

Using excess glycine in glacial acetic acid, 4.46 g. of monoglycine hydrochloride and 4.52 g. of glycine (150%) were dissolved in 400 cc. of boiling glacial acetic acid under a reflux condenser. The copious fine white precipitate formed on cooling was washed several times with acetic acid; yield 7.04 g. (94%); m. p. 187°.

Anal. Calcd. for $C_4H_{11}ClN_2O_4$: Cl, 19.00. Found: Cl, 18.91.

Monoglycine Hydrobromide.—Fifteen grams of glycine was treated with 33.1 cc. of hydrobromic acid containing 24.3 g. of hydrogen bromide (150%). All dissolved on warming. After evaporation the light brown crystals were ground and further dried, becoming nearly colorless; m. p. 143–144°. The compound is hygroscopic.

Anal. Calcd. for $C_2H_5BrNO_2$: Br, 51.23. Found: Br, 51.31.

Diglycine Hydrobromide.—Made by evaporation of water solutions of glycine and monoglycine hydrobromide and glycine and hydrobromic acid in theoretical quantities; m. p. 163–165° (av.).

Anal. Calcd. for $C_4H_{11}BrN_2O_4$: Br, 34.59. Found: Br, 34.44 (av.).

Diglycine Hydriodide.—This compound was prepared by crystallization from hot solutions of glycine in both water and acetic acid containing excess hydriodic acid; m. p. 169–170° (av.).

Anal. Calcd. for $C_4H_{11}IN_2O_4$: I, 45.64. Found: I, 45.82 (av.).

Discussion

The diglycine hydrochloric, hydrobromic and hydriodic acid compounds are colorless crystals, stable in the dry condition. They yield the free

halogen acids on dissolving in water. They are very soluble in water but the first two are less soluble than the corresponding monoglycine compounds. Their water solubility increases with rise in atomic weight of the halogen. They are insoluble in alcohol and ether. Attempts to prepare the corresponding hydrofluoric acid compounds were not successful.

Information on the structure must await investigation. The possibilities of the use of the diglycine compounds in glycine separations and identification are of interest as well as their usefulness as therapeutic agents. It would seem to be desirable to determine which types of the following compounds $(CR_2NR_2COOH)_2 \cdot HX$ can exist where R refers to H or various organic radicals. Compounds in which the amino group is on other than the alpha carbon atom also should be investigated. The dialanine compounds are under investigation and other reports are contemplated.

Summary

Methods for the preparation of the diglycine derivatives of hydrochloric, hydrobromic and hydriodic acids and the compounds themselves have been described. Possibilities for further research have been suggested.

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RECEIVED JANUARY 29, 1942

[CONTRIBUTION FROM THE COLLEGE OF PHARMACY, UNIVERSITY OF CALIFORNIA]

Sulfophenylarsonic Acids and Certain of Their Derivatives. VI. Derivatives of *p*-Sulfonamidophenylarsonic Acid.¹

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In continuation of our problem relative to studies of sulfophenylarsonic acids and certain of their derivatives, we have extended the number of sulfonamide derivatives of *p*-sulfonamidophenylarsonic acid as indicated in Tables I and II. A number of these compounds are being prepared in quantity for toxicological and pharmacological investigations, the results of which will be published elsewhere.

The condensation of benzyaniline, *p*-aminobiphenyl, morpholine and piperidine with *p*-chlorosulfonylphenylarsonic acid was carried out in aqueous media according to a method described in

a previous publication.² Condensation of methyl-aniline with the above-mentioned sulfonyl chloride was effected by a procedure previously employed in the preparation of *p*-arsono-*N*-phenylbenzenesulfonamide.³ The diiodoarsines and arsine oxides appearing in Tables I and II were prepared in the usual way with hydriodic acid and ammonium hydroxide. The oxides were obtained as arsenoso or arsono derivatives depending upon the conditions of isolation and purification. *p*-Arsenoso-*N*-methyl-*N*-phenylbenzenesulfonamide, for example, was obtained upon precipita-

(1) Aided by a grant from John Wyeth and Brother.

(2) Oneto and Way, *THIS JOURNAL*, **63**, 762 (1941).

(3) Oneto and Way, *ibid.*, **61**, 2106 (1939).

TABLE I
 DERIVATIVES OF *p*-SULFONAMIDOPHENYLARSONIC ACID

Compound R ¹ = benzenesulfonamide	Recrystallized from	M. p., °C., uncor.	Yield, % ^c	Formula	As analyses, %	
					Calcd.	Found
R = arsono, -AsO ₃ H ₂						
<i>p</i> -R-N,N-methylphenyl-R ¹	50% HAc	...	82	C ₁₈ H ₁₄ O ₆ NSAs	20.18	20.53
<i>p</i> -R-N-4-biphenyl-R ¹	60% EtOH	...	90	C ₁₈ H ₁₆ O ₆ NSAs	17.29	17.34
<i>p</i> -R-N,N-benzylphenyl-R ¹	95% EtOH	...	80	C ₁₉ H ₁₈ O ₆ NSAs	16.75	16.88
R = diiodoarsino, -AsI ₂						
<i>p</i> -R-N,N-methylphenyl-R ¹	glac. HAc	98-99	85	C ₁₃ H ₁₂ O ₂ NSAsI ₂	13.03	13.73
<i>p</i> -R-N-4-biphenyl-R ¹	90% HAc	146-147	75	C ₁₈ H ₁₄ O ₂ NSAsI ₂	11.76	12.00
<i>p</i> -R-N,N-benzylphenyl-R ¹	glac HAc	154-156	80	C ₁₉ H ₁₆ O ₂ NSAsI ₂	11.51	11.98
R = arsenoso, -As=O						
<i>p</i> -R-N,N-methylphenyl-R ^{1a}	66	C ₁₃ H ₁₂ O ₂ NSAs	22.21	22.16
<i>p</i> -R-N-4-biphenyl-R ¹	50% EtOH	...	80	C ₁₈ H ₁₄ O ₂ NSAs	18.76	18.77
R = arsonoso, -As(OH) ₂						
<i>p</i> -R-N,N-methylphenyl-R ^{1b}	50% EtOH	...		C ₁₃ H ₁₄ O ₄ NSAs	21.09	21.05
<i>p</i> -R-N,N-benzylphenyl-R ¹	60% EtOH	...	70	C ₁₈ H ₁₈ O ₄ NSAs	17.38	17.52

^a Also prepared by condensation of methylaniline with *p*-chlorosulfonylphenylarsine oxide. The product was purified by precipitation from a 5% NaOH solution with 5% H₂SO₄. When converted to the corresponding diiodoarsine a mixed m. p. of 98-99° was obtained. ^b Prepared by recrystallization of the corresponding arsenoso compound from 60% EtOH. ^c Yields are for purified products.

 TABLE II
 DERIVATIVES OF *p*-SULFONAMIDOPHENYLARSONIC ACID

Compound	Recrystallized from	M. p., °C., uncor.	Yield, % ^c	Formula	As analyses, %	
					Calcd.	Found
R = arsono, -AsO ₃ H ₂						
<i>p</i> -R-benzenesulfonylmorpholide	Water	...	50	C ₁₀ H ₁₄ O ₆ NSAs	21.33	21.38
<i>p</i> -R-benzenesulfonylpiperidide	80% EtOH	...	48	C ₁₁ H ₁₆ O ₆ NSAs	21.45	21.78
R = diiodoarsino, -AsI ₂						
<i>p</i> -R-benzenesulfonylmorpholide	HAc glacial	167.5-169.5	74	C ₁₀ H ₁₂ O ₃ NSAsI ₂	13.50	13.70
<i>p</i> -R-benzenesulfonylpiperidide	HAc glacial	127-129	50	C ₁₁ H ₁₄ O ₂ NSAsI ₂	13.58	13.98
R = arsenoso, -As=O						
<i>p</i> -R-benzenesulfonylmorpholide ^a	50% EtOH	196-197	72	C ₁₀ H ₁₂ O ₄ NSAs	23.62	23.39
<i>p</i> -R-benzenesulfonylpiperidide ^b	50% EtOH	194-195.5	76	C ₁₁ H ₁₄ O ₃ NSAs	23.76	23.36

^a Dried at a temperature of 140° under reduced pressure (15 mm.) for 4 hours. ^b Dried at a temperature of 150° under reduced pressure (10 mm.) for four hours. ^c Yields are for purified products.

tion of the corresponding arsonoso compound from sodium hydroxide solution with dilute hydrochloric acid. The arsonoso compound, however, gave rise to the corresponding arsonoso derivative upon crystallization from 60% ethyl alcohol.

Summary

An additional number of derivatives of *p*-sulfonamidophenylarsonic acid have been prepared and studied.

SAN FRANCISCO, CALIFORNIA RECEIVED MARCH 3, 1942