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INTRAMOLECULAR ARYLATION OF SOFT CARBON CENTRE OR ENOLATE USING Mn(III) ACETATE : STUDIES TOWARDS SPIROSTRUCTURE OF FREDERICAMYCIN A+

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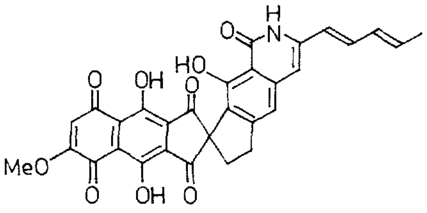
Abstract : Intramolecular arylation of a cyclic β-diketone using $Mn(OAc)_3$ is applied for construction of the spirocyclic structure in Fredericamycin A.

An elegant approach to the synthesis of the spirostructure of Fredericamycin A 1 would be an intramolecular arylation of the soft carbon in compounds such as 2. This has indeed been achieved by two methods, one using Pd(0)[1] where the aromatic ring carries a halogen substituent and the other using alkaline ferricyanide[2] where the ring carries a phenolic hydroxyl group. In the latter, the cyclisation occurs predominantly at the para position with respect to the phenolic hydroxyl group, vitiating the obtension of the ortho cyclised compound in significant amount as desired for Fredericamycin A itself.



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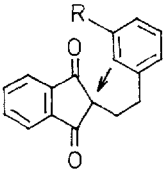
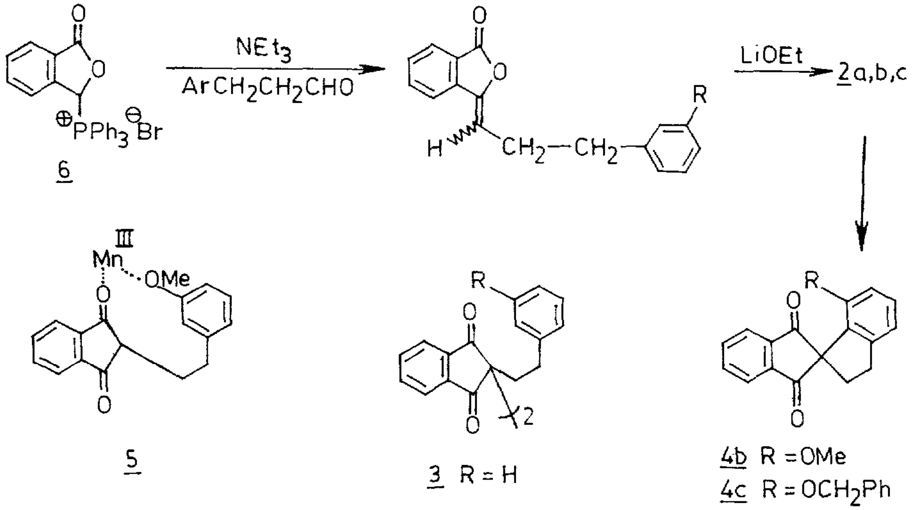


2a R = H
2b R = OMe
2c R = OCH_2Ph

This paper reports the direct arylation of soft carbon centres or enolates using $Mn(OAc)_3$. This is an unusual mode of forming C-C bond connectivity and indeed there is not a single report to date where a cyclic β-diketone has been added intramolecularly to an aromatic ring using $Mn(OAc)_3$.

The starting compounds, indandiones (2a, b, c), were obtained from 6[3] according to Scheme 1. Compound 2a (1 mmol) was refluxed with 2 eq. of $Mn(OAc)_3$ in acetic acid (10 ml). A clean reaction ensued, complete in 1.5 hr, to give a compound (50% yield), which was unfortunately the dimer 3 (m.p. 189-191°C, M^+ 498). The aromatic ring was presumably not sufficiently active for the arylation reaction, as compared to the dimerisation and other fragmentation reactions. The reaction, carried out in dilute solution, also gave only the dimer, now in decreased yield, presumably due to alternate fragmentations reactions.

Scheme 1



The experiments were then carried out on the methoxylated compound 2b and the benzyloxy 2c derivative , which had the more reactive aromatic ring. When 2b (1 mmol) in acetic acid (10 ml) was added dropwise to $Mn(OAc)_3$ (2 eq.) in acetic acid (20 ml) at 95-100°C over 2 hrs, the desired spiro compound 4b[4] (m.p. 151-153°C; M^+ 278; ^1H NMR ($CDCl_3$, δ units) : 2.54 (t, J=8 Hz, 2H); 3.25 (t, J=8 Hz, 2H), 3.42 (s, 3H); 6.60 (d, J=8 Hz, 1H); 6.97 (d, J=8 Hz, 1H); 7.23 (t, J=8 Hz, 1H); 7.82-8.10 (m, 4H)) was obtained in 32% yield. The dimer corresponding 2b was also obtained, in variable but small amounts. Interestingly 4b was the ortho cyclised compound and not the para. The ortho cyclisation could be favoured by coordination of the methoxyl group with the Mn(III) reagent as in 5. Similarly 2c also gave the compound 4c in 25% yield (m.p. 139-141°C, ^1H NMR ($CDCl_3$, δ units) : 2.45 (t, J=8 Hz, 2H); 3.28 (t, J=8 Hz, 2H); 4.68 (s, 2H); 6.65 (d, J=8 Hz, 1H); 6.71-7.34 (m, 7H); 7.8-8.10 (m, 4H). In both the reactions(2b and 2c)considerable amount of intractable material was obtained.

Attempts to increase the yield are in progress.

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References :

[+] For leading references see : M. Toyota, S. Tereshima, Tetrahedron Lett., 1989, 30, 829 and references cited therein.

1. M.A. Ciufolini; H-BoQi, M.E. Browne, J. Org. Chem., 1988, 17, 4149.
2. A.S. Kende, F.H. Ebetino, T. Ohta, Tetrahedron Lett., 1985, 26, 3063.
3. D.W. Knight, G. Pattenden, J. Chem. Soc. Perkin Trans. I, 1975, 7, 635.
4. M. Braun, R. Veith (Tetrahedron Lett., 1986, 27, 179) have obtained 4b by an alternate route. They report no m.p.. ^1H NMR reported is identical except that the 7.23 signal obtained by us is reported at 7.53 by them.

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