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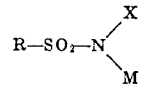
ALKALI METAL N-HALO-ALKANESULFONAMIDES AS BLEACHING AGENTS AND METHODS OF THEIR PREPARATION

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ABSTRACT OF THE DISCLOSURE

Novel alkali metal N-halo-alkanesulfonamides, having bleaching and antiseptic properties and capable of being formulated in bleaching and detergent compositions, are represented by the formula



wherein X is chlorine or bromine, M is an alkali metal, and R is an alkyl having from 1 to about 22 carbon atoms; the novel compounds can be prepared, for example, by reacting an alkane sulfonamide with an alkali metal hypochlorite or hypobromite.

BACKGROUND OF THE INVENTION

The invention herein relates generally to bleaching agents and methods of their preparation. More particularly, the invention herein provides novel compounds which are effective bleaching agents and which additionally have antiseptic properties.

The use of various N-halogenated organic compounds as bleaching agents and disinfectants is generally known. Thus, N-halo-aromatic compounds, e.g., chloroamine-T (N-chloro-p-toluenesulfonamide) have been known for many years. While N-halo-aromatic sulfonamides are useful, the prior art has well-recognized the inability to prepare and/or isolate N-halo-alkanesulfonamides and determine the extent of any usefulness such compounds may possess as bleaching agents. See, for example, Hadert, "Active Chlorine Compounds," Seifen-Ole-Fette-Wasche, vol. 94, No. 2, at pp. 329–332 (May 22, 1968) and Sidgwick, Organic Chemistry of Nitrogen, 3rd Edition, (Millar & Springhall), 1966 at pp. 250–252.

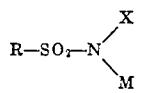
Therefore, it is an object of this invention to provide alkali metal N-halo-alkanesulfonamides as bleaching agents.

It is another object of this invention to provide a method for readily preparing alkali metal N-halo-alkanesulfonamides.

Another object of the invention herein is to provide bleaching and detergent compositions containing alkali metal N-halo-alkanesulfonamides.

BRIEF SUMMARY OF THE INVENTION

Applicant has now discovered a novel class of compounds, namely N-halo compounds having the formula:



wherein X is selected from the group consisting of chlorine and bromine, M is an alkali metal, and R is an alkyl having from 1 to about 22 carbon atoms.

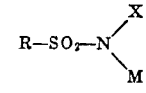
The N-halo compounds herein are effective bleaching agents and, in addition, possess desirable antiseptic properties. Further, certain of the N-halo compounds herein additionally possess surface-active properties.

The alkali metal N-halo-alkanesulfonamides herein can be prepared without great difficulty. Thus, for example, an alkanesulfonamide can be reacted with an alkali metal hypochlorite or hypobromite and the resulting alkali metal N-halo-alkanesulfonamide thereafter recovered; similarly, an alkanesulfonamide can be reacted with an alkali metal hydroxide and hypochlorous or hypobromous acid and the resulting alkali metal N-halo-alkanesulfonamide thereafter recovered.

The N-halo compounds of the invention herein can readily and effectively be employed in granular bleaching compositions and in granular detergent compositions, the other constituents of such compositions being known in the art in great detail.

DETAILED DESCRIPTION OF THE INVENTION

Accordingly, the invention herein comprises alkali metal N-halo-alkanesulfonamides having the formula:



wherein X is chlorine or bromine, M is an alkali metal, and R is an alkyl having from 1 to about 22 carbon atoms.

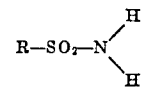
While all of the alkali metal N-halo-alkanesulfonamides herein possess satisfactory bleaching and/or antiseptic properties, the preferred alkali metal N-halo-alkanesulfonamides are those wherein R is an alkyl having from 1 to about 18 carbon atoms. Additionally, where R has a chain length in the range of from about 8 to about 20 carbon atoms, the N-halo compounds herein additionally possess desirable surface active properties.

M in the above formula can be any suitable alkali metal, e.g., sodium, potassium, or lithium; preferably, M is sodium or potassium and, most preferably, M is sodium.

An example of a particularly preferred alkali metal N-halo-alkanesulfonamide is sodium N-bromo-dodecanesulfonamide. Examples of other preferred compounds of the invention herein include sodium or potassium:

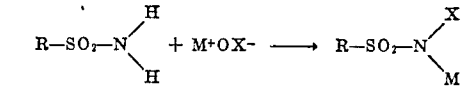
N-chloro-hexadecanesulfonamide,
N-chloro-tetradecanesulfonamide,
N-chloro-octanesulfonamide,
N-chloro-octadecanesulfonamide,
N-bromo-octanesulfonamide,
N-bromo-tetradecanesulfonamide,
N-bromo-hexadecanesulfonamide,
N-bromo-octadecanesulfonamide,
N-bromo-decanesulfonamide, and
N-chloro-decanesulfonamide.

The N-halo compounds of the invention herein can readily be prepared by one of several methods. According to one method, an alkanesulfonamide, having the formula



wherein R is an alkyl having from one to about 22 carbon atoms, is reacted with an alkali metal hypohalite selected from the group consisting of alkali metal hypobromite and alkali metal hypochlorite in accordance with the following reaction:

(1)



wherein X is chlorine or bromine, M is an alkali metal (preferably sodium or potassium) and R is an alkyl hav-

ing from 1 to about 22 carbon atoms. The resulting reaction product is an alkali metal N-halo-alkanesulfonamide which can then be recovered by any convenient means, e.g., by drying (i.e., removing the water from the resulting solution).

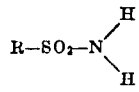
Preferably, the process employs special conditions to enable the desired reaction product to be recovered in substantially pure form. Thus, the alkanesulfonamide is preferably reacted in aqueous solution with substantially pure alkali metal hypohalite (preferably, sodium hypochlorite) in equimolar proportions, and the resulting aqueous solution of the alkali metal N-halo-alkanesulfonamide is preferably dried (and recovered) by evaporation under reduced pressure.

Substantially pure sodium hypochlorite can be prepared, for example, by distilling hypochlorous acid (and water) from a solution of commercial sodium hypochlorite and boric acid, and thereafter neutralizing the distilled aqueous acid with an equivalent of sodium hydroxide.

When the above-described preferred method is employed, there is avoided a difficult separation of the resulting N-haloalkanesulfonamide from impurities, e.g., sodium halide and/or free sodium hydroxide in the commercial hypohalite solution.

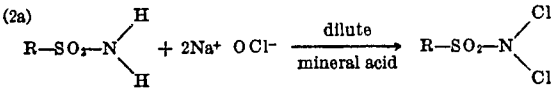
In preparing longer chain (i.e., the alkane moiety contains at least about 12 carbon atoms) sodium N-chloroalkane sulfonamides by the above method, unpurified commercial sodium hypochlorite can be used, inasmuch as the sodium N-chloroalkanesulfonamide formed in the reaction is sufficiently insoluble in the resulting solution, when cold, to allow its recovery by crystallization techniques.

Another general method, which permits the direct use of unpurified commercial sodium hypochlorite, comprises reacting a dispersion of an alkanesulfonamide, having the formula



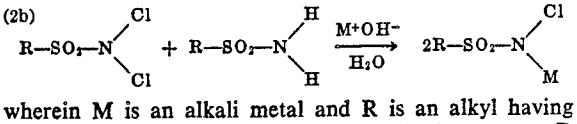
wherein R is an alkyl having from 1 to about 22 carbon atoms, in dilute mineral acid (e.g., dilute sulfuric acid) with sodium hypochlorite to form, as an intermediate, N,N-dichloro-alkanesulfonamide; this reaction can be illustrated as follows:

(2a)



The N,N-dichloro intermediate can then be recovered, e.g., by extraction in a volatile organic solvent, and thereafter added to a dispersion (preferably cold) of a stoichiometric amount of additional alkanesulfonamide in an aqueous solution of an alkali metal (preferably sodium or potassium) hydroxide to form the desired alkali metal N-chloro-alkanesulfonamide, in accordance with the following reaction:

(2b)



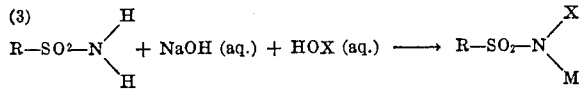
wherein M is an alkali metal and R is an alkyl having from 1 to about 22 carbon atoms and is the same as R used in Reaction 2a above. The resulting N-chloro compound herein can then be recovered, e.g., by drying the resulting solution, preferably by drying or evaporating the solution under reduced pressure.

The method exemplified by Reactions 2a and 2b above is particularly suitable for preparing N-chloro compounds herein having an alkane moiety of fewer than 12 carbon atoms.

A further method of preparing the N-halo compounds of the invention herein is to react a fine dispersion of an

alkanesulfonamide in one equivalent of alkali metal hydroxide solution with one molar equivalent of an aqueous solution of substantially pure hypohalous acid and thereafter recover the resulting alkali metal N-halo-alkanesulfonamide. This method can be exemplified by the following reaction:

(3)



wherein R is an alkyl having from 1 to about 22 carbon atoms, X is bromine or chlorine, and M is an alkali metal, preferably sodium or potassium.

In the method exemplified by reaction 3 above, if X is bromine, the substantially pure aqueous solution of hypobromous acid can be prepared, e.g., by distillation from bromine water which has been treated with mercuric oxide and the resulting alkali metal N-bromo-alkanesulfonamide can be recovered by evaporation at low temperature under reduced pressure, for instance, by freeze drying. By "low temperature" is meant a temperature low enough not to cause undue decomposition of the resulting N-bromo compound herein during the drying.

Similarly, in Reaction 3 above, if X is chlorine, the substantially pure aqueous solution of hypochlorous acid can be prepared by distillation from commercially available sodium hypochlorite, and the resulting alkali metal N-chloroalkanesulfonamide can be recovered either by drying (preferably by evaporation under reduced pressure) the resultant solution or by crystallization from the solution, when cold.

The N-halo compounds herein are readily and conveniently employed in the formulation of bleaching or sanitizing compositions by mixing them with carrier substances, for example, builder salts or surface active agents or both. Detergent compositions can contain the N-halo compounds herein in admixture with a compatible organic detergent and, if desired, a builder salt.

Alkaline inorganic salts, which can be used in conjunction with the N-halo compounds of the invention herein, include alkali metal carbonates, borates, phosphates, polyphosphates, bicarbonates, silicates, and sulfates, for example, sodium pyrophosphate, sodium tripolyphosphate, trisodium and disodium orthophosphates, sodium carbonate, sodium sesquicarbonate, sodium bicarbonate and various sodium silicates. Many other inorganic alkaline, neutral or acidic salts can be included as fillers or for processing reasons. The corresponding salts of other alkali metals, for example potassium, can be substituted for part or all of the sodium salts specifically illustrated above.

Examples of suitable organic alkaline builder salts are: (1) water soluble aminopolyacetates, e.g., sodium and potassium ethylenediaminetetraacetates, nitrilotriacetates, and N-(2-hydroxyethyl)-nitrilodiacetates; (2) water solubule salts of phytic acid, e.g., sodium and potassium phytates (see U.S. Pat. 2,739,942); (3) water soluble polyphosphonates, including specifically, sodium, potassium, and lithium salts of (a) ethane-1-hydroxy-1,1-diphosphonic acid, (b) methylene diphosphonic acid, and (c) ethane-1,1,2-triphosphonic acid; other examples include alkali metal salts of ethane-2-carboxy-1,1-diphosphonic acid, hydroxymethanediphosphonic acid, carbonyl diphosphonic acid, ethane-1-hydroxy-1,1,2-triphosphonic acid, ethane-2-hydroxy-1,1,2-triphosphonic acid, propane-1,1,3,3 - tetraphosphonic acid, propane-1,1,2,3-tetraphosphonic acid, and propane-1,2,2,3-tetraphosphonic acid; (4) water-soluble salts of polycarboxylate polymers and copolymers as described in the patent of Francis L. Diehl, U.S. 3,308,067 issued Mar. 7, 1967, e.g., polymers of itaconic acid, aconitic acid, maleic acid, citraconic acid, mesaconic acid, sumaric acid, methylene malonic acid, and copolymers with themselves and other compatible monomers such as ethylene.

Detergent compositions, in which a novel compound of the invention herein is a component, can comprise a novel N-halo compound of the invention herein, a water-soluble inorganic or organic alkaline builder salt, and a water-soluble organic detergent. In such compositions, the novel compounds herein can be present in an amount ranging from 0.5% to 25% by weight; the amount of detergent can range from about 1% to about 50%, preferably from about 5% to about 25%, by weight, and the ratio of detergent to builder salt is, preferably, in the range of from 4:1 to 1:20, respectively, by weight. Preferably, such detergent compositions have a pH range of from about 8 to about 11.

Examples of water-soluble detergent compounds which can be used in conjunction with the bleaching agents of this invention include, but are not limited to, the following:

(a) Anionic synthetic detergents, as represented by sodium alkyl sulfates, sodium or potassium alkylbenzenesulfonates, sodium alkylglycerylethersulfonates, and others;

(b) Nonionic synthetic detergents, as represented by polyethylene oxide condensates of alkylphenols; condensation products of aliphatic alcohols of 8 to 18 carbon atoms with ethylene oxide; long chain tertiary amine oxides corresponding to the general formula $R_1R_2R_3N\rightarrow O$, wherein R_1 is an alkyl radical of about 8 to 18 carbon atoms with R_2 and R_3 being methyl or ethyl radicals; long chain tertiary phosphine oxides corresponding to the general formula $R_4R_5R_6P\rightarrow O$, wherein R_4 is an alkyl, alkenyl or monohydroxyalkyl radical of about 10 to 18 carbon atoms with R_5 and R_6 being alkyl or monohydroxyalkyl groups of 1 to 3 carbon atoms;

(c) Ampholytic synthetic detergents, as represented by the derivatives of aliphatic amines which contain about 8 to 18 carbon atoms and an anionic water solubilizing group (e.g., carboxy, sulfo, sulfato); and,

(d) Zwitterionic synthetic detergents, represented by derivatives of aliphatic quaternary ammonium compounds, wherein one of the aliphatic groups has about 8 to 18 carbon atoms, another contains an anionic water-solubilizing group, and any of which are straight or branched.

The anionic, nonionic, ampholytic, and Zwitterionic detergents can be used singly or in combination together with the compounds of the present invention. With regard to these detergents, a more complete disclosure can be found in Francis Diehl, U.S. Pat. 3,213,030, issued Oct. 19, 1965, lines 53 to 75 of column 3, lines 1 to 75 of column 4, and lines 1 to 30 of column 5, the entire disclosure of which is hereby incorporated by reference.

In bleaching, sanitizing, or detergent compositions, the N-halo compounds of the invention herein can comprise up to about 90% or more (by weight) of the total composition. Generally it is included in an amount which provides from about 0.5% to about 8%, preferably about 4%, by weight of available chlorine in the composition, or equivalent proportion of available bromine.

The term "available chlorine" as used above and hereinafter represents the level of molecular chlorine (Cl_2) having equal bleaching power. Since one atom of active chlorine in these N-chloro compounds and in hypochlorites, has the same activity as one molecule of molecular chlorine (i.e. two atoms), the percentage "available chlorine" stated, by weight, is double the weight percentage of reactive chlorine in the molecule. Thus sodium N-chloro-ethanesulphonamide, having the formula

$$C_2H_5SO_2NClNa$$

contains 21.4% actual chlorine by weight, expressed as 42.8% available chlorine. The term "available bromine" has the analogous meaning.

The N-halo compounds herein are especially suitable for use in granular detergent compositions, in particular

in heavy duty granular detergent compositions. Such compositions generally comprise an organic detergent and an inorganic alkaline builder salt. A suitable heavy duty detergent composition, containing a N-halo bleaching agent herein, has the following formulation, wherein percentages are by weight:

	Percent
Sodium dodecylbenzenesulphonate	22
Sodium tripolyphosphate	37
Sodium silicate solids	7
Sodium carboxymethylcellulose	1
Sodium sulphate	12
Monoethanolamide of coconut fatty acids	3
Moisture	8
Sodium N-bromo-dodecanesulphonamide	10

This product is suitable for washing soiled white goods, e.g., table linen and bed linen, at normal washing machine temperature (below about 80° C.), and it is not necessary to use high temperatures (about 90° C. to boiling) which are required for effective bleaching with compositions containing, e.g., perborate.

The bleaching performance of the above exemplary detergent-bleaching composition remains substantially unchanged after up to 3 months storage in wax laminated carbons at ordinary room conditions (about 18° C.) or in a controlled atmosphere at 32° C. and 80% relative humidity.

The N-halo compounds of the invention herein can also be valuable as stain removing and forming agents in abrasive or other hard surface cleansers. They have very good bactericidal properties and can be used in the formulation of disinfectant and sanitizing compositions. For example, they can be included in dish washing compositions for use in automatic dishwashing machines in which they serve both as a "protein spotting" preventive and as sanitizing agents.

Detergent, bleaching and sanitizing compositions containing the compounds of the invention herein can contain the normal minor ingredients of such compositions, such as suds boosters, soil suspending agents, corrosion inhibitors, chlorine stable optical brighteners, coloring agents, and perfumes. Amongst suitable perfume materials are terpenic and non-terpenic compounds which contain in the molecule a double bond between two carbon atoms, at least one of which is tertiary. Some of these materials can also serve as stabilizers for the N-chloro compounds of the invention herein.

The invention herein also provides a method of bleaching textile fabrics which comprises treating the fabrics in an aqueous medium with an N-halo compound or N-halo containing composition according to the invention herein.

The following examples illustrate the invention:

EXAMPLE I

100 ml. of 0.25 M hypochlorous acid (prepared by distillation of a mixture of commercial sodium hypochlorite solution and boric acid) were neutralized with 25 ml. N-sodium hydroxide solution and 2.72 g. ethanesulfonamide were added. The resulting clear solution was evaporated to dryness under reduced pressure and the crystalline residue was transferred, filtered and washed with acetone, and dried to give sodium N-chloro-ethanesulfonamide (3.6 g.).

Sodium N-chloro-methanesulfonamide and sodium N-chloro-hexanesulfonamide were made by the same method, with appropriate adjustment of the weight of alkanesulfonamide added.

EXAMPLE II

5 g. of ethanesulfonamide were dissolved in 72 ml. of 0.8 M-sulfuric acid, and 60.5 ml. of 1.63 M commercial sodium hypochlorite solution were added dropwise to the cold solution. 7 grams of N,N-dichloroethanesul-

fonamide were isolated by extracting the resulting mixture with carbon tetrachloride and evaporating the extract. This intermediate material was added dropwise to a stirred, ice-cold solution of 4.28 g. ethanesulfonamide in 75 ml. N-sodium hydroxide. The resulting solution was evaporated to dryness under reduced pressure to give 10.5 g. of sodium N-chloro-ethanesulfonamide which was transferred, filtered and washed with acetone.

EXAMPLE III

A mixture of dodecanesulfonamide (5 g.), sodium hydroxide (0.8 g.), and water (50 ml.) was heated to boiling and then cooled to room temperature. 58 ml. of 0.35 M hypobromous acid (prepared by treating bromine water with mercuric oxide and distilling the filtrate) was added and the solution stirred until it became clear. 6.1 g. of sodium N-bromo-dodecanesulfonamide were recovered by freeze drying the solution in the absence of light.

EXAMPLE IV

A mixture of dodecanesulfonamide (10 g.) and 1 N sodium hydroxide solution (40 cc.) was heated to boiling and then cooled to 50° C. Commercial sodium hypochlorite solution (35 cc.; 1.32 M) was added and the resultant clear solution was cooled. The crystalline N-chloro body was filtered, washed with a little ice water and cold acetone, and dried. The yield was 10.5 g. sodium N-chloro dodecanesulfonamide, which can be recrystallized from 0.01 N sodium hydroxide.

Sodium N-chloro-and N-bromo-dodecanesulfonamide were substantially equal in bleaching effectiveness on tea-stained cloth test pieces to the corresponding sodium N-chloro- and N-bromo-benzenesulfonamides, respectively, when used at a concentration corresponding to 100 parts per million of available chlorine, or an equimolar concentration of available bromine, at 49° C. The dodecane compounds were additionally surface active, having foaming capacity in 0.05% solution in distilled water at least equal to that of sodium dodecanesulfonate.

EXAMPLE V

It is known in the art that detergent compositions which contain a combination of sodium tripolyphosphate (STP) and sodium salts of nitrilotriacetic acid (NTA) greatly enhance cleansing ability and maintenance of whiteness. (See Burton H. Gedge, U.S. Pat. 3,356,613 issued Dec. 5, 1967.) The novel N-halo compounds are suitable for use in such granular built detergents and serve to more effectively provide cleaning and whitening ability. Formulations of such granular detergents, containing N-bromo and N-chloro compouds of the invention herein and having a pH rage of from about 8 to about 11, are illustrated as follows:

	Formulations [1]			
	A	B	C	D
Sodium linear dodecyl benzene sulfonate	13.3	----	----	10
Reaction product of SO_3 and C_{18} α-olefins neutralized with NaOH	----	20	----	----
Condensation reaction product of 1 mole of tallow alcohol and 10 moles of ethylene oxide (TE_{10})	----	----	10	----
NTA	9.5	9	14.3	24.1
STP	41.2	40	30.7	22.9
Sodium carboxymethyl cellulose	0.33	1.6	----	----
Sodium random octadecyl phosphonate	0.1	0.1	----	----
Sodium sulfate	11	14	20	11
Sodium silicate (SiO_2:Na_2O=1.6:1)	10	6	10	10
Sodium salt of marine fatty acid	0.5	----	----	----
Sodium salt of tallow fatty acids	1.5	----	----	----
Benzotriazole	----	0.2	----	----
Optical brightener (optional) [2]	----	----	----	----
Coloring (optional) [3]	----	----	----	----
Perfume (optional) [4]	----	----	----	----
Sodium N-bromo-dodecane-sulfonamide	7	7	7	7
Water	Bal.	Bal.	Bal.	Bal.

[1] Figures in the columns are percentages by weight.
[2] The range is variable and generally runs from 0.1% to 1% by weight.
[3] The range is variable and only traces are used, usually amounting to less than 0.5% by weight.
[4] The range is variable and generally runs from 0.1% to 1% by weight.

EXAMPLE VI

The following is a granular detergent composition which contains a novel N-halo compound and the water-soluble organic alkaline salt, NTA:

	Percent by weight
Sodium N-bromo-dodecanesulfonamide	7
Sodium linear dodecylbenzene-sulfonate	7
NTA	50
Sodium carbonate	10
Sodium silicate	10
Water	Balance

EXAMPLE VII

An effective dry, granular, scouring cleanser composition, having bleaching and disinfecting characteristics and conveniently containing a novel N-bromo or N-chloro compound, is as follows:

(1) from about 0.1% to about 4%, by weight, of a novel N-chlorocompound or from about 0.5% to about 9% of a novel N-bromo compound;
(2) from about 0.1% to about 10%, by weight, of a compatible water-soluble organic detergent;
(3) from about 2.5% to about 30%, by wight, of a water-soluble alkaline detergency builder (organic or inorganic); and,
(4) from about 60% to 95%, by weight, of water-insoluble abrasive material.

The scouring cleanser formulations are most effective when used at a pH level of from 9 to 12. Examples of suitable detergents for use in these scouring cleanser compositions include those described earlier in the Specification herein; similarly, suitable water-soluble alkaline builder salts include those disclosed earlier herein. Examples of water-insoluble abrasives, suitable for use in the scouring cleanser compositions of the invention herein, include finely divided particulate siliceous abrasives such as silica, feldspar, pumice, volcanic ash, diatomaceous earth, bentonite, talc, and the like. A suitable particle size for the abrasive material ranges from about 0.03 mm. diameter to about 0.001 mm. diameter and finer.

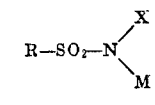
An optional component of such scouring cleanser compositions is perfume, which if added, generally ranges from about 0.1% to about 1% by weight.

Suitable specific scouring cleanser compositions, containing an N-chloro or N-bromo compound of the invention herein, are as follows, wherein all figures are given as percentages by weight:

	Compositions	
	A	B
Silica abrasive	83.62	70.39
Trisodium phosphate	6.0	15.8
Sodium linear dodecylbenzenesulfonate	8.9	9.3
Perfume	0.15	0.15
Sodium N-chlorododecanesulfonamide	1.33	----
Sodium N-bromo-dodecanesulfonamide	----	4.36

Having described the invention herein in detail, what I now claim is:

1. An alkali metal N-halo-alkanesulfonamide having the formula



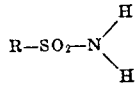
wherein X is selected from the group consisting of chlorine and bromine, M is an alkali metal, and R is an alkyl having from 1 to about 22 carbon atoms.

2. An alkali metal N-halo-alkanesulfonamide in accordance with claim 1 wherein M is selected from the group consisting of sodium and potassium and R is an alkyl having from 1 to about 18 carbon atoms.

3. An alkali metal N-halo-alkanesulfonamide in accordance with claim 2, wherein X is bromine, M is sodium, and R is an alkyl having 12 carbon atoms.

4. An alkali metal N-halo-alkanesulfonamide in accordance with claim 2, wherein X is chlorine, M is sodium, and R is an alkyl having 12 carbon atoms.

5. A method of preparing an alkali metal N-chloro-alkanesulfonamide of claim 1, which comprises: (a) reacting a dispersion of an alkanesulfonamide, having the formula



wherein R is an alkyl having from 1 to about 22 carbon atoms, in dilute mineral acid with sodium hypochlorite to form N,N-dichloro-alkanesulfonamide as an intermediate; (b) reacting said intermediate with a stoichiometric proportion of additional alkanesulfonamide herein in an aqueous solution of an alkali metal hydroxide; and (c) recovering the resulting alkali metal N-chloro-alkanesulfonamide by drying the resulting solution under reduced pressure.

6. A method in accordance with claim 5, wherein step (b) comprises reacting said intermediate with additional alkanesulfonamide in an aqueous solution containing about two equivalents of an alkali metal hydroxide selected from the group consisting of sodium hydroxide and potassium hydroxide.

7. A method in accordance with claim 6, wherein step (a) comprises reacting an alkanesulfonamide, wherein said R is an alkyl having fewer than 12 carbon atoms, with said sodium hypochlorite.

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