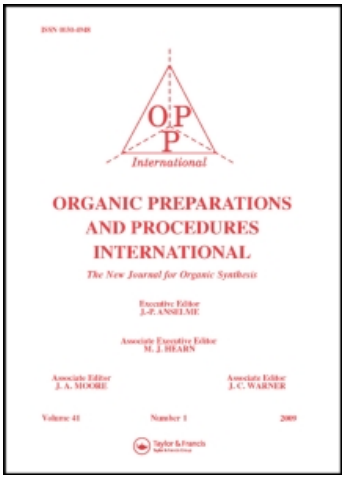

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A CONVENIENT SYNTHESIS OF 2,3-DIBROMOANTHRACENE

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A CONVENIENT SYNTHESIS OF 2,3-DIBROMOANTHRACENE

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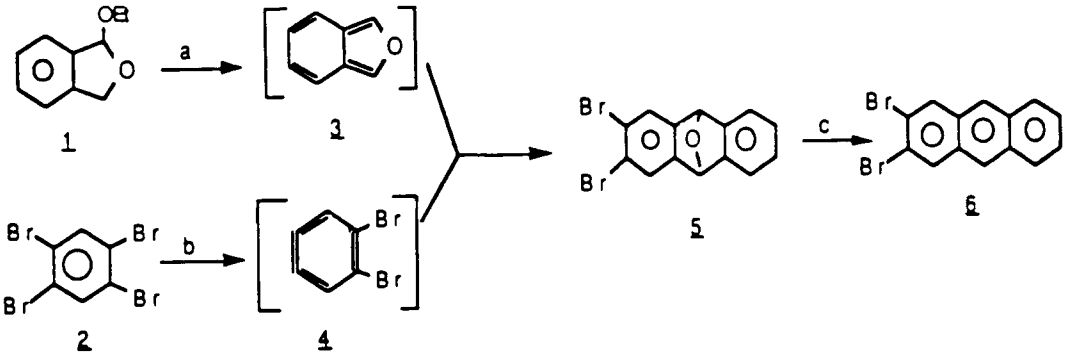
Arynes are useful transient synthetic intermediates which can readily undergo facile Diels-Alder cycloadditions with a variety of dienophiles such as isobenzofurans, furans, pyrroles and butadienes.[1,2]



a) LDA/Et_2O b) MeLi/Et_2O c) Zn/$TiCl_4$/THF or $Fe_2(CO)_9/C_6H_6$

Potential precursors of these arynes are o-dibromoarenes. One such previously unknown arene is 2,3-dibromoanthracene which was recently prepared by Lin and Chou[3] by a three-step procedure. The method of these authors required an autoclave and drastic reaction conditions. The present communication reports the synthesis of the title compound under mild reaction conditions in two steps utilizing the Diels-Alder addition of isobenzofuran (3) and 4,5-dibromobenzyne (4). Thus, the cycloaddition of isobenzofuran (3) and benzyne 4 was conducted according to the procedure of Crump et al.[4] The acetal 1 was treated with methyllithium and a catalytic amount of diisopropylamine followed by treatment with 1,2,4,5-tetrabromobenzene (2) and methyllithium to yield 2,3-dibromo-9,10-epoxy-9,10-

dihydroanthracene (5) in 74% yield. Reductive deoxygenation of epoxide (5) was attempted by several methods[5] of which the $Zn/TiCl_4$ method of Hart et al.[2] or the $Fe_2(CO)_9$ procedure of Crump et al.[4] afforded the aromatic compound 6 in 80-90% yield.

EXPERIMENTAL SECTION

All the chemicals were used as received. Acetal 1 was prepared according to the method described previously.[6] 1,2,4,5-Tetrabromobenzene (2) was made following the procedure of Hart et al.[2] ^1H NMR spectra were recorded on a JEOL Fx-60 Fourier-transform spectrophotometer. Melting points were recorded on a Thomas-Hoover melting point apparatus and are uncorrected. Column chromatography was performed on silica gel 60 (70-230 mesh).

2,3-Dibromo-9,10-epoxy-9,10-dihydroanthracene (5).- The acetal 1 (9.2 mL, 67 mmol) was dissolved in 200 mL ether in a flask equipped with a stir bar and a rubber septum. Diisopropylamine (47 μL, 3.4 mmol) was added followed by methyllithium (67 mmol in 43 mL of ether). The mixture was stirred at room temperature for 3 hrs, at which point the conversion to isobenzofuran was judged to be complete by examination of the aromatic region of the NMR spectrum taken directly of an aliquot of the reaction mixture. 1,2,4,5-Tetrabromobenzene (23.6 g, 60 mmol) was added, the mixture was brought to reflux and methyllithium (60 mmol in 38 mL ether) was added over 0.5 hr. The mixture was taken up in additional ether, washed with water and brine, dried over K_2CO_3, and evaporated to give crude product. Chromatography (EtOAc/hexane 9:1) gave a 74% yield of a colourless gummy material shown to be 5 and pure by NMR. ^1H NMR ($CDCl_3$): δ, 6.23 (s, 2H, benzylic bridge head protons), 6.9-7.4 (m, 4H, symmetrical AA'BB' pattern) and 7.45 (s, 2H, aromatic).

Anal. Calcd. for $C_{14}H_8Br_2O$: C, 47.72; H, 2.27. Found: C, 47.46; H, 2.05

2,3-Dibromoanthracene (6). a) $Zn/TiCl_4$ Method.- To an ice-cold suspension of Zn dust (9.5 g) in 100 mL THF under argon was carefully added 20 mL of $TiCl_4$ and the mixture was heated to reflux for 5 min, then cooled to 0° and a solution of 5 (11.6 g, 33 mmol) in 50 mL THF was added dropwise. The mixture was refluxed overnight, cooled and poured into 300 mL of cold 10% HCl. The mixture was extracted with CH_2Cl_2 and the extract was washed with water, dried and evaporated. The yellowish residue was purified by column chromatography (hexane) to yield 8.5 g (80%) of 6 as yellow flakes, mp. 268°, lit.[3] mp. 270°; ^1H NMR (C_6D_6): δ, 7.30-7.75 (m, 4H, AA'BB' pattern), 7.78 (s, 2H) and 8.04 (s, 2H).

Anal. Calcd. for $C_{14}H_8Br_2$: C, 50.04; H, 2.40. Found: C, 50.40; H, 2.68

b) Iron Carbonyl Method.- A mixture of 5 (200 mg) and $Fe_2(CO)_9$ (235 mg) in 10 mL benzene was slowly heated in an oil bath. At ca. 60°, the mixture turned black. The bath was held at this temperature for 1 hr, and the temperature was increased to initiate reflux which was continued overnight. After cooling and filtration through Celite, the solution was evaporated to dryness on a steam bath with a stream of nitrogen to remove any residual $Fe(CO)_5$. The crude product was purified as mentioned before to yield 172 mg (89%) of product.

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5. The reagents employed were: a) $NaBH_4/CF_3COOH/THF$ [Gribble et al. Synthesis, 1, 143 (1982)]. b) $LTBAH/Et_3B$. c) $TiCl_4/LAH/Et_3N/THF$ [Xing et al. J. Org. Chem., 47, 70, (1982)]. d) Lithium naphthalenide [Polovsky et al. ibid., 39, 3010, (1974)]. e) Zn/AcOH [Bhatt and Reddy, Tetrahedron Lett., 21, 3627 (1980)]. Procedures (a) and (b) gave no 6 while the other ones gave only poor yields.
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THE PREPARATION OF 5-CHLORO-2-INDOLINONE BY DIRECT CHLORINATION OF 2-INDOLINONE

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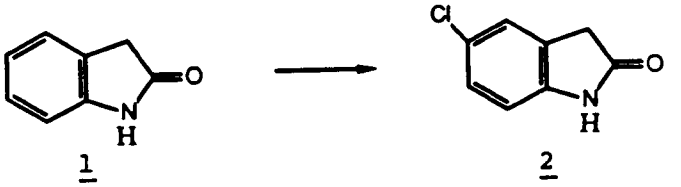
5-Chloro-2-indolinone (2) is an important chemical intermediate used in the synthesis of compounds reported to be useful in the treatment of anxiety[1] and as anti-inflammatory agents.[2] A recent patent[3] reviews the literature methods for preparing 2 and reports a two-step synthesis of 2, starting with 5-chloroindole. All of these methods require several steps. The bromination of 2-indolinone (1) yields 5-bromo-2-indolinone[4], but apparently no one has reported the chlorination of 1. This paper describes the preparation of 2 from 1 by direct chlorination.



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