This article was downloaded by: [University of Chicago Library] On: 26 December 2014, At: 13:17 Publisher: Taylor & Francis Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Synthetic Communications: An International Journal for Rapid Communication of Synthetic Organic Chemistry

Publication details, including instructions for authors and subscription information: http://www.tandfonline.com/loi/lsyc20

Selective Oxidation of 6-Propionylflavonols and 6-Propionyl-2-Hetarylchromdnols Using Hypervalbnt lodine Reagents in Methanol

Mahavir S Khanna^a, Km Sangeeta^a, Chandra P Garg^a & Ram P Kapoor^a ^a Department of Chemistry, Kurukshetra University, Kurukshetra, 132 119, INDIA

Published online: 23 Sep 2006.

To cite this article: Mahavir S Khanna , Km Sangeeta , Chandra P Garg & Ram P Kapoor (1992) Selective Oxidation of 6-Propionylflavonols and 6-Propionyl-2-Hetarylchromdnols Using Hypervalbnt lodine Reagents in Methanol, Synthetic Communications: An International Journal for Rapid Communication of Synthetic Organic Chemistry, 22:6, 893-900, DOI: <u>10.1080/00397919208020853</u>

To link to this article: http://dx.doi.org/10.1080/00397919208020853

PLEASE SCROLL DOWN FOR ARTICLE

Taylor & Francis makes every effort to ensure the accuracy of all the information (the "Content") contained in the publications on our platform. However, Taylor & Francis, our agents, and our licensors make no representations or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the Content. Any opinions and views

expressed in this publication are the opinions and views of the authors, and are not the views of or endorsed by Taylor & Francis. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Taylor and Francis shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever or howsoever caused arising directly or indirectly in connection with, in relation to or arising out of the use of the Content.

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden. Terms & Conditions of access and use can be found at <u>http://www.tandfonline.com/page/terms-and-conditions</u>

SELECTIVE OXIDATION OF 6-PROPIONYLFLAVONOLS AND 6-PROPIONYL-2-

HETARYLCHROMONOLS USING HYPERVALENT IODINE REAGENTS IN METHANOL

Mahavir S Khanna, (Km) Sangeeta, Chandra P Garg and Ram P Kapoor Department of Chemistry, Kurukshetra University, Kurukshetra 132 119, INDIA

6-propionylflavonols Abstract: Selective oxidation of (1a-d) 6-propionyl-2-hetarylchromonols (le-f) to 2,3-dimethoxy-3and hydroxy-6-propionylflavanones (2a-d) and 2,3-dimethoxy-3-hydroxyusing 6-propiony1-2-hetary1chromanones (2e-f), respectively, bis(trifluoroacetoxy)iodo|benzene(BTFAIB), (hydroxy(tosyloxy)iodo|benzene(HTIB), iodobenzene diacetate (IBD) and iodosylbenzene (IB) in methanol has been described.

During the past two decades, hypervalent iodine reagents have emerged as a group of versatile oxidative reagents in organic synthesis for effecting a myriad of useful and unique transformations¹. A noteworthy feature of these reagents is that they are capable of oxidizing phenols² as well as aryl alkyl ketomes³ affording different products under different conditions⁴⁻⁷. With a view to compare the relative susceptibilities of oxidation of phenol and aryl alkyl ketone moleties with various hypervalent iodine reagents, it was thought of interest

Copyright © 1992 by Marcel Dekker, Inc.

To whom correspondence should be addressed.

to investigate the oxidation of some 6-propionylflavonols (having both aryl alkyl ketone as well as phenol moieties) with these reagents.

In the present communication, we wish to report that the treatment of 6-propionylflavonols (1a-d)⁸ with stoichiometric amounts of various hypervalent iodine reagents, viz., [bis(trifluoroacetoxy)iodo]benzene (BTFAIB), [hydroxy(tosyloxy)iodo]benzene (HTIB), iodobenzene diacetate (IBD), and iodosylbenzene (IB) and acid in methanol, results in spontaneous and smooth transformation of these compounds into the corresponding 2,3dimethoxy-3-hydroxy-6-propionylflavanones or methyl-3-hemiacetals of 2-methoxy-6-propionyl-3,4-flavandiones (2a-d) in 90-92% yields (Scheme I). Whereas in the case of BTFAIB, IBD and HTIB the transformation 1--->2 occurs in methanol alone, in the case of IB it occurs quite smoothly in the presence of 1 or 2 drops of an acid $(HClO_4 \text{ or conc. } H_2SO_4)$. 6-Propionyl-2-hetarylchromonols (le-f), upon treatment with BTFAIB, HTIB and IBD in methanol, and IB in methanol in the presence of 1 or 2 drops of acid also result in the formation of the corresponding 2,3-dimethoxy-6propionyl-2-hetarylchromanones (2e-f) in very high yields.

The above results clearly indicate that iodine(III) reagents preferentially attack the phenolic C_3 -OH rather than C_6 -OOCH₂CH₃ group of 1. Hence in analogy with our earlier results with thallium(III) salts⁹, it can be concluded that the transformation of 1--+2 with iodine(III) reagents is also selective as the propionyl group, which is susceptible to oxidation with



Reagents: 1 $C_6H_5I(OCOCF_3)_2/C_6H_5I(OCOCH_3)_2/C_6H_5I(OH)(OTS)$ 11 $C_6H_5I=0$, H⁺

Scheme I

the hypervalent iodine reagents $^{3-5}$, remains intact during the course of the oxidation.

The formation of hemiacetal type of compounds 2 has previously been reported from the oxidation of simple flavonols with various oxidizing agents such as periodic $acid^{10}$, DDQ^{11} , Cu(II) salts¹² and HTIB¹³ in methanol. It may be proposed that the reaction proceeds by the same mechanism as reported earlier^{9,11,13}. The stereochemistry of the hemiacetals 2 has not been assigned.

conclusion. it may be mentioned that, during In oxidation with hypervalent iodine reagents, 6-propionyIflavonols and 6-propionyl-2-hetarylchromonols behave like phenols rather than typical aryl alkyl ketones, α , β -unsaturated ketones and 1,2-diones as evident by the fact that rearranged products including 3 are not formed even in traces. Further, this method for the synthesis of 2 is superior to earlier reported procedure involving oxidation of 6-propionylflavonols with toxic Tl(III) salts⁹. In addition, the oxidative behaviour of BTFAIB, HTIB, TBD and IB in methanol resembles that of earlier reported reagents^{10,11,12,13}

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

Iodobenzene diacetate was purchased from Aldrich Chemical Co., [hydroxy(tosyloxy)iodobenzene)] (HTIB) was prepared by the reaction of iodobenzene diacetate and p-toluenesulphonicacid according to conditions of Neiland, Karele¹⁴ and Kosen and Wettach¹⁵, [bis(trifluoroacetoxy)iodo]benzene (BTFAIB) was prepared according to the procedure of Vargolis¹.

All the flavonols and chromonols were synthesized according to Alger-Flymn Oyamada reaction¹⁶ of various <u>o</u>-hydroxy chalcones.

896

General procedures:

Method A: Oxidation of 1 with [bis(trifluoroacetoxy)iodo]benzene (BTFAIB): To a suspension of 6-propionylflavonol

1a (0.01 mol) in methanol (20 ml) was added solid BTFAIB (0.011 mol) rapidly. The mixture was warmed on a water bath, till a clear solution was obtained (5-10 min). It was then cooled to room temperature and poured in ice cold water (100 ml). The solid, so obtained, was filtered, washed with water and crystallized from methanol to afford **2a** in 92% yield.

Similar procedure was employed for the oxidation of (1b-d) and the results are summarized in Table I.

Method B: Oxidation of 1 with iodobenzene diacetate (IBD) and

[hydroxy(tosyloxy)iodo]benzene (HTIB): A mixture of 6-propionylflavonol 1a (0.01 mol) and IBD or HTIB (0.011 mol) in methanol was warmed for 5-10 min. The resulting colourless solution on cooling and working up as above afforded 2a in 90-92% yield.

Similar procedure was employed for oxidation of (1b-d) and the results are given in Table I.

Method C: Oxidation of 1 with iodosylbenzene (IB) : A mixture of 6-propionylflavonol 1a (0.01 mol) and iodosylbenzene (0.011 mol) in methanol containing 1-2 drops of acid (conc. H_2SO_4 or $HCIO_4$) was warmed on a water bath for 5-10 min. The resulting mixture on working up as above yielded 2a in 90-92% yield.

Table	I: Oxidation of 6-propionylflavonols (la using BTFAIB, HTIB, IBD and IB.	-d) and 6-propionyl-	-2-hetarylchramonols (1e-f)
Produ	cts mp(litmp) ^a °C	Yield ^b ş	LR in cm ⁻¹
R	172-75 (172-75) ⁹	92	3465, 1701, 1675
8	140-42 (140-42) ⁹	06	3459, 1702, 1677
2c	152-53 ^C	92	3466, 1702, 1676
2d	160-61 ^C	06	3465, 1700, 1676
2e	142-43 ^c	80	3464, 1702, 1678
2f	149-50 ^C	85	3470, 1702, 1670
(a)	All compounds lost methanol upon heating and finally melted over a range.	, turned yellow at	characteristic temperatures
(P)	Yields are based upon the isolated solid in all the experiments.	products with respe	set to the amount of 1 used

Satisfactory ¹H-NMR spectral data and C & H analysis were obtained. છ

Downloaded by [University of Chicago Library] at 13:17 26 December 2014

Similar procedure was employed for oxidation of (1b-d) and the results are summarized in Table I.

However, in the oxidation of (1e-f) the gummy mass obtained after pouring the reaction mixture in water, was extracted with CH_2Cl_2 (2x20ml). The organic layer was washed with water and dried (Na_2SO_4) . The solvent was then distilled off at reduced pressure and the gummy residue upon trituration with pet ether: ethylacetate (9:1), afforded (2e-f) as crystalline solids in 80-85% yield (Table I).

Acknowledgements: The authors are thankful to UGC, New Delhi and Kurukshetra University, Kurukshetra for financial assistance.

References:

- Vargolis, A., Chem. Soc. Rev., 1981, <u>10</u>, 377; Vargolis, A., 1984, 709; Moriarty, R.M., Prakash, O., Acc. Chem. Res., 1986, <u>19</u>, 244; Moriarty, R.M. and Vaid, R.K., Synthesis, 1990, 431; Merkushev, E.B., Russ. Chem. Rev., 1987, <u>56</u>, 826; Singh, O.V., Garg, C.P. and Kapoor, R.P., Synthesis, 1990, 1025.
- Yasumitsu, T., Takyukia, Y., Hirofurai, T., Kazumi, K. and Yasuyuki, K., Synthesis, 1989, 126.
- Singh, O.V., Prakash, O., Garg, C.P. and Kapoor, R.P., Ind. J. Chem., 1989, 28B, 814.

Koser, G.F., Relenyl, A.G., Kalos, A.N., Rebrovic,
 L. and Wettach, R.H., J. Org. Chem. 1982, <u>47</u>, 2487.

- Prakash, O. and Goyal, S., Ind. J. Chem., 1990, <u>30B</u>, 2913.
- Yasumitsu, T., Voshiaki, S. and Jun.Ichi, H., Synthesis, 1984, 231.

KHANNA ET AL.

- Moriarty, R.M., Hu, H. and Gupta, S.C., Tetrahedron Lett., 1981, <u>22</u>, 1283.
- Singh, O.V., Ph.D. thesis, Kurukshetra University, Kurukshetra, 1989.
- Singh, O.V., Khanna, M.S., Tanwar, M.P., Garg, C.P., and Kapoor, R.P., Synthetic Commun., 1990, <u>20</u>, 2401.
- 10. Smith, M.A., Webb, R.A. and Cline, L.J., J. Org. Chem., 1965, <u>30</u>, 989.
- 11. Becker, N.P., *ibid*, 1965, <u>30</u>, 989.
- 12. Utaka, M. and Tabeda, A., J. Chem. Soc. Chem. Commun., 1985, 1824.
- Moriarty, R.M., Prakash, O., Musallam, H.A. and Mahesh,
 V.K., Heterocycles, 1986, <u>24</u>, 1641.
- Neiland, O. and Karele, B., J. Org. Chem., USSR (Eng. Trans), 1970, <u>6</u>, 889.
- 15. Koser, G.F. and Wettach, R.H., J. Org. Chem., 1976, <u>22</u>, 3609.

Algar, J. and Flymn, J.P., Proc. Roy. Irish Acad., 1934, <u>B42</u>, 1; Chem. Abstr., 1935, <u>29</u>, 161, Oyamada, T., J. Chem. Soc., Japan, 1934, <u>55</u>, 1256.

(Received in UK 1 October, 1991)