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BIOCIDAL QUATERNARY AMMONIUM SULFAMATES

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3 Claims. (Cl. 167—22)

This invention relates to quaternary ammonium compounds, and it specifically relates to the products resulting from the reaction of quaternary ammonium and certain organic sulfamates.

This application is a division of application No. 148,029, filed Oct. 27, 1961, now U.S. Patent 3,223,704, granted Dec. 14, 1965.

Quaternary ammonium compounds have heretofore been known to possess germicidal and fungicidal properties; however, these desirable properties were at least partly offset by their irritating effect on the skin and other bodily surfaces when such surfaces are exposed thereto. They were, furthermore, generally unpleasant to the taste so that they could not readily be used for oral hygiene purposes and the like.

It has now been discovered that certain organic sulfamates, when reacted with quaternary ammonium compounds, form products which are at least as biocidally active as the ordinary quaternaries and which are, additionally, devoid of undesirable side reactions on the skin and other bodily surfaces as well as on fabrics and the like. Furthermore, certain of such products are sweet-tasting and, therefore, particularly suitable for oral hygiene purposes.

The quaternary ammonium radical of compounds embodying the present invention may be selected from any of the well-known class of quaternary ammonium compounds; for example, the alkyl quaternaries such as lauryl trimethyl ammonium, stearyl trimethyl ammonium, stearyl dimethyl ethyl ammonium, cetyl dimethyl ethyl ammonium, myristyl dimethyl ethyl ammonium, lauryl dimethyl ethyl ammonium, tallow trimethyl ammonium, hydrogenated tallow trimethyl ammonium, coco trimethyl ammonium, di-hydrogenated tallow dimethyl ammonium, di-coco dimethyl ammonium, di-soya dimethyl ammonium, hydrogenated tallow dimethyl ethyl ammonium, coco dimethyl ethyl ammonium, tallow dimethyl ethyl ammonium and soya dimethyl ethyl ammonium; the alkylaryl quaternaries such as lauryl dimethyl benzyl ammonium, alkyl dimethyl benzyl ammonium, cetyl dimethyl benzyl ammonium, stearyl dimethyl benzyl ammonium, alkyl dimethyl dichlorobenzyl ammonium, alkyl dimethyl ethyl benzyl ammonium, alkyl dimethyl benzyl ammonium, dodecyl benzyl trimethyl ammonium, dodecyl methyl benzyl trimethyl ammonium, octyl phenoxy ethoxy ethyl dimethyl benzyl ammonium, soya dimethyl benzyl ammonium, hydrogenated tallow dimethyl benzyl ammonium, tallow dimethyl benzyl ammonium and coco dimethyl, benzyl ammonium; the alkyl and the alkylaryl pyridiniums such as coco pyridinium, cetyl pyridinium and dodecyl benzyl pyridinium; the alkyl and alkylaryl isoquinolinium such as alkyl isoquinolinium, cetyl isoquinolinium and dodecyl benzyl isoquinolinium; the alkyl and alkylaryl picoliniums such as alkyl alpha picolinium, alkyl beta picolinium and alkyl gamma picolinium; the imidazoliniums such as alkenyl benzyl hydroxyethyl imidazolinium, alkenyl dichlorobenzyl hydroxyethyl imidazolinium, coco benzyl hydroxyethyl imidazolinium, coco ethyl hydroxyethyl imidazolinium, stearyl ethyl hydroxyethyl imidazolinium, stearyl benzyl hydroxyethyl imidazolinium, stearyl dichlorobenzyl hydroxyethyl imidazolinium and stearyl ethyl benzyl hydroxyethyl imidazolinium; the morpholiniums such as coco methyl morpholinium and myristyl methyl morpholinium; and the N-pyridinium such as N-(stearoyl colamino formyl methyl)-pyridinium and N-(lauroyl colamino formyl methyl)-pyridinium.

The sulfamate radical may be selected from any organic sulfamate and more specifically, may be either an aliphatic, an aromatic, a cyclic or a heterocyclic derivative of sulfamic acid. An example of an aliphatic derivative is n-hexyl sulfamate, of a cyclic derivative is cyclo hexyl sulfamate, of a heterocyclic derivative is piperidine sulfamate and of an aromatic derivative is aniline sulfamate.

Each of the above-mentioned types of compound can be prepared in a similar manner with variations depending primarily on differing molecular weights of the components. In general, the method of preparation comprises mixing stoichiometric amounts of the selected sulfamate and the selected quaternary ammonium salt in an aqueous solution, at ambient temperatures and pressures, whereby both reactants are dissolved in the water at approximaely 25% strength and react with each other under vigorous agitation. In most instances the reaction product separates as a liquid; therefore, to facilitate separation, an excessive amount of the reactants is used, the aqueous layer is separated and the non-aqueous layer is washed and dried under reduced pressure or in a forced draft oven.

The following examples are illustrative of the preparation of compounds embodying the present invention:

Example 1

380 grams (0.5 mol.) of alkyl dimethyl benzyl ammonium chloride, at 50% strength, is diluted to 25% strength with deionized water. 100 grams (0.5 mol.) of sodium cyclo hexyl sulfamate is dissolved in 300 grams of deionized water. The quaternary solution is then intermixed with the sulfamate solution accompanied by rapid and vigorous agitation. The resulting oil layer is then separated, washed and dried under reduced pressure. The end product, when dried, is a waxy, light yellow product and has a sweet taste.

Example 2

265 grams (0.5 mol.) of a 50% aqueous solution of dodecyl trimethyl ammonium chloride is diluted to 25% strength with deionized water. 100 grams of sodium cyclo hexyl sulfamate is dissolved in 300 grams of water. The two solutions are intermixed and blended. There is no separation since the dodecyl trimethyl ammonium cyclo hexyl sulfamate is completely water-soluble. The reaction product is isolated by removing the water by evaporation under reduced pressure or in a forced draft oven at 160° F. The residue is then dissolved in 99% isopropanol and filtered to remove any salts. The alcoholic filtrate is then evaporated to remove the alcohol. The end product is a yellow waxy material completely soluble in water and having a sweet taste.

Example 3

350 grams (1 mol.) of anhydrous dodecyl benzyl trimethyl ammonium chloride is dissolved in isopropyl alcohol to make a 25% solution. 180 grams (1 mol.) of cyclo hexyl sulfamic acid is dissolved in isopropyl alcohol to make a 25% solution. The two alcoholic solutions are then blended together: 56 grams of KOH pellets are then added and the mixture is thoroughly agitated. The resultant salt is removed by filtration to provide a filtrate comprising an alcoholic solution of dodecyl benzyl trimethyl ammonium cyclo hexyl sulfamate. Upon evaporation of the alcohol, there is provided an end product

which is low melting and has a waxy appearance. If desired NaOH may be substituted for the KOH.

Example 4

The same procedure is carried out as in Example 3 except that the KOH or NaOH is first dissolved in isopropyl alcohol and then a stoichiometric amount of this latter solution is used in place of the pellets.

The above examples are specific to the preparation of cyclo hexyl sulfamates; however, the previously mentioned aniline, n-hexyl and piperidine sulfamates, as well as all other equivalent sulfamates are prepared in the same manner and in the same proportions, mol for mol, whereby only the particular weights differ depending on the molecular weights of the specific compounds involved.

Illustrative of the biocidal properties of the compounds of the present invention are bacteriostatic tests whereby each of cyclo hexyl, n-hexyl, aniline and piperidine sulfamates were used against *E. typhosi, E. coli* and *Staphylococcus aureus*. All of these compounds exhibited effective inhibition against *Staphylococcus aureus* in concentrations as low as 1 part in 10,000 in aqueous solution. They also exhibited effective inhibition against *E. coli* in concentrations of 1 part in 1,000. Against *E. typhosi*, all exhibited effective inhibition at a concentration of 1 part in 1,000 and the aniline sulfamate proved effective in concentrations even as low as 1 part in 10,000.

The compounds of the present invention may also be complexed with halogens, such as bromine and iodine, to form addition products having enhanced germicidal properties, these products being free from the toxic, irritating and discoloring effects of free halogens. Such halogen complexes are easily prepared by diluting the selected quaternary ammonium halide salt to 10% and then heating to about 160° F., after which the selected halogen or halogen complex or halogen solution is added slowly with rapid agitation. The mixture is then cooled to about 75° F. and a stoichiometric amount of the sodium salt of the sulfamate in 10% aqueous solution is added. Purification then follows the normal procedure as in the examples above.

The quaternary ammonium sulfamates of the present invention are substantive to both skin and fabrics and are generally water-soluble. They may be used in a variety of liquid and solid compositions where an effective nontoxic, non-irritating, substantive biocidal ingredient is desirable. Furthermore, certain of these compounds, such as the cyclo hexyl sulfamates, are highly desirable because of their sweet, pleasant taste when the composition is utilized for oral hygiene purposes. The following examples are illustrative of such compositions:

Example 5

A biocidally active, sweet-tasting tooth paste is prepared as follows:

Component:	Parts by wt.
Glycerin	23.0
Gum tragacanth mucilage (5% in H_2O)	14.0
Precipitated chalk	49.9
Bentonite	3.0
Sodium lauryl sulfate	3.0
Water	7.0
Dodecyl trimethyl ammonium cyclohexyl sulfamate	1.0

All the above ingredients are thoroughly intermixed at ambient temperatures to form a homogeneous paste.

Example 6

A biocidally active cold cream is prepared as follows:

Component:	Parts by wt.
Mineral oil	47.9
Beeswax	6.0
Spermaceti	6.0
Cetyl alcohol	1.0
Lanolin	1.0
Water	38.0
Perfume	0.1
Alkyl dimethyl benzyl ammonium aniline sulfamate	0.1

The mineral oil, beeswax, spermaceti, cetyl alcohol and lanolin are mixed with the alkyl dimethyl benzyl ammonium aniline sulfamate and the mixture is heated to form a melt. It is then cooled to 50° C. and water is added with continuous stirring. It is then cooled, with continuous stirring, to 40° C. At this point, the perfume is added and the mixture is then cooled, with continuous stirring to 25°–30° C. to give the final product.

Example 7

A biocidally active tooth powder is prepared in the following manner:

Components:	Parts by wt.
Precipitated calcium carbonate	94.9
Powdered soap	5.0
Cetyl trimethyl ammonium cyclohexyl sulfamate	0.1

The above components are admixed at ambient temperatures to form a granular composition.

Example 8

An antiseptic lozenge is prepared as follows:

Components:	Parts by wt.
Sucrose	73.0
Glucose solution in H_2O (50% conc.)	24.0
Glycerin	1.0
Alkyl dimethyl benzyl ammonium cyclohexyl sulfamate	2.0

The above ingredients are intermixed and the mixture is brought to a boil with constant stirring. It is then poured into molds and allowed to harden.

Example 9

A sun-tan cream with biocidal properties is prepared as follows:

Components:	Parts by wt.
Diethyleneglycol monostearate	2.0
Stearic acid	1.5
Cetyl alcohol	0.5
Methyl anthranilate	5.0
Triethanolamine	1.0
Water	89.9
Perfume	0.2
Alkyl dimethyl benzyl ammonium piperidine sulfamate	1.0

The above components are intermixed at ambient temperature to form a homogenized cream.

Example 10

A biocidally active hair rinse is prepared in the following manner:

Components:	Parts by wt.
Glyceryl monostearate	3.0
Water	95.0
Cetyl trimethyl ammonium n-hexyl sulfamate	2.0

These ingredients are thoroughly intermixed at ambient temperature to form the final product.

Example 11

An antiseptic lozenge is prepared as follows:

Components:	Parts by wt.
Sucrose	73.0
Glucose solution in H_2O (50% conc.)	24.0
Glycerin	1.0
Alkyl dimethyl ammonium cyclo hexyl sulfamate	2.0

The above ingredients are mixed and the mixture is brought to a boil while constantly being stirred. The mixture is then poured into molds and allowed to harden.

Example 12

A liquid shampoo with biocidal activity is prepared as follows:

Components:	Parts by wt.
Coconut oil fatty acids	42.0
Oleic acid	56.0
Propylene glycol	55.0
Triethanolamine	58.0
Alkenyl dimethyl ethyl ammonium n-hexyl sulfamate	1.5

The fatty acids are intermixed after which first the amine and then the propylene glycol is added. The mixture is then stirred until a clear solution is obtained after which the alkenyl dimethyl ethyl ammonium n-hexyl sulfamate is added. All the mixing takes place at ambient temperature.

The above mixture is then diluted with water to any desired consistency. During this addition of water, the mixture assumes a petrolatum-like consistency but gradually changes to a clear, very slightly viscous solution. If the solution becomes cloudy, more of the amine is stirred in, a little at a time, until the solution again becomes clear. The final product preferably contains about 3 parts by weight of water to 1 part by weight of the above mixture.

Example 13

A biocidally active industrial cleaning composition is prepared as follows:

Components:	Parts by wt.
Neutral toilet soap, preferably Na or K soaps of stearic, palmitic or oleic acids ("neutral" meaning no excess alkali)	30.0
Bentonite	30.0
Sodium lauryl sulfate	10.0
Lanolin	5.0
Perfume	1.0
Lauryl isoquinolinium n-hexyl sulfamate	1.5

The bentonite and sodium lauryl sulfate are mixed together. The soap and lanolin are mixed with the lauryl isoquinolinium n-hexyl sulfamate and heated to about 70° C., after which they are mixed with the bentonite and sodium lauryl sulfate. The perfume is added as the mixture cools to ambient temperature. The product may then be pressed into cake form or 27 parts of corn meal may be mixed with 75 parts of the mixture to form a powdered soap.

Example 14

A biocidally active wash solution is prepared as follows:

Components:	Parts by wt.
Potassium tripolyphosphate	19.5
Sodium tripolyphosphate	5.0
"Ultrawet 60 L" (alkyl aryl sulfonate anionic detergent produced by Atlantic Ref. Co., Philadelphia, Pa.)	33.0
"Onyxol 336" (lauric acid alkanolamine condensate; a liquid detergent produced by Onyx Oil & Chem. Co., Jersey City, N.J.)	5.0
Carbonyl methyl cellulose	0.5
Alkyl dimethyl benzyl ammonium piperidine sulfamate-bromine complex containing 10% by weight bromine	1.0

The above components were mixed together at ambient temperature to form the final product.

Unless otherwise specified, all parts and percentages described herein are by weight.

Obviously, many modifications and variations of the present invention are possible in the light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

The invention claimed is:

1. A method of inhibiting the growth of micro-organisms which comprises treating said micro-organisms with an effective amount of a quaternary ammonium organic mono sulfamate.

2. A biocidally active composition comprising a carrier and an effective amount of a biocidal agent, said biocidal agent consisting essentially of a quaternary ammonium organic mono sulfamate.

3. A biocidally active composition comprising a carrier and an effective amount of a biocidal agent, said biocidal agent consisting essentially of a complex of a halogen and a quaternary ammonium organic mono sulfamate.

References Cited

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