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HYPERVALENT IODINE OXIDATION OF 5-ACYL-α-BENZOYL-o-HYDROXYACETOPHENONES: A SELECTIVE SYNTHESIS OF 2,5-DIACYLCOUMARAN-3-ONES.

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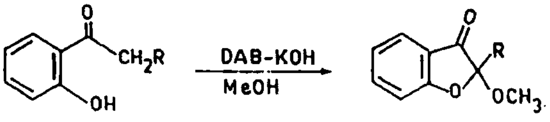
Abstract : Oxidation of 5-acyl-α-benzoyl-o-hydroxyacetophenones **3a-e** with (diacetoxyiodo)benzene in methanolic potassium hydroxide (DAB-KOH-MeOH) provides a selective synthesis of 2,5-diacylcoumaran-3-one **4a-e** in good yield.

During the recent past, (diacetoxyiodo)benzene in methanolic potassium hydroxide (DAB-KOH-MeOH) has been shown to be a versatile system for accomplishing a large number of very useful and unique transformations[1], e.g., oxidation of β-dicarbonyl compounds to iodonium ylide[2], enolizable ketones to α-hydroxy ketone dimethylacetals[3]. The latter reaction, however, does not work successfully, when applied on o-hydroxyacetophenones as it leads to the formation of coumaran-3-ones 2 by neighbouring group participation[2-4] Scheme I.



1 2

Scheme I

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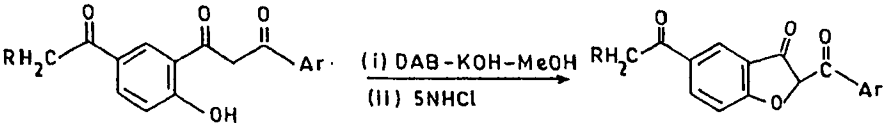


3 4

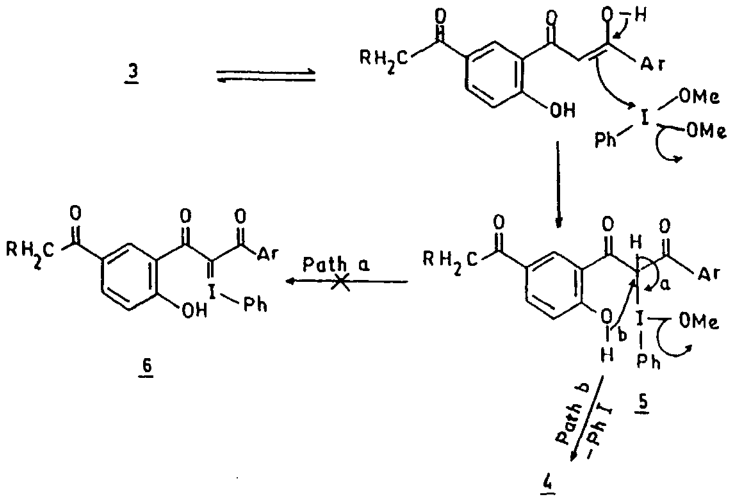
R=H, CH_3; Ar = C_6H_5, 4-$CH_3C_6H_4$, 4-$CH_3OC_6H_4$

Scheme II

In continuation of our interest in oxidation using hypervalent iodine reagents[5-8], with a view to compare the relative succeptibilities of β-diketones (for ylide formation), aryl alkyl ketone (for α-hydroxy dimethylacetal formation) and o-hydroxy group (for neighbouring group participation), we have examined the oxidation of 5-acyl-α-benzoyl-o-hydroxyacetophenones[9] **3a-e** (having all the above structural requirements) with DAB-KOH-MeOH under the similar condition[4] and the results are summarized in Scheme II.

In a typical procedure **3a** (one equivalent) upon treatment with (diacetoxyiodo)benzene in methanol containing a large excess of potassium hydroxide at 0-5°C for 2-3 hr followed by acidification with 5N HCl afforded **4a** in 79-86% yield. The structures of all the new compounds **4a-e** were confirmed on the basis of elemental analysis ir, and ^{1}H-NMR spectral characteristics.

The most probable mechanistic course for the conversion of 3→4is outlined in Scheme III. Initially electrophilic attack of



Scheme III

iodine(III) reagent $PhI(OMe)_2$ (formed **in situ** from $PhI(OAc)_2$ and $^{\ominus}$OMe) upon the enol form of 3 to give an intermediate 5, which undergoes cyclization by a neighbouring group participation of *o*-hydroxy group with a concomitant reductive cleavage of C-I(III) bond (path b) to give the product **4**. In a competing path the intermediate **5** could form iodonium ylide **6** after the lose of a proton (path a). Since the present oxidative approach provides **4** as exclusive products, neighbouring group participation by *o*-hydroxy group might be a more facile process than the formation of ylide **6**.

In conclusion it may be added that the present oxidation provides a new convenient iodine(III) approach for the synthesis of 2,5-diacylcoumaran-3-ones in high yields in addition this is being selective as the aryl alkyl ketone moiety remains intact. Another

Table 1 : Oxidation of 3a-e to 4a-e using DAB-KOH-MeOH

	Products[a] 4	Yield[b] (%)	mp.(lit mp.) (°C)	IR (nujol) (Cm^{-1})	^{1}H-NMR	Analysis	
						Found (Calculated) (C)	(H)
a;	R=H; Ar=C_6H_5	82	182-83	1687, 1609	2.66(s,3H,$COCH_3$,7.40-8.45 (m,8H,aromatic protons)	72.79 (72.85)	4.13 (4.29)
b;	R=H; Ar=$4CH_3C_6H_4$	80	165-66	1683 1607	2.46(s ,3H,$4CH_3C_6H_4$),2.67 (s,3H,$COCH_3$),7.25-8.45(m,7H, aromatic protons)	73.38 (73.47)	4.59 (4.76)
c;	R=H; Ar=$4CH_3OC_6H_4$	86	170	1687 1607	2.67(s,3H,$COCH_3$),3.90(s, 3H,$4CH_3OC_6H_4$),7.04-8.45 (7H,m,aromatic protons)	69.75 (69.68)	4.58 (4.52)
d;	R=CH_3; Ar=$4CH_3C_6H_4$	79	177-78	1687 1603	1.26(t,3H,$COCH_2CH_3$,J=7.0Hz) 2.44(s,3H,$4CH_3C_6H_4$),3.07(q, 2H,$COCH_2CH_3$,J=7.0Hz),7.22 - 8.48(m,7H,aromatic protons)	73.91 (74.03)	5.26 (5.19)
e;	R=CH_3; Ar=$4CH_3OC_6H_4$	82	185-86	1683 1600	1.26(t,3H,$COCH_2CH$,J=7.0Hz), 3.08(q,2H,$COCH_2CH_3$,J=7.0Hz), 3.89(s,3H,$4CH_3OC_6H_4$),6.85- 8.40(m,7H,aromatic protons)	70.01 (70.37)	4.86 (4.94)

a; Crystallization with ethanol. b; Yields are based upon the isolated solid products.

advantage of the procedure reported herein is that these compounds can not be prepared by commonly available methods for the synthesis of 2-acylcoumaran-3-ones[10].

Experimental

Melting points were determined in sulphuric acid bath in an open capillaries and are uncorrected. IR spectra were recorded in nujol mulls on Perkin-Elmer 842 IR spectrophotometer and ^{1}H-NMR on Perkin-Elmer R-32 machine using $CDCl_3$ as solvent and TMS as an internal standard.

General Procedure :

A suspension of 5-Acyl- α -benzoyl-o-hydroxyacetophenone (3a; 0.01 mol) in methanol containing a large excess of KOH (0.05 mol) was stirred at 0-5°C. (Diacetoxyiodo)benzene (DAB; 0.11 mol) was then added in small portion with constant stirring. The stirring was continued at 0-5°C for 1 hr and then at room temperature for further 2 hr. The mixture was poured in 100 ml of cold water. It was then acidified with 5N HCl. The gummy mass so obtained, was extracted with CH_2Cl_2 (2x50 ml) washed with aqueous $NaHCO_3$ followed by water and dried ($MgSO_4$). The residual mass left after distilling off the solvent was purified by passing through a column of silica gel 'G' using Benzene :ethyl acetate (80:20) as an eluent.

All other 2,5 diacylcoumaran-3-ones **4b-e** which were prepared in a similar manner are listed in Table 1 with their spectral characteristics.

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