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Received December 23, 1977

The 5-chloro-1-alkoxy-1,2,3-benzotriazole system has been synthesized and characterized via its physical and chemical properties. HMO calculations predict the most reactive sites on the molecule.




J. Heterocyclic Chem., 15, 1043 (1978)

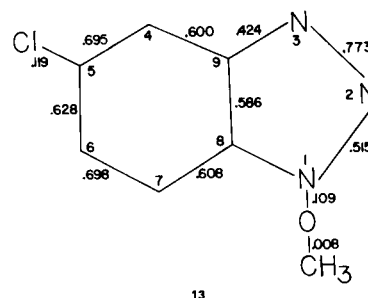
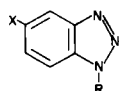
The similarity of the 1,2,3-benzotriazole molecule (1) to the purine nucleus has prompted us to look for derivatives of 1 which may be biologically active. Schweizer and Rogers (1) showed that 5-chloro-1,2,3-benzotriazole (2) had a pronounced effect on plant physiology. Tamm and co-workers (2) reported that 2 could inhibit poliovirus multiplication and also possessed cytopathogenic properties.

The 1-alkoxy derivatives of 2, however, have not been reported. The 1-alkoxy derivatives of 2 are of interest since they could alter the biological activity of 2 by (a) increasing the lipid solubility of the molecule, (b) changing the gross structure of the molecule thereby allowing the molecule to react with different cellular membrane

receptors or (c) providing a handle on the molecule by which microsomal oxidase enzymes might metabolize derivatives of 2 into new compounds which may also possess biological activity.

We wish to report the synthesis, physical and spectral properties of several 5-chloro-1-alkoxy-1,2,3-benzotriazoles (4-12). All the compounds were prepared by treating the sodium salt of 5-chloro-1-hydroxy-1,2,3-benzotriazole (3) with the appropriate alkyl halide. The elemental analyses found (Table I) agreed with the calculated values. The ultraviolet spectra of 4-12 possessed one major absorption at 273 nm, which can be ascribed to a $\pi \rightarrow \pi^*$ transition. The infrared spectra of 4-12 all possessed: bands at 1240, 1270 and 1380 cm^{-1} which are characteristic of a 5-membered ring fused to a benzene nucleus (3); a pair of bands in the vicinity of 1000 and 1100 cm^{-1} , which have been reported for a triazole ring (4); a band at 940 cm^{-1} , which has been assigned to the N-O stretching mode in alkyl nitrites (5). The nmr spectra of 4-12 all possess the requisite alkoxy hydrogens. The aromatic proton region, however, showed a well defined AMX splitting pattern. The aromatic hydrogen splitting pattern revealed a doublet of doublets in the area of δ 7.25 (ppm ($J = 2$ Hz, $J = 9$ Hz) which was assigned to H_6 ; a doublet at δ 7.50 ppm ($J = 2$ Hz) which was assigned to H_4 ; and a doublet at δ 7.85 ppm ($J = 9$ Hz) which was assigned to H_7 (6).

	X	R
1	H	H
2	Cl	H
3	Cl	OH
4	Cl	OCH ₃
5	Cl	OCH ₂ CH ₃
6	Cl	OCH ₂ CH ₂ CH ₃
7	Cl	OCH ₂ CH ₂ CH ₂ CH ₃
8	Cl	OCH ₂ CH ₂ CH ₂ CH ₂ CH ₃
9	Cl	OCH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃
10	Cl	
11	Cl	
12	Cl	
15	H	OCH ₃



BOND ORDERS FOR 5-CHLORO-1-METHOXY-1,2,3-BENZOTRIAZOLE




HMO calculations were carried out to elucidate the bond orders (13) and π electron charge densities (14) of the alkoxy derivatives (7). In order to simplify the

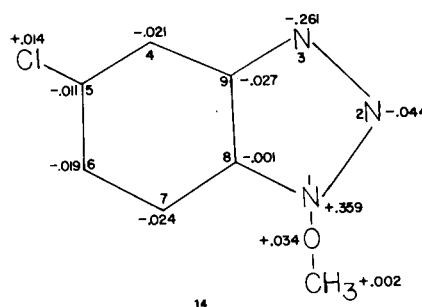
Table I

Physical and Spectral Properties of 4-12

R	Melting Point [Boiling Point]	Elemental Calcd.	Analysis Found	Ultraviolet (nm) in Ethanol	Nmr in Deuteriochloroform
O-CH ₃ (4)	99-100°	C, 45.79 H, 3.30 Cl, 19.31 N, 22.89	45.93 3.57 18.90 23.15	273 (log ε = 3.86)	4.35 ppm (s, 3H) 7.35 ppm (d, d, 1H, J = 2 Hz, 9 Hz) 7.60 ppm (d, 1H, J = 2 Hz) 7.90 ppm (d, 1H, J = 9 Hz)
O-CH ₂ CH ₃ (5)	72-73°	C, 48.62 H, 4.08 Cl, 17.94 N, 21.26	48.81 4.19 17.55 21.05	273 (log ε = 4.10)	1.45 ppm (s, 3H, J = 7 Hz) 4.60 ppm (q, 2H, J = 7 Hz) 7.20 ppm (dd, 1H, J = 2 Hz, 9 Hz) 7.50 ppm (d, 1H, J = 2 Hz) 7.80 ppm (d, 1H, J = 9 Hz)
O-CH ₂ CH ₂ CH ₃ (6)	43-44°	C, 51.07 H, 4.76 Cl, 16.75 N, 19.85	51.27 4.65 17.13 20.09	273 (log ε = 4.12)	1.15 ppm (t, 3H, J = 6 Hz) 1.80 ppm (m, 2H) 4.45 ppm (t, 2H, J = 6 Hz) 7.25 ppm (dd, 1H, J = 2 Hz, 9 Hz) 7.50 ppm (d, 1H, J = 2 Hz) 7.90 ppm (d, 1H, J = 9 Hz)
O-CH ₂ CH ₂ CH ₂ CH ₃ (7)	[140-142° (0.2 mm)]	C, 53.22 H, 5.36 Cl, 15.71 N, 18.62	53.44 5.52 15.46 18.35	273 (log ε = 4.06)	1.00 ppm (t, 3H, J = Hz) 1.70 ppm (m, 4H) 4.50 ppm (t, 2H, J = 6 Hz) 7.20 ppm (dd, 1H, J = 2 Hz, 9 Hz) 7.50 ppm (d, 1H, J = 2 Hz) 7.85 ppm (d, 1H, J = 9 Hz)
O-CH ₂ CH ₂ CH ₂ CH ₂ CH ₃ (8)	[150-152° (0.15 mm)]	C, 55.11 H, 5.89 Cl, 14.79 N, 17.53	54.96 6.04 14.99 17.26	273 (log ε = 3.98)	0.95 ppm (t, 3H, J = 6 Hz) 1.50 ppm (m, 6H) 4.52 ppm (t, 2H, J = 6 Hz) 7.25 ppm (dd, 1H, J = 2 Hz, 9 Hz) 7.55 ppm (d, 1H, J = 2 Hz) 7.90 ppm (d, 1H, J = 9 Hz)
O-CH ₂ CH ₂ CH ₂ CH ₂ CH ₂ CH ₃ (9)	[156-158° (0.1 mm)]	C, 56.80 H, 6.36 Cl, 13.98 N, 16.56	57.03 6.16 14.23 16.22	273 (log ε = 4.02)	0.90 ppm (t, 3H, J = 6 Hz) 1.35 ppm (m, 8H) 4.45 ppm (t, 2H, J = 6 Hz) 7.20 ppm (dd, 1H, J = 2 Hz, 9 Hz) 7.45 ppm (d, 1H, J = 2 Hz) 7.80 ppm (d, 1H, J = 9 Hz)

Table I (continued)
Physical and Spectral Properties of 4-12

R	Melting Point [Boiling Point]	Elemental Calcd.	Analysis Found	Ultraviolet (nm) in Ethanol	Nmr in Deuteriochloroform
	(10) 57-58°	C, 55.58 H, 5.09 Cl, 14.92 N, 17.68	55.65 5.27 14.65 17.91	273 (log ϵ = 3.88)	2.2 ppm (m, 8H) 5.5 ppm (m, 1H) 7.30 ppm (dd, 1H, J = 2 Hz, 9 Hz) 7.50 ppm (d, 1H, J = 2 Hz) 7.90 ppm (d, 1H, J = 9 Hz)
	(11) 57-58°	C, 57.26 H, 5.61 Cl, 14.09 N, 16.69	57.09 5.63 14.35 16.88	273 (log ϵ = 3.94)	1.80 ppm (m, 10H) 4.60 ppm (m, 1H) 7.30 ppm (dd, 1H, J = 2 Hz, 9 Hz) 7.55 ppm (d, 1H, J = 2 Hz) 7.90 ppm (d, 1H, J = 9 Hz)
	(12) 37-38°	C, 58.75 H, 6.07 Cl, 13.34 N, 15.81	58.88 6.13 13.57 15.67	273 (log ϵ = 4.06)	1.6 ppm (m, 12H) 4.85 ppm (m, 1H) 7.25 ppm (dd, 1H, J = 2 Hz, 9 Hz) 7.50 ppm (d, 1H, J = 2 Hz) 7.85 ppm (d, 1H, J = 9 Hz)



ELECTRON CHARGE DENSITIES FOR 5-CHLORO-1-METHOXY-1,2,3-BENZOTRIAZOLE

calculations **4** was used as the model compound. A comparison of **13** with the calculations reported on the unsubstituted 1-methoxy-1,2,3-benzotriazole (**15**) (**8**) showed that the chlorine had little effect on the bond orders. However, comparison of the π electron densities shows that the 5-chloro substituent does alter the sites for potential electrophilic attack on the phenyl ring. In **15** the most negative sites on the phenyl ring are positions 5 and 7, whereas in **14** positions 4, 6 and 7 are the more likely sites of attack and carry comparable π charges.

EXPERIMENTAL

The infrared spectra were obtained on a Perkin Elmer 735-B spectrophotometer. The ultraviolet spectra were obtained on a Cary 14 spectrophotometer. The nmr spectra were obtained on a Varian EM-360.

Materials.

5-Chloro-1-hydroxy-1,2,3-benzotriazole was prepared according to the procedure of Singh and Kapic (**9**).

The procedure for the preparation of the 5-chloro-1-alkoxy-1,2,3-benzotriazoles has been previously delineated (**8**).

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