United States Patent Office 3,503,890 Patented Mar. 31, 1970



3,503,890

# DRAIN CLEANER

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No Drawing. Filed July 29, 1966, Ser. No. 568,757
Int. Cl. C11d 1/18, 1/38, 1/50, 3/26, 7/32
U.S. Cl. 252—152 9 Claims

## ABSTRACT OF THE DISCLOSURE

A method for alleviating sluggish or clogged drain conditions arising from the accumulation of household wastes in the drain lines by adding to the drain line effective quantities of a non-metal corrosive cationic quaternary ammonium salt surface-active agent.

This invention is directed to a method for controlling and reducing the accumulation of waste materials in sink traps and drain lines. More specifically, this invention is directed to a method for alleviating sluggish or clogged drain conditions arising from the accumulation of household wastes in drain lines.

Sluggish or blocked household drains are generally caused by the accumulation of water-insoluble household wastes in sink traps or by the accumulation of wastes along the inner walls or at the point of junction of drain pipe sections. For example, the uncontrolled build up in drain lines of fats, oils, and greases produced during the preparation of foods as well as accumulated deposits of inorganic and organic salts resulting from the use of detergents and soaps in the presence of ionized or "hard" water can be responsible for sluggish drainage.

If the above wastes are permitted to accumulate in drain lines undisturbed, the drain becomes sluggish, i.e. partly blocked so that the drain does not empty freely, and eventually will become completely blocked. When this occurs, the drain generally backs up and deposits partially decomposed, germ-infested waste materials outside the drain lines.

A blocked or sluggish drain may, in most instances, be remedied by the periodic use of a drain cleaner which will attack and remove accumulated wastes in the drain lines. Most of the consumer products currently available for cleaning a drain and for alleviating sluggish drain conditions consist primarily of a strong acid or a strong alkali. Caustics and acids have been widely used in drain cleaners mainly because they are relatively economical and have represented for many years the only alternative to the expense of calling a professional plumber.

Basically, alkaline and acid type drain cleaners operate on a heat-generating principle. That is, they are capable of liberating heat when mixed with water or when contacted with the drain obstruction. This rapid liberation of heat melts away the drain obstruction. One serious disadvantage associated with the use of drain cleaners relying on heat to melt away drain obstructions is that in many instances the melted material is merely redistributed in the drain lines and upon cooling will resolidify elsewhere in the drain line. This creates the illusion of solving the problem; however, on rehardening, these greases and fats may form a caustic hard soap which may be more difficult to remove than were the original deposits.

Another disadvantage associated with the use of alkalies and acids in drain cleaner compositions is that these materials can be both corrosive and toxic and, thus, great care must be exercised to protect against their misuse.

Compositions containing enzymes are also available for use as a drain cleaner. Although these compositions are



non-toxic and non-corrosive, they have other disadvantages. One disadvantage is that the effectiveness of an enzyme drain cleaner depends to a larger degree on the existing climate, or environment, in the drain lines. For example, temperature, pH and oxygen concentration are all environmental factors on which the effectiveness of an enzyme drain cleaner depends.

Another disadvantage is that such enzymes cannot be conveniently stored for any extended periods of time as a solution without the enzyme losing its activity.

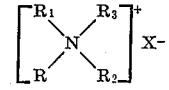
It is, therefore, a primary object of this invention to provide a drain cleaner which is non-toxic, non-corrosive, may be stored as a liquid, and which is effective over a broad range of environmental conditions.

Another object of this invention is to provide a method for maintaining free-flowing drains by controlling, as well as removing, waste accumulation in drain lines.

Other objects of this invention will be apparent from the disclosure which follows.

Broadly, this invention provides a method for overcoming sluggish (slow draining) and clogged drains by periodically contacting the waste accumulated in the drain line with effective waste-reducing and waste-removing amounts of a cationic quaternary ammonium salt compound having at least one hydrophilic based functional group such as N and at least one hydrophobic long chain alkyl group containing at least 10 carbon atoms attached either directly to the functional group or through some intermediate linkage such as an alkyl amide radical. Generally the cationic material will have a molecular weight of between 200 and 2,000.

One particular class of quaternary ammonium salt compounds, such as the quaternary surface active agents, which can be used may be represented by the general formula



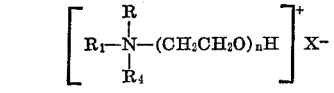
wherein R is a higher alkyl having more than 10 carbon atoms and preferably having between about 12 and 22 carbon atoms; $R_1$ is the same as R or is a lower alkyl radical having from 1 to 4 carbon atoms; and $R_2$ and $R_3$ are independently selected from the group consisting of lower alkyl radicals having 1 to 4 carbon atoms, benzyl radicals hydroxyalkyl radicals, hydroxyalkoxyalkyl radicals which include, for example, the hydroxy polyethers formed by the condensation of ethylene oxide or propylene oxide, acyl aliphatic radicals, amido aliphatic radicals, acylated polyazaalkyl radicals, imido aliphatic radicals, aryl radicals, and imido aliphatic radicals wherein the nitrogen of the functional group is part of a heterocycle; and X is an anion.

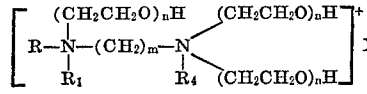
Although the choice of anion is not particularly critical to this invention, the chloride and methyl (metho) sulfate anions (obtained during methylation) are the anions most generally employed. Other suitable anions include the nitrite, halide, sulfate, alkyl sulfate, oleate, palmitate, stearate, benzoate, organic and inorganic phosphates, and the like.

The higher alkyl radicals above referred to in the general formula are carbon chains which may be straight or branched and saturated or unsaturated. Preferably, the carbon chains are obtained from long chain fatty acids such as those derived from tallow, soybean oil, or coconut oil. Mixtures of the above as well as other quaternary ammonium surface active agents may also be used if desired. Preferably, both R and $R_1$ are alkyl groups containing 12 to 18 carbon atoms and $R_2$ and $R_3$ are methyl groups. However, excellent results have also been obtained when $R_1$ is also a methyl group or when $R_2$ is a benzyl group.

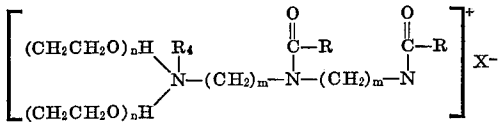
Examples of suitable quaternary ammonium surface active agents which fall within the class of compounds above described include lauryl trimethyl ammonium methosulfate, palmityl trimethyl ammonium acetate, stearyl dimethyl benzyl ammonium nitrite, myristyl dimethyl benzyl ammonium chloride, stearyl trimethyl ammonium chloride, distearyl dimethyl ammonium methosulfate, palmityl trimethyl ammonium chloride. Quaternary ammonium salts generally referred to as hydrogenated tallow alkyl trimethyl ammonium chlorides have been found to be particularly effective for alleviating sluggish drain conditions.

Other classes of quaternary ammonium surface active agents which can be used are ethoxylated quaternary ammonium salts selected from the group consisting of compounds having the formulas





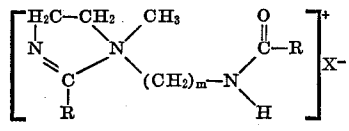
and



wherein R and $R_1$ are the same as R and $R_1$ of the general formula, $R_4$ is a benzyl radical, methyl radical, or a $-(CH_2CH_2O)_nH$ radical, $n$ is a number from 1 to 20, $m$ is a number from 2 to 3, and X is an anion.

Examples of various types of ethoxylated quaternary ammonium surface active agents which fall within the above class or compounds include dilauryl methyl polyoxyethylene ammonium chloride; stearyl methyl dipolyoxyethylene ammonium chloride; dimyristyl methyl polyoxyethylene ammonium methyl sulfate; distearyl benzyl polyoxyethylene ammonium chloride; distearyl methyl polyoxyethylene ammonium chloride; N-capryl, N,N'-dimethyl polyoxyethylene propylene diammonium chloride; dicapryl methyl polyoxyethylene ammonium chloride, dilauryl benzyl polyoxyethylene ammonium chloride; N-lauryl, N,N'-diethyl polyoxyethylene ethylene diammonium ethyl sulfate; N-stearyl, N,N'-dibenzyl polyoxyethylene propylene diammonium chloride; disoya benzyl polyoxyethylene ammonium chloride; dicoco ethyl polyoxyethylene ammonium chloride; N-soya, N,N'-dimethyl polyoxyethylene propylene diammonium methyl sulfate; N-tallow, N,N'-dibenzyl polyoxyethylene propylene diammonium chloride, N-coco, N,N'-dimethyl polyoxyethylene ethylene diammonium chloride. The terms "disoya," "dicoco," and "N-tallow," etc. as used above refer to the source from which the long chain fatty alkyl chains are derived, and the products contain a variety of long-chain groups varying in length, unsaturation, branching, etc.

Still another class of useful compounds include quaternary compounds having the formula



wherein R, $m$, and X are as defined above.

An example of the above type of quaternary ammonium compound is 1-methyl-1-alkylamidoethyl-2-alkylimidazolinium methosulfate.

Other specific surface active agents which may be used in this invention and which fall within the classes of compounds above described may be found in the Annual Report "Detergents and Emulsifiers" through John W. McCutcheon, Inc.



For convenience a 5% by weight aqueous solution of a quaternary ammonium salt is generally used; however, a 1% to 10% solution or even a more concentrated or more dilute solution may be used if desired. For example, for most household drains the addition of 1 cup or 8 ounces of a 5% solution of a quaternary ammonium salt to a drain will be sufficient to remedy most sluggish or slow moving drains. However, where the blockage is due to abnormally larger quantities of waste material, a longer "working" period or repeated treatments may be required to remedy sluggish conditions.

Calculated on a weight ratio basis, the amount of quaternary ammonium salt required may be varied from about 0.01 to 5 parts of quaternary ammonium salt per part of waste material. However, the use of an amount between 0.1 to 1.0 part of quaternary ammonium salt per part of waste material is preferred.

The solvent for the quaternary ammonium salt compound is generally water; however, various organic solvents such as alcohols, ethers, benzene and the like, either alone or in combination, one with the other or organic solvents in combination with water, may be used. Organic solvents which are water soluble such as the mono and polyhydric alcohols are preferred. Examples of suitable mono and polyhydric alcohols include ethyl alcohol, isopropyl alcohol, methanol, glycerol and the like. Other materials such as perfumes, coloring agents, stabilizers etc. may also be added to the quaternary ammonium salt solution if desired.

In the examples to follow several variations of the preferred embodiments of this invention are shown. These, however, are not to be interpreted as specific limitations of the invention.

## EXAMPLE 1

A liquid drain cleaner was prepared by adding to 1,000 ml. of distilled water:

(a) 1,100 ml. of a 50% isopropyl alcohol solution of "Aliquat 26" (tallow alkyl trimethyl ammonium chloride)
(b) 5.5 gms. of pine oil
(c) 5.5 gms. of isooctyl phenyl polyethoxy ethanol (pine oil solubilizer)
(d) 50 drops of McCormick's blue vegetable dye
(e) 25 drops of McCormick's red vegetable dye

The above solution was then diluted with distilled water to a volume of 11,100 ml.

One cup or approximately 8 ounces of the above prepared composition was poured into a slow draining kitchen sink drain capable of removing water, before treatment, at a rate of about 6 gallons per minute. The composition was allowed to "work" in the drain for about 3 hours before flushing with tap water.

After flushing, the draining rate of the sink drain was determined to be about 8 gallons per minute. The improvement in the drainage rate was 33.3%.

## EXAMPLE 2

One cup or approximately 8 ounces of the drain cleaner composition of Example 1 was introduced into a bathroom sink drain capable of removing water, before treatment, at a rate of about 5.5 gallons per minute. The composition was allowed to "work" in the drain for about 6 hours before flushing with tap water.

After flushing, the draining rate of the treated drain was determined to be about 7.5 gallons per minute. This was an improvement in the draining rate of 36.4%.

## EXAMPLE 3

One cup or approximately 8 ounces of the drain cleaner prepared in Example 1 was introduced into a bathtub drain exhibiting poor draining characteristics. The rate of water removal prior to treatment was determined to be about 3.5 gallons per minute. The composition was allowed to "work" in the drain overnight (approximately

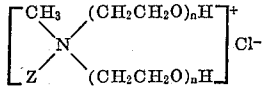
8 or 9 hours) before flushing the drain with tap water. After flushing, the draining rate of the treated bathtub was determined to be about 6.3 gallons per minute.

The following day the above procedure was repeated again on the same drain. After flushing with tap water, the draining rate of the bathtub drain was determined to be about 7.0 gallons per minute. The improvement in drainage after the first treatment was 80% and after the second treatment it was 100%.

## EXAMPLE 4

A liquid drain cleaner was prepared by adding to 1,000 ml. of distilled water:

(a) 1,100 ml. of a 50% solution of "Ethoquad 18–25" (polyethoxylated quaternary ammonium chloride) represented by the formula



wherein Z is an 18 carbon alkyl group derived from stearic acid and wherein each *n* is a number from 2 to 13 the sum of which is 15

(b) 5 gms. of pine oil

(c) 5 gms. of isoactyl phenyl polyethoxy ethanol (pine oil solubilizer)

(d) 50 drops of McCormick's blue vegetable dye

(e) 25 drops of McCormick's red vegetable dye

The above solution was then diluted with distilled water to a volume of 11,100 ml.

One cup or approximately 8 ounces of the above prepared composition was poured down a slow draining kitchen sink drain. The composition was allowed to "work" for about 8 hours prior to flushing with tap water. After flushing, the draining rate of the kitchen drain was determined to be improved by about 38%. When the above composition was used on bathroom sink drains and bathtub drains, an improvement in the drain's rate of water removal was increased by a factor as high as 85%.

## EXAMPLE 5

When Example 4 was repeated with a drain cleaning composition containing "Variquat 450" (dodecyl benzyl trimethyl ammonium chloride) instead of "Ethoquad 18–25," improved draining was similarly detected.

## EXAMPLE 6

For this example, a simulated drain plug was prepared by heating a mixture of 71.5% lard, 15% Crisco hydrogenated vegetable oil, 13% hydrogenated cottonseed oil and 0.5% human hair to the melt temperature. After the mixture was melted and thoroughly blended, approximately 2.5 grams of the melt mixture was placed along the bottom of a glass U-tube (to simulate a household drain trap) having an internal diameter of 15 mm. The mixture was sufficient to coat the bottom portion of the U-tube without completely blocking the U-tube. The rate at which water flowed through the tube containing the plug was determined to be 13 ml. per second. Twenty ml. of distilled water was added to the tube containing the plug to simulate a partially blocked household drain trap having a volume of water trapped therein.

Twenty ml. of a 5% aqueous solution of "Arquad 18–50" (tallow alkyl trimethyl ammonium chloride) was added to the tube containing the plug and water. The tube was then placed in a rack to permit undisturbed "working" of the composition on the plug. After a period of 16 hours, the tube was flushed with tap water and then dried for a period of 6 hours at a temperature of 120° F. The rate at which water flowed through the tube, following treatment with the composition, was determined to be 32 ml. per second. The improvement in the rate of flow was calculated to be 126%.

## EXAMPLE 7

Example 6 was repeated with the exception that 20 ml. of a 10% aqueous solution rather than a 5% aqueous solution of "Arquad 18–50" was used. The percent improvement in this instance was calculated to be 130%.

## EXAMPLE 8

Example 6 was again repeated with the exception that a 0.5% rather than a 5.0% solution of "Arquad 18–50" was used. The percent improvement in the rate of flow through the tube in this instance was calculated to be 12%.

## EXAMPLE 9

Example 6 was again repeated with the exception that 20 ml. of distilled water was substituted for the aqueous solution of "Arquad 18–50." The percent improvement in the rate of the flow of the drain in this instance after 48 hours was less than 2%. This comparative example shows that water alone has little effect in remedying the slow draining conditions.

## EXAMPLES 10–14

In these examples approximately 3 gms. of the simulated drain plug prepared in Example 6 was deposited in each of nine U-tubes. The amount added was sufficient to reduce the flow through the tube by about 85%. Each of the plugs in the tubes was covered with 15 ml. of distilled water followed by 15 ml. of a 5% aqueous solution or a 5% water-alcohol solution of different types of cationic quaternary ammonium salt compounds. After a "working" period of about 16 hours, the percent improvement in the rate of flow was determined for each of the tubes and reported in Table I.

TABLE I

| Ex. | 5% solution of cationic material tested: Trade name | Quaternary compound | Percent flow increase, ml./min. |
|---|---|---|---|
| 10 | Variquot 450 | Dodecyl benzyl trimethylene ammonium chloride. | 129.6 |
| 11 | Arquad 12-50 | Dodecyl trimethyl ammonium chloride. | 40.0 |
| 12 | Varisoft 222 | Bis-ethylene N,N'distera-midoethyl methyl ammonium methosulfate. | 61.6 |
| 13 | Culversoft S-75 | 1-Methyl-1-alkylamidoethyl-2-alkylimidazalinium methosulfate. | 52.0 |
| 14 | Arquad 2HT-50 | Dimethyl distearyl ammonium chloride. | 40.0 |

## EXAMPLE 15

In this example a simulated "kitchen" drain plug was prepared by heating hamburger grease to its melt temperature and placing approximately 3.5 grams of the melt along the bottom of a weighed 150 x 15 mm. glass U-tube. After the melt had been hardened by cooling, the tube and simulated plug were weighed. It was found that the tube and simulated plug weighed 30.50 gms. Fifteen ml. of distilled water was then added to the tube followed by 15 ml. of a 5% solution of "Arquad 18–50." The tube was set aside for 16 hours to permit "working" of the composition on the simulated plug. After this period the tube was rinsed very carefully with tap water and dried at 100° F. for six hours. The U-tube was then reweighed and was found to weigh 27.05 gms. The removal of the plug by action of the cationic solution was essentially complete.

## EXAMPLE 16

When Example 15 was repeated with a simulated kitchen plug containing 50% hamburger grease, 25% ham drippings and 25% sausage grease, the percent of plug removed ranged from 85% to 95%.

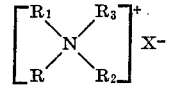
## EXAMPLE 17

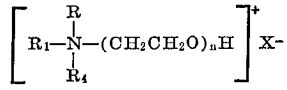
Example 15 was repeated several times with a simulated plug containing 31% soap, 31% lard, 31% Crisco, 5% $CaCo_3$, and 2% hair. Following treatment with a 5%

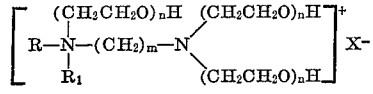
solution of "Arquad 18–50," it was found that 40% to 50% of the plug was removed in each instance.

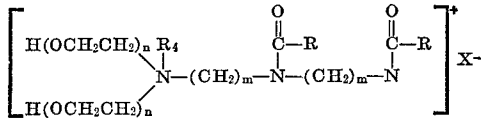
We claim:

1. A method for alleviating sluggish or clogged drain conditions arising from the accumulation of wastes in a drain line which comprises contacting the accumulated waste with an aqueous composition consisting essentially of at least 1% by weight of a cationic quaternary ammonium salt compound having at least one hydrophilic based functional group and at least one hydrophobic long chain alkyl group, said salt compound having a structure selected from the group consisting of

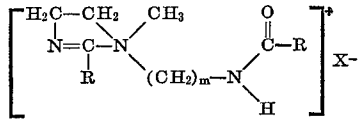








and



wherein each R is selected from the group consisting of alkyl groups having from 10 to 22 carbon atoms and benzyl groups substituted with an alkyl group of from 10 to 22 carbon atoms; $R_1$ is selected from the group consisting of alkyl groups of from 1 to 4 carbon atoms and alkyl groups having from 10 to 22 carbon atoms; $R_2$ and $R_3$, independently are selected from the group consisting of alkyl groups having from 1 to 4 carbon atoms and benzyl; $R_4$ is selected from the group consisting of benzyl, alkyl group of from 1 to 4 carbon atoms and $-(CH_2CH_2O)_nH$; *n* is a number from 1 to 20; *m* is a number from 2 to 3; and X is an anion, and wherein the quaternary ammonium salt has a molecular weight of between 200 and 2,000.

2. The method of claim 1, wherein the quarternary ammonium salt compound is hydrogenated tallow alkyl trimethyl ammonium chloride.

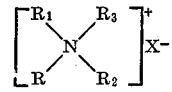
3. The method of claim 1, wherein the hydrogenated tallow alkyl trimethyl ammonium chloride is introduced as a solution.

4. The method of claim 3, wherein the hydrogenated tallow alkyl trimethyl ammonium chloride is present in the solution in an amount of between about 1% and 10% by weight of the solution.

5. The method of claim 1, wherein the cationic quaternary ammonium salt is present in the drain in a weight ratio of between 0.01 to 5 parts of quaternary ammonium salt per part accumulated waste.

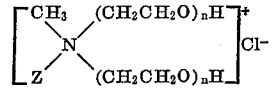
6. The method of claim 1, wherein the quaternary ammonium salt compound is 1-methyl-1-alkylamidoethyl-2-2 alkyl-imidazolinium methosulfate.

7. The method of claim 1, wherein the quaternary ammonium salt compound has the structure



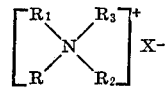
wherein R and $R_1$ are higher alkyl groups having from about 12 to 22 carbon atoms, $R_2$ and $R_3$ are lower alkyl radicals having from 1 to 4 carbon atoms and X is a halide.

8. The method of claim 1, wherein the cationic quaternary ammonium salt is a polyethoxylated quaternary ammonium chloride having the formula



wherein Z is an 18 carbon alkyl group derived from stearic acid and wherein each *n* is a number from 2 to 13, the sum of which is 15.

9. The method of claim 1 wherein the quaternary ammonium salt compound has the general formula



wherein R is a higher alkyl group having from about 12 to 22 carbon atoms; $R_1$ is selected from the group consisting of an alkyl group having from about 12 to 22 carbon atoms and lower alkyl having from 1 to 4 carbon atoms; and $R_2$ and $R_3$, independently, are selected from the group consisting of lower alkyl groups having 1 to 4 carbon atoms and benzyl groups; and X is an anion.

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MAYER WEINBLATT, Primary Examiner

U.S. Cl. X.R.

134—42; 210—23; 252—106, 156, 157, 158; 260—309.6, 567.6

PO-1050
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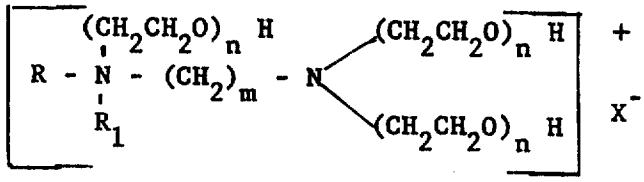
# UNITED STATES PATENT OFFICE
# CERTIFICATE OF CORRECTION

Patent No. 3,503,890 Dated March 31, 1970

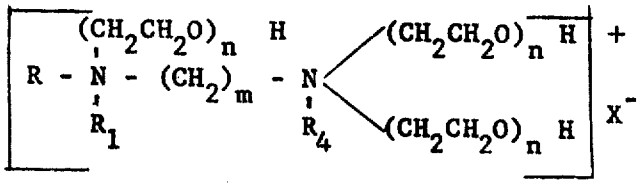
Inventor(s) Marian C. Davisson and Robert L. Kraudel

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 5, line 75, for "126%" read ---146%.--- Column 6, line 31, for "quarternary" read ---quaternary--- The structure in column 7, between lines 20 and 25, for



read



SIGNED AND
SEALED
SEP 1 - 1970

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents