Tetrahedron Letters No.52, pp. 4535–4538, 1970. Pergamon Press. Printed in Great Britain.

ARSONIUM YLIDES IN THE SYNTHESIS OF INDOLES

P.Bravo, G.Gaudiano, P.P.Ponti and M.G.Zubiani
Istituto di Chimica del Politecnico di Milano, 20133 Milano, Italy.

(Received in UK 2 October 1970; accepted for publication 8 October 1970)

Little information is available on the chemistry of arsonium ylides, in comparison with the akin phosphonium and sulphonium ylides[1]. From the few reports available their behaviour seems to be intermediate between that of S- and P-ylides[1,2].

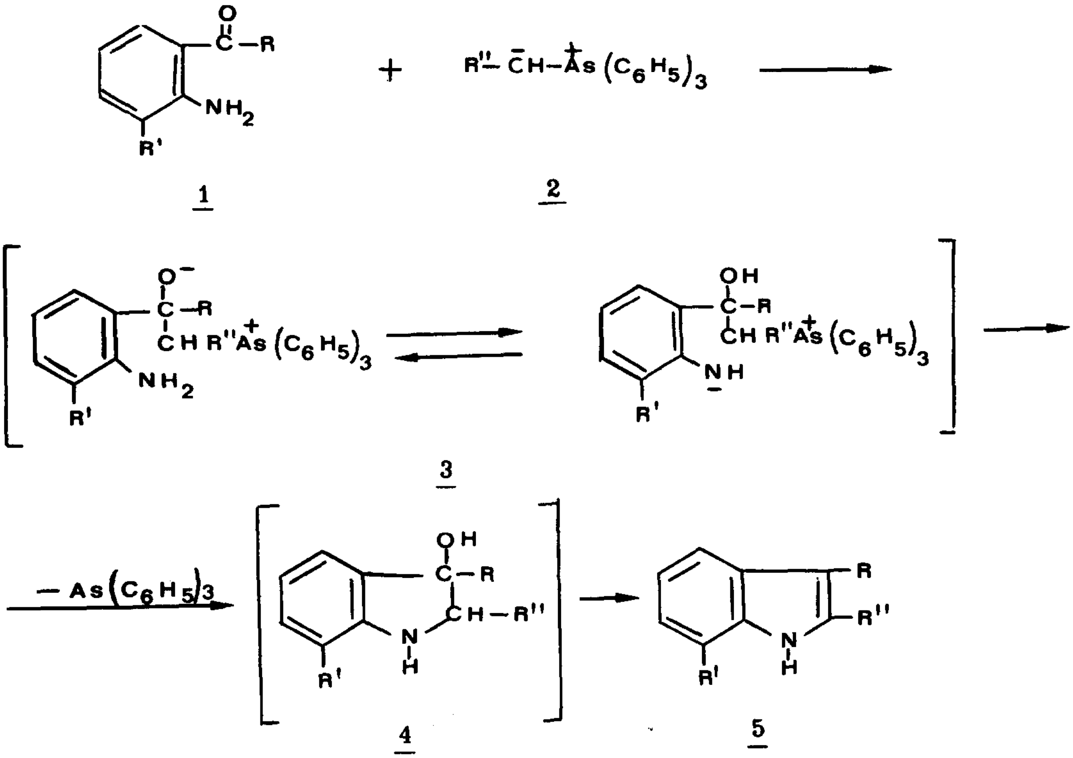
With the purpose of a further investigation in this field, following our previous researches on the synthesis of indoles from aromatic o-amino ketones 1 by sulphur ylides[3-5], we have investigated the reaction of these ketones with non stabilized arsonium ylides (2).

When 2a was reacted with the amino ketones (1a - 1e) in a cold 1:1 DMSO-THF solution a smooth reaction took place and the corresponding 3-substituted indoles (5a - 5e) were obtained in fair to good yields*. A similar behaviour was shown by the homologous ylide 2f, though the yields were poorer.

---

* 2a and 2f were generated "in situ" from the corresponding alkylarsonium iodides by methylsulphinyl carbanion (Na salt[6]) at 0°C. The reactions were carried out at 0°C for several hours and handled in the same way as for the analogous reactions with sulphur ylides[3,4]. The products, purified by crystallisation or chromatography, were identified by comparison with authentic samples.

This reaction parallels the one between dimethylsulphonium or dimethyloxosulphonium methylides[3,4] and 1, the main difference being the lack of formation of significant amounts of N-alkylindoles as side-products, and can be outlined as follows:

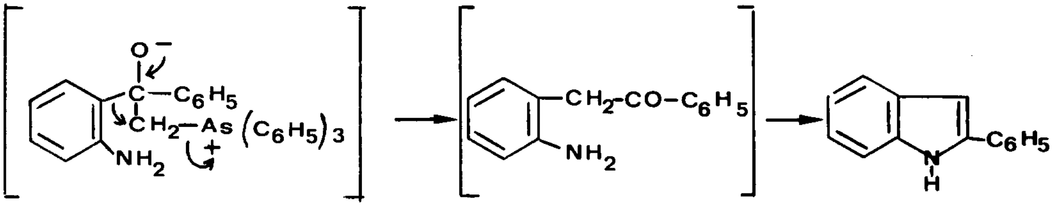


	R	R'	R"	yields%
a	CH_3	H	H	98
b	C_6H_5	H	H	97
c	$p\text{-}CH_3C_6H_4$	H	H	94
d	COOH	H	H	41
e	COOH	CH_3	H	44
f	C_6H_5	H	CH_3	19

The intermediacy of an epoxide* between 3 and 4 can also be operating, although no trace of epoxide could be detected.

It is interesting to note that when the reaction between 2a and o-aminobenzophenone (Ib) was run in cold THF in the presence of LiI** , that is in conditions such as to lower the nucleophilicity of nitrogen and oxygen in the intermediate betaine 3b, beside the normal reaction to 3-phenylindole, a rearrangement occurred leading to 2-phenylindole (6), the former being the predominant isomer.

A possible mechanism for such a rearrangement can be formulated as follows:***



3 b

6

---

* It has been reported[7] that the reaction between 2a and benzophenone in ether at 60°C, affords diphenylacetaldehyde, probably by a thermal rearrangement[8] of an intermediate epoxide. Since our reactions have been performed at 0°C, the intermediacy of o-aminodiphenylacetaldehydes to give indoles seems unlikely.

** The ylide was generated "in situ" from methyltriphenylarsonium iodide by n-butyllithium in THF at 0°C.The reaction was carried out at room temperature for several hours and the products separated by chromatography.

*** A similar rearrangement has been reported to occur in the sulphonium betaine from diphenylsulphonium isopropylide and benzophenone[9], and in the reaction of lb with either trimethylammonium methylide or diazomethane in the presence of magnesium iodide (Dr.A.Umani-Ronchi, personal communication).

Also in a comparative experiment made in THF with dimethylsulphonium methylide, wich in DMSO leads to only 3-phenylindole[3], a similar rearrangement was observed, the two isomeric indoles being obtained in a 1:1 ratio:

All these results confirm the general trend observed for the non-stabilized arsonium ylides wich, in many reactions, behave as the corresponding sulphonium rather than phosphonium ylides[1,2]. Actually triphenylphosphonium methylide, on reaction with *o*-aminobenzophenone, both in DMSO and THF solution, gave *o*-amino-1,1-diphenylethylene, in a normal "Wittig" reaction.

Acknowledgments. We thank Prof.Quilico for reading the manuscript. Financial support (contratto N.70.000141 - 115.3957) from the Italian National Research Council is acknowledged.

REFERENCES

1. A.W.Johnson, *Ylid Chemistry*, Academic Press, New York (1966).
2. A.W.Johnson and H.Schubert, *J.Org.Chem.*, **35**, 2678 (1970).
3. P.Bravo, G.Gaudiano and A.Umani-Ronchi, *Tetrahedron Letters*, **1969** 679.
4. P.Bravo, G.Gaudiano and A.Umani-Ronchi, *Gazz.Chim.Ital.*, **100** in the press.
5. Our unpublished results.
6. E.J.Corey and M.Chaykovsky, *J.Am.Chem.Soc.*, **87**, 1345 (1965).
7. M.C.Henry and G.Wittig, *ibid*, **82**, 563 (1960).
8. J.Bornstein, M.A.Joseph and J.E.Shields, *J.Org.Chem.*, **30**, 801 (1965).
9. E.J.Corey, M.Jautelat and W.Oppolzer, *Tetrahedron Letters*, **1967** 2325.