Tetrahedron Letters No.7, pp. 403-406, 1965. Pergamon Press Ltd.
Printed in Great Britain.

PREPARATION OF ARYL DIFLUOROMETHYL ETHER, THIOETHER AND SULPHONE DERIVATIVES.

ELECTRONIC PROPERTIES OF THE DIFLUOROMETHOXY, -METHYLTHIO AND -METHYLSULPHONYL SUBSTITUENTS.

R. Van Poucke, R.Pollet and A. De Cat
Chemical Research Department, Gevaert-Agfa N.V.
Mortsel-Antwerp (Belgium)

(Received 8 December 1964)

Research made with the support of the "Instituut tot Aanmoediging van het Wetenschappelijk Onderzoek in Nijverheid en Landbouw" (I.W.O.N.L.) of Belgium.

The preparation of aryl difluoromethyl ethers in yields between 44 and 66 % by the reaction of chlorodifluoromethane with phenols in aqueous diaxane and in the presence of an excess of sodium hydroxide, has been described by Miller and Thanassi (1). In this method, difluorocarbene, constituting the real reactive species, is generated from chlorodifluoromethane. We have now found that reaction of difluorocarbene with thiophenols, in the experimental conditions of Miller and Thanassi, provides an excellent synthetic route to aryl difluoromethyl sulphides, which are obtained in yields between 55 and 80 %.

In these reactions solvent systems other than aqueous dioxane were used with good success.

The different behaviour of dichlorocarbene and difluorocarbene in their reaction towards phenoxide ions - the former being the well-known Reimer-Tiemann reaction (2) - can be seen in analogy with the alkylation of ambient anions (3), also called ambident nucleophiles, which have more than one nucleophilic centre. With respect to carbenes these anions can be considered as "ambident carbenophiles".

Difluoromethyl ether and thioether derivatives can easily be converted to other derivatives, without affecting the difluorinated group, by avoiding, however, to conduct the reactions in acid media.

Aryl difluoromethyl sulphones were obtained by hydrogen peroxide oxidation of the corresponding difluoromethyl thioethers.

The meta- and para-tolyl difluoromethyl ethers and sulphones were converted to the corresponding benzoic acids by alkaline permanganate oxidation.

By treating the meta- and para-bromophenyl difluoromethyl thioethers with copper(I) cyanide we obtained the corresponding benzonitriles, and by subsequent alkaline hydrolysis the corresponding benzoic acids.

The ionisation constants of the acids have been determined potentiometrically in the solvant system ethyleneglycol monomethyl ether (80 wt %) water (20 wt %) proposed by Simon (4). These measurements allowed us to calculate the substituent parameters of the difluorinated groups. The Hammett substituent parameters are given in Table I ; they are compared with the parameters of the analogous trifluorinated groups (5,6).

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TABLE

Hammett substituent constants (a)

Substituent	σ m	σ p
$OCHF_2$	0.31	0.18
OCF_3	0.38 (b)	0.35
$SCHF_2$	0.33	0.36
SCF_3	0.40	0.50
SO_2CHF_2	0.75	0.86
SO_2CF_3	0.79 (c)	0.93

(a) All data of trifluorinated groups from ref. (5) unless otherwise noted.

(b) Corrected value of ref. (5) : personal communication of W.A. Sheppard.

(c) Value taken from ref. (6).

We intend to present later a more extensive description of the synthetic applications of difluorocarbene (7) and a more thorough discussion of the electronic properties of difluorinated substituents (8).

Acknowledgement

We wish to thank Prof. Dr. A.Van Dormael, Director of the Chemical Research Department (Gevaert-Agfa N.V.), for his kind interest in this work.

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