Pergamon

Tetrahedron Letters 39 (1998) 5931–5932

TETRAHEDRON LETTERS

Conversion of an Amine-substituted Arene-Manganese Tricarbonyl Complex to a Functionalized Cyclohexenone

Anthony J. Pearson* and Richard J. Vickerman

Department Of Chemistry, Case Western Reserve University, Cleveland, Ohio 44106

Received 12 May 1998; revised 4 June 1998; accepted 8 June 1998

Abstract : The synthesis of functionalized cyclohexenones can be achieved via double nucleophile addition, with intermediate reactivation by ligand exchange, to aminoarene-manganese tricarbonyl cationic complexes by adjusting the electron donating power of the amine. © 1998 Elsevier Science Ltd. All rights reserved.

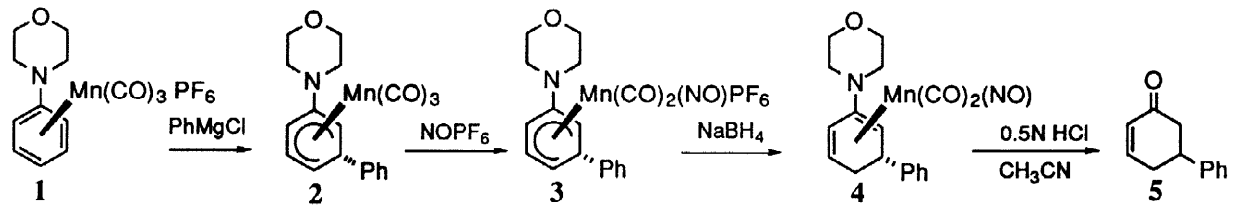
Keywords: Manganese and compounds; Arene; Cyclohexenone; Transition metals.

Addition of nucleophiles to arene-manganese tricarbonyl complexes provides useful methodology for the conversion of aromatic compounds to functionalized cyclohexenones.[1] An example using an η^6-(anisole)$Mn(CO)_3$ cationic complex as the starting complex has been reported by Sweigart.[2] Miles and Brinkman have studied asymmetric nucleophile addition to an η^6-(phenoxybenzene)$Mn(CO)_3$ cationic complex in their formal synthesis of (+)-juvabione.[3]

The development of a general asymmetric version of this transformation based on arene-manganese tricarbonyl chemistry has been a subject of continuing research in our laboratories.[4,5] A *trans*-2,5-dimethylpyrrolidine substituent on the arene-manganese tricarbonyl complex has been shown to serve as an efficient chiral auxiliary during nucleophilic addition, diastereomeric ratios of up to 95:5 having been obtained with PhMgBr as the nucleophile or as high as 40:1 with the corresponding *p*-methyl derivative.[4] All attempts to make the transition to the cyclohexenone were unsuccessful due to facile rearomatization of the very electron rich diene complex formed after the second nucleophile addition.[6,7] A cyclic amino substituent would provide the best platform on which to build chiral, non-racemic, auxiliary but a less electron rich system would be needed to reduce or eliminate the aromatization problem.

The morpholinobenzene-$Mn(CO)_3$ complex (**1**, Scheme 1) was prepared by reacting η^6-(chlorobenzene) $Mn(CO)_3PF_6$ with morpholine and K_2CO_3, as the base, in acetone solvent, at room temperature for 15 min. giving a 95% yield after recrystallization from acetone/ether. Reaction of **1** (Scheme 1) with PhMgCl in THF at -78 °C afforded dienyl **2** in 90% yield. Reactivation by CO ligand exchange with $NOPF_6$ in CH_2Cl_2 at 0 °C affordeded dienyl **3** in 95% yield.

0040-4039/98/$ - see front matter © 1998 Elsevier Science Ltd. All rights reserved.
PII: S0040-4039(98)01214-3



Scheme 1

The dienyl **3** is rather unstable and was not characterized by NMR due to interference by paramagnetic impurities. It was isolated by precipitation with pentane from a methylene chloride solution and used immediately. $NaBH_4$ was added to a solution of **3** in THF at 0 °C to form the red colored diene complex **4**. Since oxidative demetallation would likely lead to rapid aromatization, and since all attempts to isolate **4** resulted in the formation of that aromatization product, a non-oxidative procedure was developed as a single step immediately following the second nucleophile addition. Acetonitrile (known to be a good ligand for Mn(0)) and 0.5N HCl were added in large excess directly, at 0 °C, to the reaction mixture after **4** had been formed. The solution quickly turned from red to yellow then slowly became colorless over 12 hours at room temperature. Cyclohexenone **5** was isolated in an 80% yield (68% overall from **1**). The ^1H NMR spectrum of **5** corresponded with published data.[8]

The procedure was also successfully carried out with MeLi as the first nucleophile but the yields were lower (50% for MeLi addition). The second nucleophile is currently limited to $NaBH_4$, and future work will concentrate on expanding this range, and on the identification of an electronically suitable chiral auxiliary.

In conclusion, a facile synthesis of a racemic, substituted cyclohexenone from an amino-arene manganese tricarbonyl cationic complex was developed, which promises to be a route to a more general asymmetric version.

Acknowledgment: This research was supported by the National Institutes of Health (GM 36925).

References and Notes

1. Semmelhack, M. F. In *Comprehensive Organic Synthesis*; B.M. Trost and I. Fleming, Eds.; Pergamon Press: Oxford, 1991; vol.4; pp. 517-549.
2. Pike, R. D.; Sweigart, D. A. *Synlett* **1990**, 565-571.
3. Miles, W. H.; Brinkman, H. R. *Tetrahedron. Lett.* **1992**, *33*, 584-592.
4. Pearson, A. J.; Zhu, P. Y. *J. Am. Chem. Soc.* **1993**, *115*, 10376-10377.
5. Gontcharov, A. V. Ph.D. Thesis, Case Western Reserve University, 1997.
6. Pearson, A. J.; Woodgate, P.D. unpublished results, Case Western Reserve University 1993.
7. Zhu, P. Y. Ph.D. Thesis, Case Western Reserve University, 1994.
8. Kryshtal, G. V.; Kulganek, V. V.; Kucherov, V. F.; Yanovskaya, L. A. Synthesis, 1979, 107-109.