COMMUNICATIONS

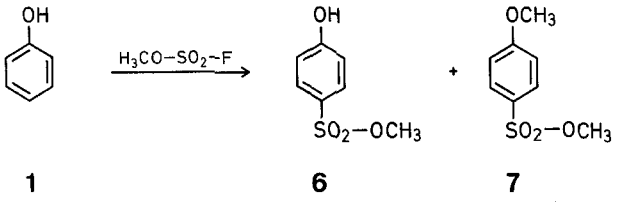
A Novel Methylsulfonation of Hydroxy or Alkoxy Aromatics with Methyl Fluorosulfonate

T. KAMETANI, K. TAKAHASHI and K. OGASAWARA

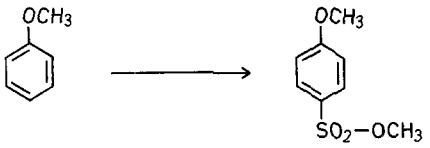
Pharmaceutical Institute, Tohoku University, Aobayama, Sendai, Japan

Methyl fluorosulfonate has been known as one of the strongest methylating agents[1,2], and, therefore, its application to synthetic studies as a facile and efficient methylating agent has been promising.

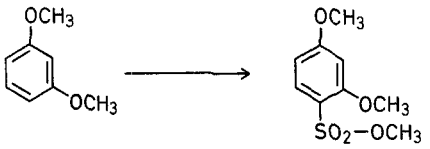
However, this reagent, as its chloro analogue[3], may also act as a sulfonyl halide. We wish now to report these results. Thus, heating of one equivalent of the aromatic compound with one or two equivalents of methyl fluorosulfonate at 100° for 12 hr afforded the corresponding aromatic methyl sulfonate.



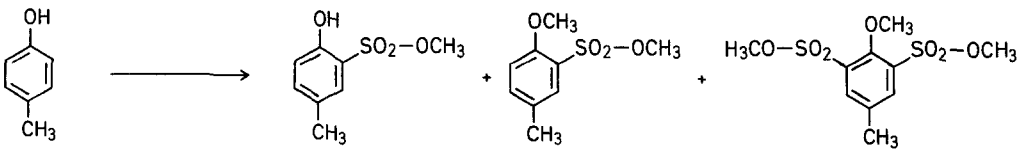
1 6 7



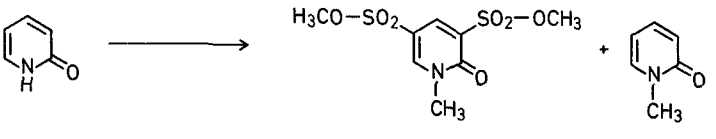
2 7



3 8



4 9 10 11



5 12 13

The structure of these sulfonates was confirmed by I. R., N. M. R., and mass spectra. In N. M. R. spectra of the sulfonates, methoxy signals appeared between 3.7–4.0 [ppm], and M^+ and ($M^+ - 31$) or ($M^+ - 32$) predominated in the mass spectra. These results and the N. M. R. data of aromatic protons are summarised in Table 1. In the case of 2-pyridone, 1-methyl-3,5-dimethoxysulfonylpyridone was obtained together with 1-methylpyridone[4] in poor yield because of its quarternisation and difficulty in separation.

General Procedure:
A solution of methyl fluorosulfonate (either 10 or 20 mmol) was added dropwise to the aromatic compound (10 mmol) with occasional shaking at 0° under nitrogen. The mixture was then heated at 100° for 12 hr. After cooling, the reaction mixture was poured into saturated aqueous sodium hydrogen carbonate (30 ml) and was extracted either with ether or chloroform. The extract was washed with saturated sodium chloride solution and dried over sodium sulfate.

We thank Dr. A. Brossi, Hoffmann-La Roche Inc., Nutley, New Jersey, for providing the methyl fluorosulfonate.

Table 1. Sulfonate Derivatives

Starting material	Product	Mol. weight	Yield %[a] 1 equiv. CH_3SO_3F	Yield %[a] 2 equiv. CH_3SO_3F	m.p. or b.p. (Solvent of crystallisation)
Phenol	**6**	188	20	8	m.p. 99–100° (ether/hexane)
	7	202	7	14	b.p. 146–148°/3 mm[b]
Anisol	**7**	202	40	—	
1,3-Dimethoxybenzene	**8**	232	50	—	m.p. 67–68° (benzene/hexane)
4-Methylphenol	**9**	202	25	10	m.p. 69–70° (hexane)
	10	216	10	20	m.p. 71–72° (ether/hexane)
	11	292	0	2	m.p. 88–89° (chloroform/hexane)
2-Pyridone	**12**	297	—	1	m.p. 152–154° (methanol/ether)

Table 1. continued

Product	Analysis			N.M.R. Data Position[c] 1	2	3	4	5	6	Solvent
6	calc.	C 44.69	H 4.29	OH	6.97[d]	7.74[d]	SO_3CH_3	7.74[d]	6.97[d]	$CDCl_3$
	found	44.51	4.25							
7	calc.	C 47.53	H 4.99	OCH_3	6.98[d]	7.81[d]	SO_3CH_3	7.81[d]	6.98[d]	$CDCl_3$
	found	47.63	4.85							
7										
8	calc.	C 46.55	H 5.21	OCH_3	6.51[f]	OCH_3	SO_3CH_3	7.80[d]	6.51[e]	$CDCl_3$
	found	46.51	5.23							
9	calc.	C 47.53	H 4.99	OH	SO_3CH_3	7.35[f]	CH_3	7.26[e]	6.83[d]	CCl_4
	found	47.34	4.80							
10	calc.	C 50.04	H 5.60	OCH_3	SO_3CH_3	7.63[f]	CH_3	7.37[e]	6.95[d]	$CDCl_3$
	found	50.17	5.58							
11	calc.	C 36.02	H 4.14	OH	SO_3CH_3	7.87[g]	CH_3	7.87[g]	SO_3CH_3	$CDCl_3$
	found	36.29	3.98							
12	calc.	N 4.72		CH_3		SO_3CH_3	8.55[f]	SO_3CH_3	8.55[f]	CF_3COOH
	found	4.68								

[a] After purification.
[b] Bath temperature.
[c] The values show aromatic proton resonance [ppm].
[d] Doublet, $J = 8.0–10.0$ Hz.
[e] A pair of doublets, $J = 8.0–10.0$ and 2.0–3.0 Hz.
[f] Doublet, $J = 2.0–3.0$ Hz.
[g] Singlet.

Received: March 30, 1972

[1] M. G. AHMED, R. W. ALDER, G. H. JAMES, M. L. SINNOTT, M. C. WHITING, Chem. Commun. **1968**, 1533.
[2] M. G. AHMED, R. W. ALDER, Chem. Commun. **1969**, 1389.
[3] L. F. FIESER, D. M. BOWEN, J. Amer. Chem. Soc. **62**, 2103 (1940).
[4] E. A. PRILL, S. M. MCELVAIN, Org. Syn., Coll. Vol. **2**, 419 (1943). J. A. ELVIDGE, L. M. JACKMANN, J. Chem. Soc. **1961**, 859.