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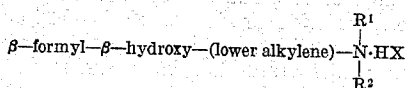
ALPHA-HYDROXY, BETA-AMINO-PROPION-
ALDEHYDE

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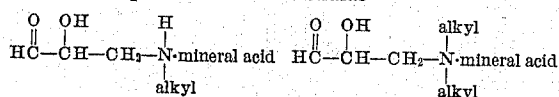
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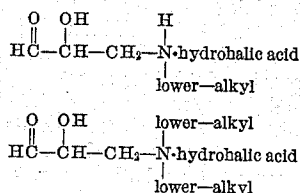
The present invention relates to novel β -amino- α -hydroxyalkanal acid addition compounds of the formula



wherein R^1 is selected from the group consisting of hydrogen and alkyl, R^2 is selected from the group consisting of alkyl and β -formyl- β -hydroxy-(lower-alkylene), lower-alkylene contains from two to five carbon atoms, inclusive, (i. e. $-\text{C}_n\text{H}_{2n}-$ wherein n is two to five, inclusive), alkyl contains from one to eight carbon atoms, inclusive, and HX is an acid having a pK_a value less than five. Of particular interest are the β -mono- and dialkylamino- α -hydroxypropionaldehyde mineral acid addition compounds of the formulas



wherein alkyl contains from one to eight carbon atoms, inclusive, as defined above. Of most interest are the β -mono- and di-(lower-alkyl)-amino- α -hydroxypropionaldehyde hydrohalic acid addition compounds of the formulas



wherein lower-alkyl contains from one to four carbon atoms, inclusive.

An object of the present invention is to provide the above-defined classes of compounds which have antiviral activity, in particular virucidal activity. Said compounds are useful for virus prophylaxis and decontami-

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nation of areas and materials and can readily be applied as the active ingredient in solutions, emulsions and suspensions for spraying, washing, painting, immersing, etc., dusts, aerosols, fumigants, etc., according to methods and procedures well known in the pesticide and disinfectant arts. As illustrated in Example 12, the acid addition compounds of the present invention are more stable and have greater water solubility than the parent free base compounds, and, therefore, said acid addition compounds can be applied much more effectively and economically for the above uses. Other objects of the present invention, and uses of the novel compounds thereof, will be apparent to one skilled in the art.

Efficacy of the present antiviral compounds is illustrated by Table I which shows the typically superior results afforded by representative compounds in the well-known in ovo survival test for antiviral potency, employing Newcastle's virus (NJ-KD strain) and influenza A virus (PR8 strain) as illustrative viruses. In the test method used to obtain the data in Table I the particular test compound is dissolved in water or suspended in water-carboxymethyl cellulose, depending on the degree of water solubility. A known volume of such a solution or suspension containing a known concentration of the test compound is injected into the allantoic sac of ten-day fertile eggs, using the technique described by Beveridge and Burnet, Medical Research Council, Special Report Series No. 256, "The Cultivation of Viruses and Rickettsiae in the Chick Embryo," London, His Majesty's Stationery Office, 1946. The test compound is usually administered at or slightly less than the maximum tolerated dose, i. e., the greatest amount which when similarly administered is found to cause no deaths in similar eggs during a 216-hour incubation period. The same

TABLE I

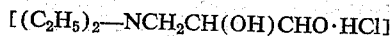
Test Compound	Protective Index		
Formula	Milligrams per egg	Newcastle's Virus	Influenza A Virus
$\text{C}_2\text{H}_5\text{-NH-CH}_2\text{-CHOH-CHO}\cdot\text{HCl}$	8.0	90, 44	
$n\text{-C}_4\text{H}_9\text{-NH-CH}_2\text{-CHOH-CHO}\cdot\text{HCl}$	4.0	43	
$(\text{CH}_3)_2\text{N-CH}_2\text{-CHOH-CHO}\cdot\text{HCl}$	8.0	68, 60	
$(\text{C}_2\text{H}_5)_2\text{N-CH}_2\text{-CHOH-CHO}\cdot\text{HCl}$	10.0		44
$(\text{C}_2\text{H}_5)_2\text{N-CH}_2\text{-CHOH-CHO}\cdot\text{HCl}$	6.0	99, 94	
$(\text{C}_2\text{H}_5)_2\text{N-CH}_2\text{-CHOH-CHO}\cdot\text{HCl}$ (as dimer)	8.0	53, 49	56, 54
$(\text{iso-C}_4\text{H}_9)_2\text{N-CH}_2\text{-CHOH-CHO}\cdot\text{HCl}$	10.0	86, 48	
$(\text{iso-C}_4\text{H}_9)_2\text{N-CH}_2\text{-CHOH-CHO}\cdot\text{HCl}$	8.0	79	
$(\text{iso-C}_4\text{H}_9)_2\text{N-CH}_2\text{-CHOH-CHO}\cdot\text{HCl}$ (as dimer)	9.0	98	
$(n\text{-C}_4\text{H}_9)_2\text{N-CH}_2\text{-CHOH-CHO}\cdot\text{HCl}$	10.0	99, 98	54
$(n\text{-C}_4\text{H}_9)_2\text{N-CH}_2\text{-CHOH-CHO}\cdot\text{HCl}$ (as dimer)	12.0	99	62
$\text{CH}_3\text{-N}(\text{CH}_2\text{-CHOH-CHO})_2\cdot\text{HCl}$	8.0	60	
	10.0	87	

volume of the same menstruum without test compound is injected into similar eggs as a control. About fifteen minutes later all eggs, test and control, are inoculated with a virus suspension containing approximately fifty times the LD_{50} dosage of virus; one LD_{50} is that amount which kills fifty percent of virus-infected embryonated eggs. The eggs are incubated at 37 degrees centigrade. Survivorship is determined by candling the eggs at eight-hour intervals during a 216-hour period. The protection afforded by a test compound is conveniently expressed thus: percent survivorship of treated eggs after 216 hours (e. g. ninety percent) minus percent survivorship of control eggs after 216 hours (e. g. five percent) equals the protective index (e. g. 85), the maximum protective index value being 100. The test compounds listed in Table I, therefore, are highly potent antiviral agents.

The acid addition compounds of the present invention are prepared by reaction of the parent free base or preferably a derivative thereof, e. g. an acetal, preferably the

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(fifty percent). This material, on recrystallization from 1750 milliliters ethyl alcohol, gives pale cream to white crystalline material. The β -diethylamino- α -hydroxypropionaldehyde hydrochloride

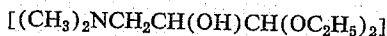


melting point 132–133 degrees centigrade, in this purified form is obtained in a yield of 388 grams (41 percent).

Anal.—Calcd. for $C_7H_{16}ClNO_2$: C, 46.28; H, 8.88; Cl, 19.52. Found: C, 46.26; H, 8.55; Cl, 19.45.

Example 4

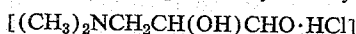
In a 500-milliliter flask fitted with reflux condenser is prepared a cold solution of 22.5 grams (0.50 mole) dimethylamine in 200 milliliters of methanol. To the chilled solution is added 73 grams (0.50 mole) α,β -epoxypropionaldehyde diethylacetal. The reaction mixture is allowed to stand in an ice bath for one hour, at room temperature for three hours, and then heated under reflux for one hour. The methanol is distilled on the steam bath, leaving an orange oil which is distilled under reduced pressure through an eight-inch, glass-helice-packed column. The β -dimethylamino- α -hydroxypropionaldehyde diethylacetal



product, boiling point 100–101 degrees centigrade at twelve millimeters pressure, is collected as a colorless oil; yield seventy grams (73 percent); n_D^{25} 1.4292.

Anal.—Calcd. for $C_9H_{21}NO_3$: C, 56.51; H, 11.07; N, 7.32. Found: C, 56.43; H, 11.24; N, 7.39.

In a 500-milliliter flask is prepared a solution of 57.3 grams (0.30 mole) β -dimethylamino- α -hydroxypropionaldehyde diethylacetal and 150 milliliters of ten percent aqueous hydrochloric acid. The solution, after heating on the steam bath for two hours, is concentrated under reduced pressure. The amber residual gum is crystallized from a mixture of 125 milliliters of ethyl alcohol and 125 milliliters of ethyl acetate. The product, melting point 117–118.5 degrees centigrade, is collected in a yield of 32 grams (69 percent). This material, after purification by decolorizing charcoal treatment and recrystallizing three times from 1:1 mixture of ethyl alcohol and ethyl acetate, has a melting point of 121.5–123.5 degrees centigrade. The yield of purified β -dimethylamino- α -hydroxypropionaldehyde hydrochloride

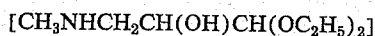


is eighteen grams (39 percent).

Anal.—Calcd. for $C_7H_{15}ClNO_2$: C, 39.09; H, 7.88; Cl, 23.08. Found: C, 39.10; H, 7.94; Cl, 22.97.

Examples 5 and 6

To a solution of fifty milliliters (0.404 mole) of 25 percent methylamine solution in fifty milliliters of methanol is added dropwise over the course of about fifteen minutes 76.0 grams (0.52 mole) of α,β -epoxypropionaldehyde diethylacetal. During this addition an exothermic reaction takes place and the temperature rises to 55 degrees centigrade. The flask is cooled occasionally in a pan of water to prevent the temperature going above this point. When the addition is complete the addition funnel is rinsed with an additional ten milliliters of methanol and the solution is allowed to stand overnight. The solution is heated under reflux for two hours and then concentrated under reduced pressure on a steam bath. The colorless residue is distilled under reduced pressure through a seven-inch column packed with glass helices. The first fraction boils at 110 degrees centigrade at thirteen millimeters pressure and solidifies in the condenser; weight, 13.2 grams (14.4 percent). This fraction is β -methylamino- α -hydroxypropionaldehyde diethylacetal



Upon recrystallization from Skellysolve B (mixture of

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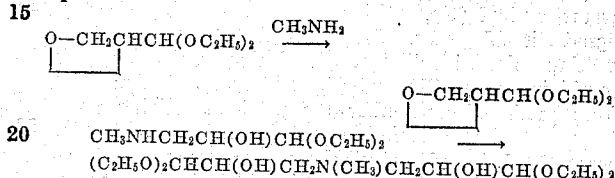
hexanes) the pure compound is obtained as fine asbestos-like needles melting at 56 degrees centigrade.

Anal.—Calcd. for $C_8H_{19}NO_3$: C, 54.21; H, 10.80; N, 7.90. Found: C, 54.01; H, 10.47; N, 7.82.

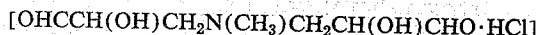
The second fraction consists of an almost colorless liquid boiling at 155 degrees centigrade at 0.6 millimeter pressure; weight 66.2 grams (79 percent); n_D^{20} 1.4460. This fraction is the bis compound, N,N-di-(γ,γ -diethoxy- β -hydroxypropyl)-methylamine.

Anal.—Calcd. for $C_{15}H_{33}NO_6$: C, 55.70; H, 10.28; N, 4.33. Found: C, 55.65, 55.97; H, 10.20, 10.46; N, 4.25, 4.56.

The foregoing reaction can be represented by the equation



To 5.2 grams of N,N-di-(γ,γ -diethoxy- β -hydroxypropyl)methylamine is added dilute hydrochloric acid (five milliliters concentrated hydrochloric acid diluted with water to fifty milliliters) and the solution is allowed to stand for three days. The solution is concentrated under reduced pressure in a water bath below forty degrees centigrade and the colorless residue is transferred to a crystallizing dish and allowed to stand over concentrated sulfuric acid in a vacuum desiccator for some time and then over potassium hydroxide. The residue is triturated with acetone until completely solid. The N,N-di-(β -hydroxy- β -formylethyl)-methylamine hydrochloride



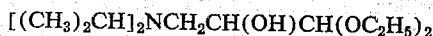
product is very insoluble in the usual organic solvents but very soluble in water; melting point 106 degrees centigrade (decomposition).

Anal.—Calcd. for $C_7H_{14}ClNO_4$: C, 39.72; H, 6.67; N, 6.62; Cl, 16.75. Found: C, 39.81, 39.86; H, 6.96, 6.94; N, 6.82, 6.52; Cl, 16.39, 16.45.

Hydrolysis of β -methylamino- α -hydroxypropionaldehyde diethylacetal with dilute aqueous hydrochloric acid solution according to the foregoing procedure provides β -methylamino- α -hydroxypropionaldehyde hydrochloride $[CH_3NHCH_2CH(OH)CHO \cdot HCl]$.

Example 7

In a 500-milliliter, round-bottomed flask is prepared a solution of 101 grams (1.0 mole) diisopropylamine, 146 grams (1.0 mole) α,β -epoxypropionaldehyde diethylacetal and three milliliters methanol. The solution is heated on the steam bath for seven hours and then allowed to stand at room temperature overnight. The reaction mixture is heated on the steam bath under reduced pressure until all low boiling material has been removed. The residual oil is distilled under reduced pressure through a ten-inch, glass-helices packed column. The β -diisopropylamino- α -hydroxypropionaldehyde diethylacetal



boiling point 84–88 degrees centigrade at 0.5 millimeter pressure, is collected as a pale yellow oil in a yield of 113 grams (46 percent); $n_D^{22.5}$ 1.4361.

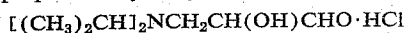
Anal.—Calcd. for $C_{13}H_{29}NO_3$: C, 63.12; H, 11.82; N, 5.66. Found: C, 63.89; H, 11.71; N, 5.63.

In a 200-milliliter, three-necked, round-bottomed flask fitted with mechanical stirrer and reflux condenser is prepared a solution of 37 grams (0.15 mole) β -diisopropylamino- α -hydroxypropionaldehyde diethylacetal and sixty grams ten percent hydrochloric acid. The solution after heating and stirring on the steam bath for fifteen minutes, begins to boil. The solution is stirred and heated on

the steam bath for four and one-half hours and then concentrated under reduced pressure. The residual gum is dried with toluene, then dissolved in a mixture of 100 milliliters ethyl alcohol, 200 milliliters ethyl acetate and 200 milliliters ether, and the solution cooled. The crystalline material (A) which separates is filtered. The filtrate is concentrated on the steam bath under reduced pressure and the residual gum, after drying, is warmed on the steam bath with acetone. The white crystalline material (B) which separates is collected by filtration. After standing four to five hours, the acetone solution gives a third crop of crystals (C). The yield of crop (A), melting point 215 degrees centigrade, is 2.0 grams, of (B), melting point 183–187 degrees centigrade, is 5.0 grams, and of (C), melting point 175–177 degrees centigrade, is 4.5 grams. Crop (A) gives no depression of melting point with diisopropylamine hydrochloride. On combining crops (B) and (C) and recrystallizing twice from methanol and ether the product, melting point 196–198 degrees centigrade, weighs 3.8 grams (twelve percent). Infrared analysis shows the compound to be β -diisopropylamino- α -hydroxypropionaldehyde hydrochloride, $[(CH_3)_2CH]_2NCH_2CH(OH)CHO \cdot HCl$, dimer.

Anal.—Calcd. for $C_9H_{20}ClNO_2$: C, 51.54; H, 9.61; N, 6.68; Cl, 16.91. Found: C, 51.69; H, 9.61; N, 6.69; Cl, 16.80.

From the residual filtrates is isolated a small amount of material which on a Fischer-Johns block shows the following changes on heating. At 120–130 degrees centigrade the material begins to color; at 150–160 degrees centigrade new crystals seem to form, and at 210–220 degrees centigrade definite melting takes place. Infrared analysis shows this material to be β -diisopropylamino- α -hydroxypropionaldehyde hydrochloride,

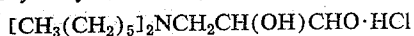


monomer.

Anal.—Calcd. for $C_9H_{20}ClNO_2$: C, 51.54; H, 9.61; N, 6.68; Cl, 16.91. Found: C, 51.43; H, 9.34; N, 6.52; Cl, 16.59.

Example 8

A solution of 16.5 grams (0.05) mole of β -di-n-hexylamino- α -hydroxypropionaldehyde diethylacetal (obtained by reaction of di-n-hexylamine and α,β -epoxypropionaldehyde diethylacetal) and 500 milliliters of 0.1 normal hydrochloric acid is prepared. The clear colorless solution is allowed to stand at room temperature for one week and then warmed on the steam bath for two hours. The solution is concentrated under reduced pressure at forty to sixty degrees centigrade. The pale-yellow, gummy, solid residue is dissolved in 150 milliliters ethyl alcohol and the alcoholic solution diluted with 450 milliliters ethyl acetate and 750 milliliters ether. After chilling in a Dry Ice chest, five grams of white crystalline material is isolated. The di-n-hexylamino- α -hydroxypropionaldehyde hydrochloride,



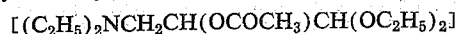
after recrystallization from 55 milliliters ethyl alcohol and 400 milliliters ether, weighs three grams (twenty percent) and melts at 148–150 degrees centigrade with decomposition. Infrared analysis shows that this product is a dimer.

Anal.—Calcd. for $C_{16}H_{32}ClNO_2$: C, 61.30; H, 10.98; N, 4.77; Cl, 12.07. Found: C, 61.39; H, 10.83; N, 4.66; Cl, 11.67.

Example 9

To 43.8 grams (0.200 mole) of β -diethylamino- α -hydroxypropionaldehyde diethylacetal in a one-necked flask fitted with an air condenser surmounted by a calcium chloride drying tube is added, with swirling, 20.4 grams (0.200 mole) of acetic anhydride. An exothermic reaction takes place with the reaction mixture warming to ninety degrees centigrade. During this time the color of the reaction mixture changes to a yellow-brown.

The reaction mixture is allowed to cool to room temperature over the course of about one-half hour and is then poured into 200 milliliters of ice-water. To the aqueous solution obtained is added seventeen grams of sodium bicarbonate, the mixture stirred well and extracted with ether. To the aqueous layer is added an additional ten grams of sodium bicarbonate and this layer again extracted twice with 150-milliliter portions of ether. The combined ethereal extracts are dried over anhydrous magnesium sulfate, the ether removed and the residue distilled in vacuo through a seven-inch column packed with glass helices. There is obtained 37.1 grams (71 percent) of β -diethylamino- α -acetoxypropionaldehyde diethylacetal



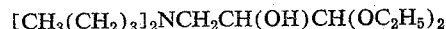
as a colorless liquid boiling at 105–106 degrees centigrade at 2.5 millimeters pressure; n_D^{22} 1.4281.

Anal.—Calcd. for $C_{13}H_{27}NO_4$: C, 59.74; H, 10.41; N, 5.36. Found: C, 60.07; H, 10.05; N, 5.60.

To 28.2 grams (0.108 mole) of β -diethylamino- α -acetoxypropionaldehyde diethylacetal is added a solution of 28.2 milliliters of concentrated hydrochloric acid and 56.4 milliliters of water. The temperature rises to 55 degrees centigrade. The colorless solution is allowed to stand overnight, and is then evaporated to dryness in vacuo at twenty millimeters pressure on a water bath at sixty degrees centigrade. The yellow, viscous, oily residue is triturated with 100 milliliters of acetone and allowed to stand for several hours until crystallization is complete and the material in the flask is completely solid. The material is filtered and washed with anhydrous ether; weight 18.3 grams. However, this product is β -diethylamino- α -hydroxypropionaldehyde hydrochloride $[(C_2H_5)_2NCH_2CH(OH)CHO \cdot HCl]$ dimer indicating that the acetoxy group is also cleaved during the foregoing hydrolysis process.

Example 10

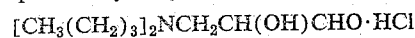
In a one-liter, three-necked flask, fitted with a reflux condenser, is prepared a solution of 194 grams (1.5 moles) of di-n-butylamine and 220 grams (1.5 moles) of α,β -epoxypropionaldehyde diethylacetal in three milliliters of methanol. After the initial heat of reaction has subsided the solution is heated for two and one-half hours. The temperature of the liquid rises to 130 degrees centigrade during this time. The dark red liquid is distilled under reduced pressure through a ten-inch, glass-helices packed column. A yellow liquid, boiling at 158–158.5 degrees centigrade at fourteen millimeters pressure, is collected. The yield of β -di-n-butylamino- α -hydroxypropionaldehyde diethylacetal



is 347 grams (84 percent); n_D^{24} 1.4376.

Anal.—Calcd. for $C_{15}H_{33}NO_3$: C, 65.41; H, 12.08; N, 5.09. Found: C, 66.03; H, 12.00; N, 5.68.

A solution of 27.5 grams (0.10 mole) of β -di-n-butylamino- α -hydroxypropionaldehyde diethylacetal in 82.5 milliliters of dilute hydrochloric acid (27.5 milliliters of concentrated hydrochloric acid and 55 milliliters of water) is prepared. The temperature of the solution rises to fifty degrees centigrade. The pink solution is allowed to stand at room temperature overnight and is then concentrated at sixty to seventy degrees centigrade under reduced pressure. The residual gum is dissolved in hot acetone and the solution then diluted with about one-third of its volume with ether. The white material which crystallizes after chilling in the refrigerator is filtered and dried in vacuo. The yield is 9.0 grams (forty percent); melting point 164.5–170 degrees centigrade (decomposition). Recrystallization of the β -di-n-butylamino- α -hydroxypropionaldehyde hydrochloride



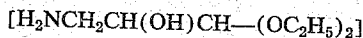
product from a mixture of ethyl alcohol and ethyl acetate

provides product melting at 179–180 degrees centigrade (decomposition). According to infrared analysis the product is a dimer.

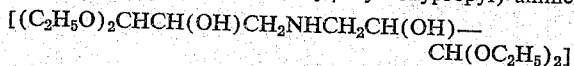
Anal.—Calcd. for $C_{11}H_{23}NO_2 \cdot HCl$: C, 55.56; H, 10.17; N, 5.89; Cl, 14.91. Found: C, 55.30; H, 9.94; N, 5.69; Cl, 14.16.

Example 11

To a solution of 150 milliliters (approximately five equivalents) of ammonium hydroxide solution and 300 milliliters of methanol is added rapidly 73 grams (0.5 mole) of α, β -epoxypropionaldehyde diethylacetal. The solution is stirred and heated at 50 to 55 degrees centigrade for two hours and then allowed to stand overnight. The excess methanol and ammonium hydroxide are removed by distillation through a short Vigreux column, first at atmospheric pressure and then under reduced pressure on a steam bath. The residue is distilled through a seven-inch, helices-packed column. There is obtained a colorless viscous liquid boiling at 116 degrees centigrade at thirteen millimeters pressure and a rather large residue of higher boiling product. The lower boiling distillate solidifies on standing to a glassy solid which, upon recrystallization from Skellysolve B (mixture of hexanes), gives colorless asbestos-like needles of β -amino- α -hydroxypropionaldehyde diethylacetal



melting point 41 degrees centigrade. The higher boiling residue is subjected to distillation through a three-inch Vigreux column. There is obtained a yellow liquid boiling at 170–171 degrees centigrade at 1.3 millimeters pressure which is di-(γ, γ -diethoxy- β -hydroxypropyl)-amine



Hydrolysis of this acetal with dilute aqueous hydrochloric acid according to the usual procedure described previously, e. g. in Examples 5 and 6, provides di-(β -hydroxy- β -formylethyl)-amine hydrochloride

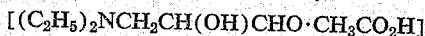


product.

Example 12

To a solution of 18.15 grams (0.1 mole) of β -diethylamino- α -hydroxypropionaldehyde hydrochloride in 25 milliliters of water is added ten grams (two equivalents) of anhydrous powdered calcium carbonate, the mixture stirred for one hour and filtered. The solid is washed with 25 milliliters of water and the yellow aqueous filtrate and washings are extracted repeatedly, first with ether and then with methylene chloride. Distillation of the solvent from these extracts at room temperature gives 1.1 grams of the free base, β -diethylamino- α -hydroxypropionaldehyde $[(C_2H_5)_2NCH_2CH(OH)CHO]$. On standing the product becomes a dark brown colored tar in a few days. The product decomposes when distillation in vacuo is attempted.

Treatment of freshly prepared β -diethylamino- α -hydroxypropionaldehyde free base dissolved in ethyl alcohol with the theoretical amount of acetic acid provides β -diethylamino- α -hydroxypropionaldehyde acetate



In the same manner β -diethylamino- α -hydroxypropionaldehyde propionate, oxalate, benzoate, cyclopentylpropionate, phenylacetate, valerate, etc., salts are prepared by reaction of the free base with the appropriate acid.

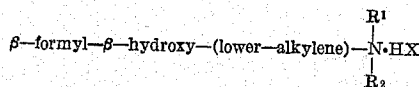
Example 13

By following the procedures of Examples 1–12, the hydrochloride, hydrobromide, hydriodide, sulfate, phosphate, formate, acetate, benzoate, trichloroacetate, citrate, maleate, α - and β -phenylpropionate, α - and β -cyclopentylpropionate, furoate, etc., salts of β -n-butylamino- α -hydroxy-n-hexaldehyde, β -ethylamino- α -hydroxy-isobutyraldehyde, β -n-octylamino- α -hydroxypropionaldehyde, β -methylethylamino- α -hydroxypropionaldehyde, β -di-n-octylamino- α -hydroxypropionaldehyde, β -diisohexylamino- α -hydroxypropionaldehyde, β -ethylamino- α -hydroxy- α -methyl-n-butyraldehyde, β -diethylamino- α -hydroxy- α -methylisovaleraldehyde, β -isooctylamino- α -hydroxypropionaldehyde, β -n-heptylamino- α -hydroxy-n-butyraldehyde, β -diisopentylamino- α -hydroxypropionaldehyde, etc., are prepared.

It is to be understood that the invention is not to be limited to the exact details of operation or exact compounds shown and described, as obvious modifications and equivalents will be apparent to one skilled in the art, and the invention is therefore to be limited only by the scope of the appended claims.

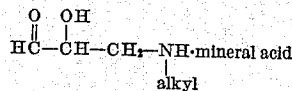
We claim:

1. Compounds of the formula



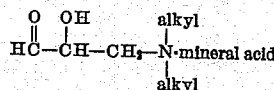
wherein R^1 is selected from the group consisting of hydrogen and alkyl, R^2 is selected from the group consisting of alkyl and β -formyl- β -hydroxy-(lower-alkylene), lower-alkylene contains from two to five carbon atoms, inclusive, alkyl contains from one to eight carbon atoms, inclusive, and HX is an acid having a pK_a value less than five.

2. β -alkylamino- α -hydroxypropionaldehyde mineral acid addition compounds of the formula



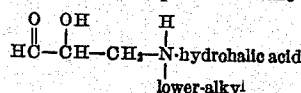
wherein alkyl contains from one to eight carbon atoms, inclusive.

3. β -dialkylamino- α -hydroxypropionaldehyde mineral acid addition compounds of the formula



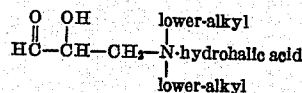
wherein alkyl contains from one to eight carbon atoms, inclusive.

4. β -(lower-alkyl)-amino- α -hydroxypropionaldehyde hydrohalic acid addition compounds of the formula



wherein lower-alkyl contains from one to four carbon atoms, inclusive.

5. β -di-(lower-alkyl)-amino- α -hydroxypropionaldehyde hydrohalic acid addition compounds of the formula



wherein lower-alkyl contains from one to four carbon atoms, inclusive.

6. β -diethylamino- α -hydroxypropionaldehyde hydrochloride.

7. β -diisopropylamino- α -hydroxypropionaldehyde hydrochloride.

8. β -dimethylamino- α -hydroxypropionaldehyde hydrochloride.

9. β -ethylamino- α -hydroxypropionaldehyde hydrochloride.

10. β -n-butylamino- α -hydroxypropionaldehyde hydrochloride dimethyl

References Cited in the file of this patent

UNITED STATES PATENTS

1,824,676 Mannich Sept. 22, 1931

UNITED STATES PATENT OFFICE

Certificate of Correction

Patent No. 2,875,248

February 24, 1959

John B. Wright et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Columns 1 and 2, Table 1, first column thereof, eighth item, left-hand portion, for " $(n-C_4H_9)_2N$." read $-(n-C_4H_9)_2N-$; same table, third column, in the heading thereto, for "Newcastle's Virus" read —Newcastle's Virus—; column 3, line 6, for "oxalic acid" read —oxalic acid—; line 59, for "0.512 mole" read $-(0.512 \text{ mole})-$; column 4, line 54, for " $[C_2H_5]_2$ " read $-(C_2H_5)_2-$; column 5, line 5, for " $[(C_2H_5)_2-NCH_2]$ " read $-(C_2H_5)_2-NCH_2-$; line 26, for "centigrade" read —centigrade—; column 7, line 23, for " $[(CH_3)_2CH]_2-NCH_2$ " read $-(CH_3)_2CH]_2-NCH_2-$; column 8, line 62, for "centigrade" read —centigrade—; column 9, line 26, for " $(OH)CH-(OC_2H_5)_2]$ " read $-(OH)CH-(OC_2H_5)_2]$; column 10, line 71, strike out "dimethyl".

Signed and sealed this 28th day of July 1959.

[SEAL]

Attest:

KARL H. AXLINE,

Attesting Officer.

ROBERT C. WATSON,

Commissioner of Patents.