboxylation of the derivatives gave large-ring ketones and diketones, but the yields of the diketones were quite low.

We reported the synthesis of 1, 6-cyclododecanedione from bis-benzimidazole methiodide salts with bis-Grignard reagent. A new method for the preparation of large-ring cycloalkanediones *via* the addition reaction of bis-benzimidazole methiodide salts with bis-Grignard reagent was provided[5]. In this paper, the addition-hydrolysis reaction of bis-Grignard reagent with dinitriles was studied. A convenient synthetic method for large-ring cycloalkanediones was provided (**Scheme1**).

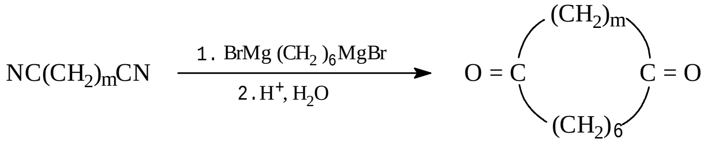
The synthetic method described in this paper for cycloalkanedione compounds has not been reported in the literature. The advantages of our new method are as follows: available starting materials, a mild reaction condition and a good yield. According to the synthetic route, if dinitriles and bis-Grignard reagents with different structures are used， the corresponding cycloalkanediones with different structures can be obtained. The method described in this paper may be used for the preparation of a variety of cycloalkanediones with different membered ring and carbonyl groups in different

---

[*] E-mail: chemdir@nwu.edu.cn

position. It provides a convenient way for synthesis of cycloalkane- diones, especially for the valuable large-ring cycloalkanediones.

Scheme 1



m = 4, 6

Experimental

Apparatus and reagents

Melting points were taken on a model X4 melting point apparatus. The thermometer was uncorrected. Reagents were purified by standard methods.

Synthesis of bis-Grignard reagent

Bis-Grignard reagent was prepared according to the methods described in literature[6].

Synthesis of 1,6-cyclododecanedione and 1,8-cyclotetradecanedione

Bis-Grignard reagent (0.01 mol) in dry ether (400 mL) was injected into a three-necked round-bottom flask. Dinitriles (0.01 mol) was added in small portion to the bis-Grignard reagent solution over 30 min. The mixture was stirred for 22-24 h, a saturated aqueous solution of oxalic acid (20 mL) was added, and the mixture was heated in hot water bath for 1.0-1.5 h with stirring. Ether was removed and the residue was extracted with benzene or chloroform (5×30mL). The extracts were washed with 5% sodium bicarbonate and dried over anhydrite $MgSO_4$. After removal of the solvent, the crude product was crystallized from acetone (10%) -petroleum ether. 1, 6-Cyclododecanedione is a colorless crystals, yield 41.0%, mp 93～94°C(lit.[2] m.p.94～95°C), IR:1700 (C=O)cm^{-1}; 1, 8-Cyclotetradecanedione, slightly yellow crystals, yield 48.0 %, mp 146～148°C(lit.[4] m.p.147.5～148°C), IR:1720(C=O)cm^{-1}.

Acknowledgments

This work was supported by the National Natural Science Foundation of China (20172041) and the Provincial Natural Science Foundation of Shaanxi Province.

References

1. G. S. Fonken, M. E. Herr, H. C. Murray, *et al.*, *J.Am.Chem.Soc.*,**1967**, *89*, 672.
2. E. T. Niles, H. R. Snyder, *J. Org. Chem.*, **1961**, *26*, 330.
3. S. Kulkowit, A. Mckervey, *J.C.S.Chem.Comm.*, **1978**,1069.
4. A.T. Blomquist, R. D. Spencer, *J. Am. Chem. Soc.*, **1948**, *70*, 30.
5. Z. Shi, H. Gu, *Synth. Commun*., **1997**, *27*, 2789.
6. F. Babuderi, A. D'Ettole, *et al.*, *J.Organometal.Chem.*, **1991**, *53*, 405.

Received November 25, 2002