Tetrahedron Letters No. 32, pp 2955 - 2958. 0040-4039/78/0801-2955$02.00/0

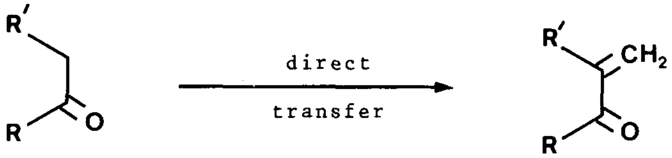
A FACILE ENTRY TO VINYL KETONES

Jean-Louis GRAS

Laboratoire associé au C.N.R.S. n° 109 - Université d'AIX-MARSEILLE III -
Rue H. Poincaré - 13397 MARSEILLE CEDEX 4 .

(Received in UK 5 June 1978; accepted for publication 12 June 1978)

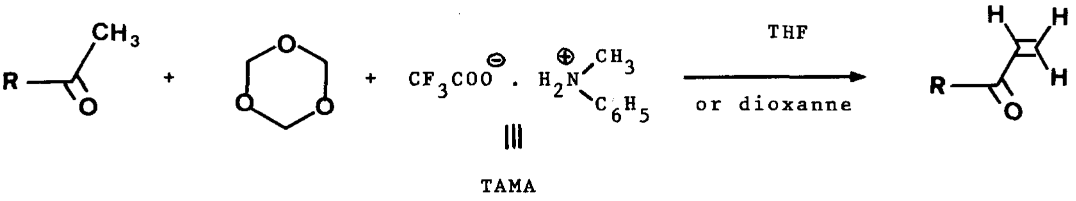
We recently described an efficient direct methylene transfer α of the carbonyle of some ketonic compounds (1) :



Derivatives of this type are useful intermediates in organic synthesis for their own reactivity (2) and for their ability to react as Michael acceptors (3) The preparation of the parent vinyl ketones (i.e. when R'= H) has received considerable interest since several methods for the synthesis of methylene ketones are ineffective when associated to this problem (4). Moreover, few methods are available starting from a methyl ketone as precursor.

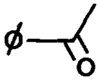
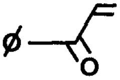
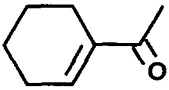
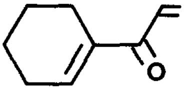
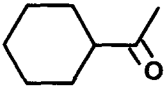
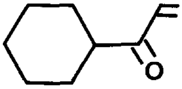
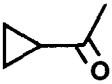
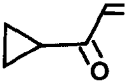
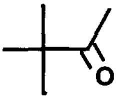
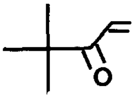
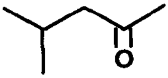
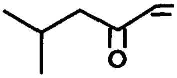
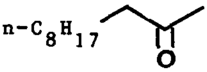
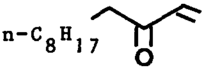
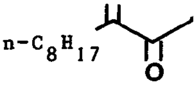
In order to increase the scope of the former methylene transfer, we report herein the easy synthesis of some vinyl ketones from simple methyl ketones. The reagent is the inexpensive commercial trioxymethylene.

Methyl ketones and trioxymethylene undergo a synthetically equivalent aldol condensation when refluxed in aprotic solvent (THF or dioxanne) in presence of N-methylanilinium trifluoroacetate : TAMA (1).



This Mannich-type reaction proved to be particularly easy. The Mannich base first formed is neither isolated nor quaternized, but directly eliminated under the reaction conditions. This attribute, confered by a suitable choice of reagents, realizes a mild and efficient reaction in many cases.

Some of our results are presented in the table below.

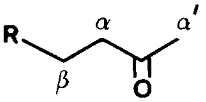
	METHYL KETONE	SOLVENT, REACTION TIME	VINYL KETONE*	YIELD
1		dioxanne, 5hr		91 %
2		dioxanne, 4hr		81 %
3		THF, 10 hr		81 %
4		THF, 7 hr		73 %
5		THF, 31 hr		82 %
6		THF, 8 hr		80 %
7		THF, 10 hr	  85 : 15	

* all compounds were identified by clear NMR, IR and elementary analyses.

As can be observed, both saturated and unsaturated ketones can be used.

The site of formation of the Mannich base opened to controversy (2, 4b, 5).

In the present reaction, methyl ketones such as 3 and 4 lead to the expected vinyl ketones in good quantity, which indicates a highly regioselective substitution of the α' (methyl) carbon.



Branching at the β carbon like in methylisobutylketone 6 leads also to the vinyl ketone and only minor quantity of substitution of the α (methylene) carbon.

Linear methyl ketone like 7 reacts indiscriminately to the α and α' positions to give a mixture 85 : 15 of isomers as well as the α,α'-diunsaturated ketone, when the reaction is conducted to completion.

Problems which arise from regio and stereoselectivity will be discussed in due course. Despite this limitation, the present reaction appears to be of valuable importance. Reagents are **simple**, the procedure very easy and yields are generally quite adequate.

Typical procedure :

Trioxymethylene (1.08 g, 12 mmol), TAMA (2.25 g, 10 mmol) and 1-acetylcyclohexene 2 (1.24 g, 10 mmol) are refluxed 2 hr in 12 ml of dioxanne (distilled over Na), under N_2 atm and magnetical stirring. The mixture is cooled and 6 mmol of trioxymethylene, 5 mmol of TAMA and 6 ml of dioxanne are added. The reaction is refluxed for another 2 hr, then diluted with pentane, water, then extracted with pentane. The organic layers are washed with H_2O, half-saturated aqueous $NaHCO_3$ solution and dried over $MgSO_4$. After concentration under vacuum, the fine crude is filtered through a short column of silica gel to yield 1.12 g (ρ=81%) of vinyl ketone.

IR (neat) cm^{-1} : 1662, 1638, 1610.

NMR (CCl_4) δppm : 7.00 (d of d, J=17 Hz, J'=10 Hz, 1H), 6.99 (s, 1H), 6.26 (d of d, J=17 Hz, J'=3 Hz, IH), 5.70 (d of d, J=10 Hz, J'=3 Hz, 1H), 3.66 (m, 4H), 1.76 (m, 4H).

Acknowledgements : the author is grateful to Mr. R. BELAIR for assistance in the preparation of this letter.

References :

1) Jean-Louis GRAS, Tetrahedron Letters, in press.

2) R.A. CORMIER, W.L. SCHREIBER, W.C. AGOSTA, J.Amer.Chem.Soc., 95, 4873 (1973)

3) for recent exemples : V.YA. VOROB'EVA, V.A. BONDARENKO, E.E. MIKHLINA, K.F. TURCHIN, L.F. LINBERG, L.N. YAKHONTOV, Khim. Geterotsikl. Soedin., (1977) 10, 1370 ; V.YA. VOROB'EVA, K.F. TURCHIN, E.E. MKHLINA, V.A. BONDARENKO A.I. ERMAKOV, YU.N. SHEINKER, L.N. YAKHONTOV, Khim. Geterotsikl. Soedin., 10, 1377, (1977).

4)a- G.T.KSANDER, J.E. Mc MURRY, Tetrahedron Letters, 4691 (1976) and ref.
  b- M.I. FARBEROV, G.S. MIRONOV, Dokl. Akad. Nauk. SSSR, 148, 1095, (1963)- Chem. Abstr. 59, 5062 (1963).
  c- A.M. SHUR, Neftekhimiya, 2, 600 (1962) - Chem. Abstr., 58, 6735 (1963).
  d- S.O. LAWESSON, E.H. LARSEN, G. SUNDSTROM, H.J. JAKOBSEN, Acta Chem. Scand. 17 (8), 2216 (1963).
  e- J.C. FLOYD, Tetrahedron Letters, 2877 (1974) and ref. therein.

5) T.A. SPENCER, D.S. WATT, R.J. FRIARY, J. Org. Chem., 32, 1234 (1967).