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Free Radical Reaction of 1-(4-Allylsulfonylbutyl)indoles

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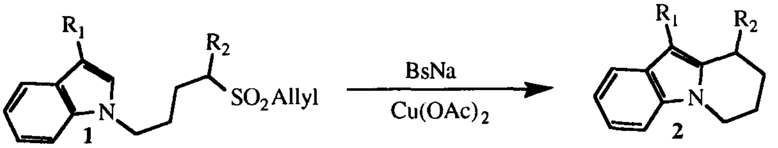
Abstract: A benzenesulfonyl radical induced radical reaction of 1-(4-allylsulfonylbutyl)indoles is described. Piperidino[1,2-a]indoles were obtained via free radical cyclization of 4-(1-indolyl)butyl radical. © 1997 Elsevier Science Ltd.

Free radical reactions mediated by sulfonyl radical have been noted by several groups.[1,2] The α-scission of most alkanesulfonyl radicals to generate alkyl radicals is an unfavorable process, but if the alkyl group represents a stabilized radical, the extrusion of sulfur dioxide occurs readily.[3] The alkyl radicals generated from alkanesulfonyl radicals presumably can undergo free radical cyclization reaction to form heterocyclic rings.[4] Benzenesulfonyl radical can be generated from sodium benzenesulfinate in aqueous acetic acid (eq. 1).[5] This report describes the results of free radical reaction between 1-(4-allylsulfonylbutyl)indoles and sodium benzenesulfinate/copper(II) acetate.

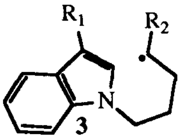
$$\mathrm{BsNa} + \mathrm{HX} \rightleftharpoons \mathrm{BsH} + \mathrm{NaX}$$

$$\mathrm{BsH} \longrightarrow [\,\mathrm{Bs}\bullet\,] \longrightarrow \mathrm{BsSPh} + \mathrm{BsOH} \qquad \text{Bs: Benzenesulfonyl} \quad \text{(eq. 1)}$$

We began our studies by examining the reaction behavior of **1a** (eq. 2). Thus, treatment of **1a** with sodium benzenesulfinate (10eq) and copper(II) acetate (2eq) in 80% aqueous acetic acid at 90°C gave **2a** in 73% yield. This free radical addition-cyclization reaction most likely proceeded via the radical intermediate **3a**. We also performed this reaction in 80% aqueous formic acid. In formic acid, this reaction was proceeded much faster. It can be rationalized by the higher acidity of formic acid. The generality of this reaction is illustrated in Table I. With R_2=CO_2Et or SO_2Ph, this reaction could proceed in good yields (entries a-e). On the other hand, with R_2=H, the reaction yields are rather poor (entries f and g). This result presumably could be ascribed to



(eq. 2)



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the stability of the radical intermediate **3**. With radical stabilizing group, radical intermediate **3** can be generated much efficiently.

Table I: Free Radical Reaction of *N*-(4-allylsulfonylbutyl)indoles

Entry	Substrate 1		Solvent	Time	Yield
	R_1	R_2			
a	COMe	CO_2Et	acetic acid	24h	73%
			formic acid	3h	94%
b	COMe	SO_2Ph	acetic acid	24h	80%
			formic acid	3h	79%
d	CN	CO_2Et	formic acid	3h	84%
d	CN	SO_2Ph	acetic acid	24h	77%
			formic acid	3h	86%
e	CO_2Me	CO_2Et	acetic acid	39h	87%
			formic acid	3h	87%
f	COMe	H	acetic acid	48h	50%
			formic acid	5h	33%
g	CO_2Me	H	acetic acid	33h	45%
			formic acid	4h	25%

In conclusion, alkyl radicals can be generated efficiently from allylsulfones. A synthetically useful method has been devised for the synthesis of piperidino[1,2-a]indoles. Further study on this reaction is in progress.

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References:

1. Cristol, S. J.; Reeder, J. A. *J. Org. Chem.* **1961**, *26*, 2182. Orochov, A.; Asscher, M.; Vofsi, D. *J. Chem. Soc. (B)*, **1969**, 225. Sinnerich, J.; Asscher, M. *J. Chem. Soc. Perkin I*, **1972**,1543. Fang, J.-M.; Chen, M.-Y. *Tetrahedron Lett.*, **1987**, *28*, 2853. Fang, J.-M.; Chen, M.-Y.; Cheng, M.-C.; Lee, G.-H.; Wang, Y.; Peng, S.-M. *J. Chem. Research (S)*, **1989**, 273 and *J. Chem. Research (M)*, **1989**, 2101.
2. De Riggi, I; Surzur, J.-M.; Bertrand, M. P. *Tetrahedron*, **1988**, *44*, 7119. De Riggi, I.; Surzur, J.-M.; Bertrand, M. P. *Tetrahedron*, **1990**, *46*, 5285. Bertrand, M. P. *Org. Prep. Proceed. Int.* **1994**, *26*, 259. Chuang, C.-P.; Wang, S.-F. *Synlett*, **1995**, 763, and references therein. Quiclet-Sire, B.; Zard, S. Z. *J. Am. Chem. Soc.* **1996**, *118*, 1209.
3. Chatgiliaoglu, C.; Lunazzi, L.; Ingold, K. U. *J. Org. Chem.* **1983**, *48*, 3588. Kang, Y.-H.; Kice, J. L. *J. Org. Chem.* **1984**, *49*, 1507.
4. Ziegler, F. E.; Jeronic, L. O. *J. Org. Chem.* **1991**, *56*, 3479. Baciocchi, E.; Muraglia, E. *Tetrahedron Lett.* **1993**, *34*, 3799 and 5015. Harrowven, D. C.; Browne, R. *Tetrahedron Lett.* **1995**, *36*, 2861. Moody, C. J.; Norton, C. L. *Tetrahedron Lett.* **1995**, *36*, 9051. Caddick, S.; Aboutayab, K.; Jenkins, K.; West, R. I. *J. Chem. Soc. Perkin Trans. I*, **1996**, 675. Aldabbagh, F.; Bowman, W. R. *Tetrahedron Lett.* **1997**, *38*, 3793. Chuang, C.-P.; Wang, S.-F. *Heterocycles*, **1997**, *45*, 347, and references therein.
5. Kice, J. L.; Pawlowski, N. E. *J. Am. Chem. Soc.* **1964**, *86*, 4898. Smith, T. A. K.; Whitham, G. H. *J. Chem. Soc., Chem. Commun.* **1985**, 897. Smith, T. A. K.; Whitham, G. H. *J. Chem. Soc. Perkin Trans. I*, **1989**, 319. Padwa, A.; Bullock, W. H.; Dyszlewski, A. D. *J. Org. Chem.*, **1990**, *55*, 955.

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