

Dimethyl-(3,3-diphenyl-4-oxohexyl)sulfonium iodide (Xa). A solution of 5.8 g. of 4,4-diphenyl-6-methylthiohexanone-3 (IX) in 20 ml. of methyl iodide was allowed to stand for 4 days. The product (Xa) separated as a white crystalline material, which after 2 recrystallizations from 95% ethanol, weighed 5.3 g., m.p. 125.5° (gas evolution). Mychajlyszn and Jilek⁵ report a m.p. of 122°.

(3,3-Diphenyl-4-oxohexyl)-ethylmethylsulfonium iodide (Xb). A solution of 25.3 g. (0.085 mole) of 4,4-diphenyl-6-methylthiohexanone-3 (IX) in 75 ml. acetone was treated with 46.8 g. (0.3 mole) of ethyl iodide. The solution was allowed to stand at room temperature for several days. The sulfonium salt separated out during this time as a crystalline solid. The mixture was filtered and the light yellow solid weighed 5.4 g., m.p. 114–115.5°. After recrystallization from 15 ml. of 95% ethanol there was obtained 4.3 g. of a white solid, m.p. 118.5–119°.

Anal. Calcd. for C₂₁H₂₇IOS: C, 55.5; H, 5.99; I, 27.9; S, 7.06. Found: C, 55.4; H, 5.61; I, 27.8; S, 7.47.

4,4-Diphenyl-6-methylthiohexanol-3 (XI). A mixture of 4.6 g. (0.12 mole) of lithium aluminum hydride in 200 ml. of ether was refluxed on a steam bath in an atmosphere of nitrogen for 4.5 hr. A solution of 119.3 g. (0.4 mole) of 4,4-diphenyl-6-methylthiohexanone-3 (IX) in 200 ml. of ether then was added dropwise over a period of 40 min. The mixture was refluxed for 2.5 hr. Wet ethyl acetate (40 ml.) was added cautiously to decompose the complex and any unreacted lithium aluminum hydride. After the decomposition was complete, 300 ml. of ice water was added. This gave a milky solution, which separated into 2 layers after standing overnight. The aqueous layer was acidified with dilute sulfuric acid, and then extracted several times with ether. The ether extracts were combined, dried over sodium sulfate, filtered, and evaporated. The residue, a thick viscous oil, was distilled at reduced pressure. The product boiled at 182–184° at 1–2 mm. and weighed 77.4 g. (64.5%). This oil solidified to a white solid, m.p. 66–69°. Recrystallization from a mixture of hexane and petroleum ether gave 75.2 g. of the product XI, m.p. 70–71.5°.

Anal. Calcd. for C₁₉H₂₄OS: C, 75.9; H, 8.05; S, 10.7. Found: C, 76.1; H, 8.22; S, 10.6.

4,4-Diphenyl-6-methylthio-3-hexyl acetate (XII). A mixture of 90 g. (0.3 mole) of 4,4-diphenyl-6-methylthiohexanol-3 (XI) in 400 ml. of dry pyridine was stirred and cooled in an ice bath while 27 g. (0.35 mole) of acetyl chloride was added over a period of 30 min. at 10–12°. The ice bath was removed and the temperature raised slowly until a clear solution formed (about 2 hr.). The solution was stirred at room temperature for 3 hr., and then poured onto ice water which had been made slightly acid with dilute hydrochloric acid. The mixture was extracted three times with portions of ether, and the ether extracts were combined, dried, filtered, and evaporated. The residue, a thick viscous amber oil, was distilled at reduced pressure. The product (XII) boiled at 180–188° at 1 mm. and weighed 60.5 g. (59%).

(4-Acetoxy-3,3-diphenylhexyl)-dimethylsulfonium iodide (XIII). This compound was prepared from XII and methyl iodide by the procedure described above for the preparation of Xa. It was obtained in 38% yield after crystallization from 95% ethanol, m.p. 121.5–122.5°.

Anal. Calcd. for C₂₂H₂₉IO₂S: C, 54.5; H, 6.03; I, 26.2; S, 6.62. Found: C, 54.2; H, 6.44; I, 26.2; S, 6.21.

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ORGANIC CHEMICAL RESEARCH SECTION
LEDERLE LABORATORIES DIVISION
AMERICAN CYANAMID COMPANY
PEARL RIVER, N. Y.

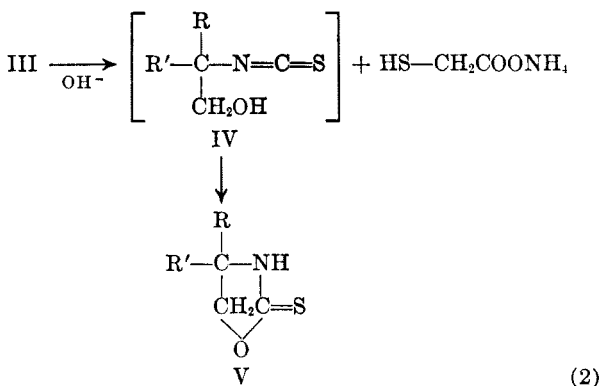
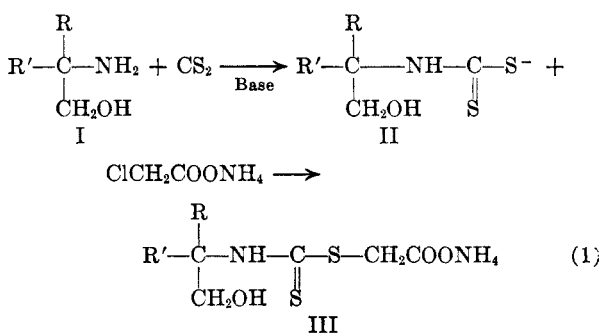
Preparation of 2-Thioöxazolidones from Substituted Dithiocarbamylacetic Acids

WILLARD T. SOMERVILLE AND CARL N. ANDERSEN

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2-Thioöxazolidones¹ substituted in the 4- and 5- positions have been prepared from aminoalcohols by reaction with carbon disulfide and potassium hydroxide^{2,3} and by the decomposition of thiuram disulfides derived from 2-aminoalcohols.³

We have now found that *N*-substituted dithiocarbamylacetic acid derivatives produced from 2-aminoalcohols, carbon disulfide, and monochloroacetic acid (Equation 1) may be decomposed by alkali to form a substituted 2-thioöxazolidone and thioglycolic acid (Equation 2).



The expected product of the scission of the substituted dithiocarbamylacetic acid would be a hydroxyalkyl isothiocyanate (IV), but this apparently cyclizes⁴ to the corresponding 2-thioöxazolidone (V).^{4,5}

In the above manner, 2-methyl-2-aminopropanol-1, I R=R'=CH₃, yields 4,4-dimethyl-2-

(1) We have confirmed the work of M. G. Ettliger, *J. Am. Chem. Soc.*, **72**, 4792 (1950), who has shown by infrared spectra that these materials are thioketones and do not contain SH groups. Therefore, they are more properly termed 2-thioöxazolidones rather than oxazoline-2-thiols.

(2) H. A. Bruson and J. W. Eastes, *J. Am. Chem. Soc.*, **59**, 2011 (1937).

(3) A. A. Rosen, *J. Am. Chem. Soc.*, **74**, 2994 (1952).

(4) B. Holmberg, *J. Prakt. Chem.*, **79**, 263 (1909) observed that dithiocarbamylacetic acid in alkali solution produced thioglycolic acid and thiocyanic acid.

thiooxazolidone whereas the carbon disulfide and alkali process of Bruson² produces a mixture of the 2-thiooxazolidone and thiazoline compounds. Similarly 2-aminobutanol-1, (I).R=H, R'=C₂H₅, produces a thiooxazolidone derivative instead of a substituted thiazoline. The reaction products are thus similar to those obtained by the thiuram procedure.³

EXPERIMENTAL⁵

Preparation of substituted 2-thiooxazolidone from 2-amino alcohols. A mixture of 1 mole (89.1 g.) 2-aminobutanol-1, or 2-methyl-2-aminopropanol-1, and 90 g. of ammonium hydroxide was cooled in an ice bath at 10° and 76 g. of carbon disulfide were added over a 15-min. period, and then stirred for 1 hr. or until it became a clear uniform solution. A solution prepared by dissolving 94.5 g. (1 mole) of monochloroacetic acid in 70 ml. of water and neutralizing with 70 ml. of ammonium hydroxide solution was added to the above dithiocarbamate solution. This reaction was somewhat exothermic and the temperature rose to 20 to 25°. Stirring was continued for an hour after addition was complete and the mixture was then allowed to stand overnight. The white crystals of the substituted 2-thiooxazolidone which formed, were filtered by suction on a Büchner funnel and washed with a small amount of cold water. The yield was 45 to 55 g. of air dried crystals (35–42% of theory).

4-Ethyl-2-thiooxazolidone, (V), R = H; R' = C₂H₅. The white crystals prepared above from 2-aminobutanol-1 melted at 72.8 to 73.2° after recrystallization from alcohol (lit.,³ m.p. 74–75°). These crystals were soluble in alcohol, ethyl acetate, benzene, and acetone.

Anal. Calcd. for C₈H₉NOS: C, 45.77; H, 6.91; N, 10.68; S, 24.44. Found: C, 46.06; H, 6.88; N, 10.35; S, 24.56.

4,4-Dimethyl-2-thiooxazolidone, (V), R = R' = CH₃. When recrystallized from alcohol, the melting point was 124.6 to 125.8° (lit.,⁶ m.p. 123–125°). The compound was soluble in alcohol, benzene, and ethyl acetate.

Anal. Calcd. for C₈H₉NOS: C, 45.77; H, 6.91; N, 10.68; S, 24.44. Found: C, 45.96; H, 6.78; N, 9.90; S, 25.04.

RESEARCH DEPARTMENT
VAN AMERINGEN-HAEBLER (A DIVISION OF
INTERNATIONAL FLAVORS & FRAGRANCES INC.)
UNION BEACH, N. J.

(5) Microanalysis by the Clark Microanalytical Laboratory, Urbana, Ill.

(6) C. Y. Hopkins, *Can. J. Research*, B20, 268 (1942).

Studies on Hydroxybenzotriazoles

H. SINGH AND R. S. KAPIL¹

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Several compounds containing the grouping >NOH have been reported² to be useful as organic precipitating agents. 1-Hydroxy-1,2,3-benzotriazoles also contain a similar grouping. In view of the fact that they can be prepared readily by the action of sodium hydroxide^{3,4j} or hydrazine hydrate on *o*-nitrophenylhydrazines⁴ or even from *o*-dinitrobenzenes,^{4a,j} it was considered worthwhile to synthesize some additional derivatives and study their analytical behavior.

1-Hydroxy-1,2,3-benzotriazoles have been prepared by the action of hydrazine hydrate on *o*-nitrophenylhydrazines and also on *o*-dinitrobenzenes. They are suitable for the estimation of silver ion with which they give a quantitative precipitate.

Details of their analytical behavior shall be published elsewhere.

(1) Present address: Division of Medicinal Chemistry, Central Drug Research Institute, Lucknow, India.

(2) (a) F. Ephriam, *Ber.*, **63**, 1928 (1930). (b) G. Denigs, *Bull. soc. pharm. Bordeaux*, **70**, 101 (1932). (c) D. C. Sen, *J. Indian Chem. Soc.*, **15**, 473 (1938). (d) J. F. Flagg and N. H. Furman, *Ind. Eng. Chem., Anal. Ed.*, **12**, 529 (1940). (e) K. J. Keuning and J. V. Dubsy, *Rec. trav. chim.*, **59**, 978 (1940). (f) P. Wenger, R. Duckert, and M. Busset, *Helv. Chim. Acta*, **24**, 889 (1941).

(3) R. Nietzki and E. Braunschweig, *Ber.*, **27**, 3381 (1894).

(4) (a) T. Curtius and M. Mayer, *J. prakt. Chem.*, **76** (ii), 369 (1907). (b) W. Borsche and D. Rantschew, *Annalen*, **379**, 152 (1911). (c) G. T. Morgan and T. Glover, *J. Chem. Soc.*, **119**, 1700 (1921). (d) O. L. Brady and J. H. Bowman, *J. Chem. Soc.*, **119**, 894 (1921). (e) O. L. Brady and J. N. E. Day, *J. Chem. Soc.*, **123**, 2258 (1923). (f) O. L. Brady and C. V. Reynolds, *J. Chem. Soc.*, **193** (1928); **1273** (1931). (g) E. Müller and W. Hoffmann, *J. prakt. Chem.*, **111**, 293 (1925). (h) E. Müller and G. Zimmermann, *J. prakt. Chem.*, **111**, 277 (1925). (i) E. Müller and K. Weisbrod, *J. prakt. Chem.*, **111**, 307 (1925). (j) S. S. Joshi and D. S. Deorha, *J. Indian Chem. Soc.*, **29**, 545 (1952).

TABLE I



No.	R ₁	R ₂	R ₃	Formula	Color	M.P. °C	Analysis	
							Calcd.	Found
1	H	Cl	H	C ₈ H ₄ N ₃ OCl	Colorless plates	210d ^{a,b}	Cl: 20.93	20.8
2	H	Br	H	C ₈ H ₄ N ₃ OBr	Colorless plates	220d ^a	Br: 37.39	37.2
3	H	I	H	C ₈ H ₄ N ₃ OI	Colorless plates	200d ^a	I: 48.66	48.4
4	H	Cl	CH ₃	C ₇ H ₆ N ₃ OCl	Colorless needles	203d ^a	Cl: 19.34	19.2
5	H	I	CH ₃	C ₇ H ₆ N ₃ OI	Colorless needles	182 ^a	I: 46.18	46.0
6	H	C	Cl	C ₈ H ₅ N ₃ OCl ₂	Colorless needles	215 ^{a,c}	Cl: 34.81	34.5
7	Br	H	Br	C ₈ H ₂ N ₃ OBr ₂	Colorless needles	218d ^a	Br: 54.61	54.4

^a Recrystallized from ethanol. ^b Lit.,^{4b} m.p. 204–205°. ^c Lit.,^{4c} m.p. 194–196°.