from the cooled reaction mixture and washed with benzene to give 1.4 g. The combined benzene solutions were evaporated to dryness and the residue was chromatographed over silica gel, using petroleum ether (bp 40–60 °C)–ether (9:1) as eluant. The initial fraction, on trituration with petroleum ether–ether formed colorless needles, 1.3 g. The filtrate essentially contained dimethylacetylenedicarboxylate. Further recrystallization from hexane afforded **13** as colorless needles, mp 125–126 °C. Additional quantities (0.76 g) of **13** were eluted from the column by increasing the amount of Et_2O in the elution mixture. Unreacted **11** was the last product eluted from the column. **13**: IR (KBr) ν_{CO} 1695, 1655 cm^{-1}; NMR ($CDCl_3$) δ 7.37 (s, 5, Ph), 4.43 (s, 2 NCH_2CO), 4.17 (q, 2, J = 7.0 Hz, $COOCH_2CH_3$), 3.67 (br, 1, NH), 1.86–1.07 (m, 25, aliphatic and $COOCH_2CH_3$); mass spectrum, m/e (relative intensity) 429 ($M^{+\cdot}$, 22).

Anal. Calcd for $C_{24}H_{35}N_3O_4$: C, 67.10; H, 8.21; N, 9.78. Found: C, 67.12; H, 8.20; N, 9.73.

Registry No. **4** (R = H), 75125-23-4; **4** (R = COOEt), 75125-24-5; **5** (R = H), 13610-49-6; **5** (R = Et), 13610-51-0; **6** (R′ = H), 75125-25-6; **6** (R′ = Ph), 75125-27-8; **7**, 75125-28-9; **8** (R′ = H), 75125-29-0; **8** (R′ = Ph), 75125-30-3; **9**, 74527-22-3; **11**, 75125-31-4; **11** ammonium salt, 75125-32-5; **13**, 75125-33-6; 2-oxazolidone, 497-25-6; ethyl bromoacetate, 105-36-2; 2(3*H*)-benzoxazolinone, 59-49-4; α-bromophenylacetic acid, 4870-65-9; *N*,*N*′-dicyclohexylcarbodiimide, 13488-09-0.

Synthesis and Characterization of [Methoxy(tosyloxy)iodo]benzene, an Acyclic Monoalkoxyiodinane

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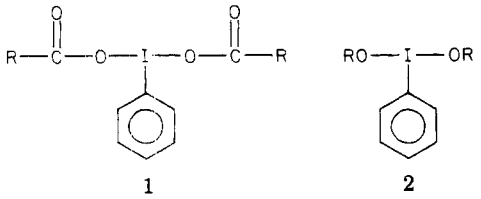
Organoiodine(III) compounds with iodine-bound alkoxy groups are rare. Indeed, while the aryliodosodicarboxylates **1** are well-known and moderately stable[1] to thermal decomposition, the analogous aryliodosodialkoxides **2** have



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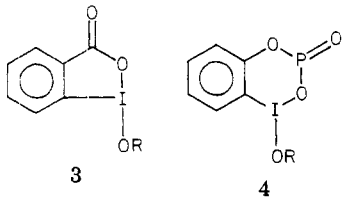
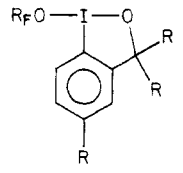


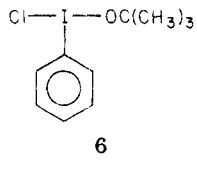
3

4

not been prepared. The inclusion of iodine into five- and six-membered rings stabilizes its hypervalent states, and cyclic alkoxyiodinanes are known. Structures **3** and **4** have been assigned to the esters of *o*-iodosobenzoic acid[2] and *o*-iodosophenylphosphoric acid.[3] Recently, Martin and Amey utilized the stabilizing capacity of electronegative ligands in conjunction with that of cyclic structures to synthesize the first dialkoxyiodinanes; these are of general structure **5**.[4,5] They also prepared several related mono-



5, R_F = $Ph(CF_3)_2$



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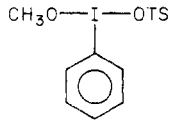
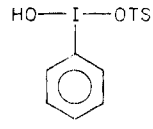


7



8

alkoxyiodinanes, among them being the first isolated bromoiodinanes. To our knowledge, [chloro(*tert*-butoxy)iodo]benzene (**6**), reported by Tanner and Gidley in 1968, is the only known example of an isolated acyclic alkoxyiodianane.[6] In this note, we detail the synthesis and characterization of [methoxy(tosyloxy)iodo]benzene (**7**), a crystalline, acyclic monoalkoxyiodinane in which two ligands are bonded to iodine(III) through oxygen.

[Hydroxy(tosyloxy)iodo]benzene (**8**), first reported by Neiland and Karele in 1970,[7] is a rather versatile reagent. We have recently found that it will undergo ligand-transfer reactions with a variety of aryl iodides[8] and that it, and some of its analogues, will react with aryltrimethylsilanes in CH_3CN, thus affording a regiospecific synthesis of iodonium salts.[9] We have also discovered a facile one-step α-tosyloxylation reaction of mono- and diketones with (**8**).[10]

[Hydroxy(tosyloxy)iodo]benzene (**8**) serves as a precursor of **7**. An example preparation of **7** follows. [Hydroxy(tosyloxy)iodo]benzene (**8**, 2.00 g) was added to trimethyl orthoformate (~2 mL), and the reaction mixture was flushed with nitrogen. After 10 min, the white crystals of **8** had dissolved to give a clear yellow solution. After a time, large glassy plates of **7** crystallized from the liquid and were subsequently isolated by decantation and blown dry with nitrogen (yield 1.79 g, mp 88–92 °C).

The structure of **7** was assigned on the basis of its elemental composition (C, H, I) and by NMR analysis. The ^1H NMR spectrum (CD_3CN, Me_4Si) exhibits singlets at δ 2.28 [(tosyloxy)methyl] and 3.92 (OCH_3) and a complex aromatic multiplet. Confusion reigned in our initial attempts to characterize **7** owing to crystal-surface hydrolysis by atmospheric moisture; in the presence of water, it hydrolyzes rapidly and efficiently back to [hydroxy(tosyloxy)iodo]benzene. In one experiment, **7** (0.90 g) was dissolved in dry acetonitrile (2 mL; **7** is quite soluble in CH_3CN). Upon treatment with 0.1 g of water, the solution immediately became filled with white crystals of insoluble **8** (0.72 g, 83%).

We considered two plausible mechanisms for the hydrolysis reaction, one involving nucleophilic displacement of $PhI(OTS)O^-$ from the methyl carbon of the methoxyl group by H_2O and another involving formal displacement of methanol from iodine after initial nucleophilic attack of water at the iodine atom; both are illustrated in Scheme I.

(1) C. Willgerodt, "Die Organischen Verbindungen mit Mehrwertigen Jod", F. Enke, Stuttgart, 1914.
(2) G. P. Baker, F. G. Mann, N. Sheppard, and A. J. Tetlow, *J. Chem. Soc.*, 3721 (1965).
(3) J. E. Leffler and H. Jaffe, *J. Org. Chem.*, **38**, 2719 (1973).
(4) R. L. Amey and J. C. Martin, *J. Am. Chem. Soc.*, **100**, 300 (1978).
(5) R. L. Amey and J. C. Martin, *J. Org. Chem.*, **44**, 1779 (1979).
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(7) O. Neiland and B. Karele, *J. Org. Chem. USSR (Engl. Transl.)*, **6**, 889 (1970).
(8) G. F. Koser and R. H. Wettach, *J. Org. Chem.*, **45**, 1542 (1980).
(9) G. F. Koser, R. H. Wettach and C. S. Smith, *J. Org. Chem.*, **45**, 1543 (1980).
(10) R. H. Wettach, A. G. Relenyi, A. Kalos and G. F. Koser, unpublished results.

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Scheme I

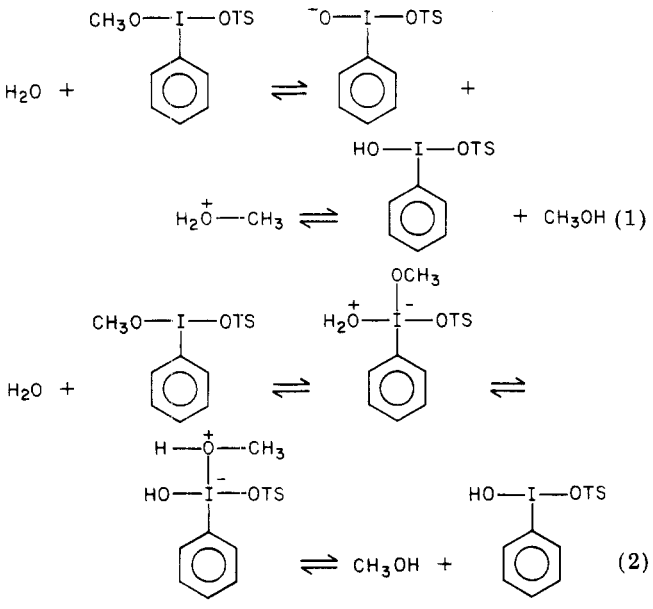
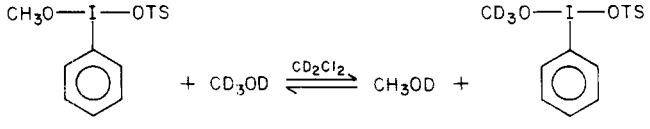


Table I[a]



	δ	$(H_z)^{obsd}$	$(H_z)^{calcd}$
CH_3OD in CD_2Cl_2	3.37	202	
$PhI(OCH_3)OTS$	3.87	232	
1 equiv of CD_3OD	3.67	220	217
2 equiv of CD_3OD	3.52	211	212
6 equiv of CD_3OD	3.40	204	206

[a] 110 mg of 7 in CD_2Cl_2.

The second mechanism might involve the intermediate formation of a four-coordinate iodine species in which iodine bears a negative charge. A similar intermediate was first proposed by Beringer and Chang in ligand exchange reactions of iodonium salts with aryllithiums[11] and subsequently by Martin and Amey in ligand exchange reactions of 5 with R_fOH/R_fOK.[5] However, such a species need not necessarily form if 7 exists as an ion pair $PhI^+(OCH_3)^-OTS$ in solution.

With water as nucleophile, the products of either mechanism would be identical. However, with methanol as nucleophile instead of H_2O, mechanism 1 would yield 8 and dimethyl ether while mechanism 2 would result in degenerate exchange. For that reason, we studied the reaction between 7 and methanol-d_4 in CD_2Cl_2 by NMR spectroscopy at probe temperature. The result was degenerate exchange.

There was no observable formation of 8 (which is very insoluble in CH_2Cl_2 and would precipitate as formed) nor was CH_3OCD_3 detected by ^1H NMR analysis. The results of the exchange study are summarized in Table I. The addition of methanol-d_4 to 7 in CH_2Cl_2 led to broadening of the singlet at δ 3.87 and, within 10 min, to a shift of that singlet to a new position and some renarrowing of the line width. The observed chemical shifts after exchange with various added quantities of CD_3OD are compared in Table I to calculated values for rapid exchange between 7 and CH_3OD (on the NMR time scale).

(11) F. M. Beringer and L. L. Chang, *J. Org. Chem.*, 37, 1516 (1972).

Experimental Section

General. NMR spectra were recorded on a Varian EM-360 spectrometer. Melting points are uncorrected. Compound 7 was sent out for elemental analysis.

Synthesis of [Methoxy(tosyloxy)iodo]benzene (7). Trimethyl orthoformate (ca. 2.0 mL) was added to 2.00 g (5.10 mmol) of [hydroxy(tosyloxy)iodo]benzene (8); the reaction vessel was purged with nitrogen and capped. After ca. 10 min, the solid 8 had disappeared, and a yellow solution resulted. The reaction mixture was then allowed to stand at room temperature whereupon large glassy plates slowly crystallized from the liquid. After 8 h the liquid was decanted and [methoxy(tosyloxy)iodo]benzene (7) was obtained as a crystalline aggregate (yield 1.79 g (86%), mp 88–92 °C). No further crystallization occurred from the mother liquor over a period of 48 h. The product was blown dry under a stream of nitrogen and subsequently stored under nitrogen; ^1H NMR (CD_3CN/Me_4Si) δ 2.28 (s, 3 H, (tosyloxy)methyl), 3.92 (s, 3 H, OCH_3), 7.0–8.2 (complex m, 9 H, aromatic).

Anal. Calcd for $C_{14}H_{15}ISO_4$: C, 41.39; H, 3.72; I, 31.24. Found: C, 41.22; H, 3.61; I, 31.16.

Hydrolysis of 7. 7 (0.90 g) was dissolved in CH_3CN (2 mL). To this solution was added 0.1 g of H_2O, and it was immediately filled with fine glassy crystals of 8 which were subsequently isolated and dried: yield 0.72 g (83%); mp 135–137 °C.

Registry No. 7, 75067-08-2; 8, 27126-76-7; trimethyl orthoformate, 149-73-5.

Heterocycles. 8. Synthesis of Oxaflozane[1,2]

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Oxaflozane (1) is a potent antidepressant agent.[4] Previous synthesis[4a] of this compound employed a Grignard reaction of 2 and 3 to give dihalo ether 4 and, finally, reaction of 4 with isopropylamine. We report an alternative synthesis of 1, taking advantage of hemiketal formation of β-oxoethanolamine[5,6] which obviates the use of the potentially explosive reagents 2.[7]

Thus, *N*-isopropylethanolamine was condensed with α-bromo-3-(trifluoromethyl)acetophenone to give hemiketal 7. Acid-catalyzed dehydration of 7 with 1.1 equiv of *p*-toluenesulfonic acid gave 8. When less than 1 equiv of catalyst was used, the reaction did not go to completion as measured by the water collected. Hydrogenation of 8 gave oxaflozane (1)[4a] in an overall yield of 34% (compared to 27% for the previous process).[4a]

(1) For part 7, see P. M. Weintraub, *J. Heterocycl. Chem.*, 16, 1081 (1979).
(2) Presented in part at the 10th Central Regional ACS Meeting, March 1979, Abstracts p 93.
(3) Milwaukee, WI.
(4) (a) R. Y. Mauvernay, N. Busch, J. Moleyre, and J. Simond, U.S. Patent 3 637 680 (1972); (b) H. C. Denber, *Ann. Med. Psychol.*, 1, 138 (1973); (c) J. Hache, P. Duchene-Marullaz, G. Streichenberger, L. Simetiere, and M. Leinot, *Therapie*, 29, 81 (1974); (d) H. Rascol, H. Maurel, J. David, and M. Layani, *ibid.*, 29, 95 (1974).
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