United States Patent Office

3,687,859

Patented Aug. 29, 1972

3,687,859

CORROSION INHIBITING PROCESSES AND COMPOSITIONS OF ALIPHATIC AMINES AND DIQUATERNARY DIAMINES

Ronald M. Silverstein, Parsippany, N.J., assignor to Drew Chemical Corporation, New York, N.Y.

No Drawing. Continuation-in-part of abandoned application Ser. No. 666,480, Sept. 8, 1967. This application Feb. 9, 1971, Ser. No. 114,055

Int. Cl. C02b 5/06

U.S. Cl. 252—180 13 Claims

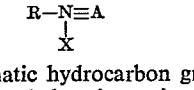
ABSTRACT OF THE DISCLOSURE

Improved compositions are described for inhibiting corrosion in systems using water as the heat transfer medium. The compositions are aqueous dispersions comprising an aliphatic long chain amine and from about 0.20 to about 1 part of N-phenyl (higher alkyl) lower alkyl quaternary diamine per part of the long chain aliphatic amine. The process of preparing the dispersion and its use to inhibit corrosion are also disclosed.

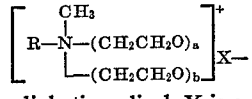
This application is a continuation-in-part of my copending application Ser. No. 666,480, filed Sept. 8, 1967, now abandoned.

This invention relates to the inhibition of corrosion in steam condensate systems and more particularly relates to improvements for maintaining dispersions containing long chain fatty acid amines used to inhibit such corrosion.

The technology of preventing corrosion of metallic surfaces in systems in which water is used as a heat transfer medium, in the form of steam or cooling water, has received considerable attention. By way of background, Kahler's U.S. Pat. No. 2,460,259 disclosed a corrosion inhibiting means in which an aliphatic amine, e.g. octadecyl amine, is used. Since most long chain aliphatic amines are only sparingly soluble in water, difficulty was encountered in maintaining the amine as a uniform dispersion in the form which the corrosion inhibiting composition is normally prepared and sold. To overcome this disadvantage, Maguire's U.S. Pat. No. 2,712,531 discloses the use of octadecyl amine acetate to assist in preventing the long chain fatty amine, particularly octadecyl amine, from crystallizing into the solid phase. The use of such an amine acetate is not entirely satisfactory, because of suspected decomposition which yields a weak acid, and which may give rise to corrosion in the system. Denman's U.S. Pat. No. 2,956,889 discloses the use of aliphatic amines utilized in conjunction with ethylene oxide condensates of aliphatic amines as corrosion inhibitors. Haggard's U.S. Pat. No. 2,564,758 discloses the use of primary rosin amines in conjunction with ethoxylated secondary amines. Cross' U.S. Pat. No. 2,779,741 discloses the use of hydrocarbon monoamines and an ammonium salt corresponding to the formula:



wherein R is an aliphatic hydrocarbon group of 8 to 20 carbon atoms, X is a salt-forming anion and N≡A represents a tertiary amine or a tertiary N-heterocyclic base radical. Kahler et al. U.S. Pat. No. 3,088,796 disclosed the use of aliphatic amines and complex ethoxylated amine salts represented by:



wherein R is an aliphatic radical, X is a halogen ion, and the integers *a* plus *b* total from 2 to 15.

It is an object of this invention to prepare a stable dispersions of a fatty amine for use as a corrosion inhibitor in aqueous systems.

Another object is to prepare a dispersion of aliphatic amine corrosion inhibitor compounds at a cost savings which were heretofore unobtainable.

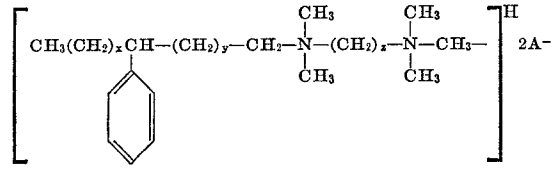
Still another object is to prepare a dispersion of a corrosion inhibiting amine which dispersion can be diluted to use concentration with no deleterious effect.

Yet another object is the provision of a method of inhibiting corrosion by the use of such novel composition.

The invention accordingly comprises the processes involving the several steps and the relation and order of one or more of such steps with respect to each of the others and the product possessing the features, properties and the relation of elements which are exemplified in the following detailed disclosure, and the scope of the application which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be made to the following detailed description.

I have now discovered a method for inhibiting corrosion in steam condensate systems by the utilization of my new corrosion inhibition composition. This composition is prepared as a dispersion of (1) a long chain aliphatic amine, and (2) a diquaternary diamine of the formula:



wherein

$x+y$ to 13–17

$z=2$ to 4, and

A is selected from the group consisting of halide, hydroxy and nitrate ions; and water (3) is the third component.

Component (1) the long chain amine are fatty monoamines of the formula:

$$R—NH_2$$

wherein R is a saturated or unsaturated hydrocarbon group containing from 8 to 22 carbon atoms. Typical examples of such compounds include but are not limited to octyl amine, dodecylamine, octadecyl amine, lauryl amine, and myristyl amine.

Typical examples of compounds within the scope of component (2) include N-phenylstearyl-1, 3-propylene diamine quaternary dichloride, N-phenyl arachidyl-1,4-N-butyl diamine quaternary dibromide, N-phenyl palmityl ethylene diamine quaternary dichloride.

The third component is water which need only be of the grade utilized in industrial processes.

In my composition, I utilize from about 0.20 part by weight of the diquaternary diamine to about 1 part by weight of the fatty monoamine with from about 80 to about 95 parts of water, more or less as is needed to form a stable dispersion.

I have found that the long chain aliphatic amine can be uniformly dispersed in the water phase and prevented from agglomerating and separating out as solid globules or flakes, by the use of a small amount of the diamine dichloride. Whereas Cross utilized from 1 part to 6 parts of his monoquaternary compound to 1 part of the aliphatic amine, I am able to keep the aliphatic amine dispersed sufficiently by the use of from only 0.20 part to about 1 part of my diquaternary diamine. Since the cost of the monoquaternary compounds and the diquaternary compounds are substantially the same, an economi-

cally noteworthy saving can be achieved by the use of my compositions, particularly in large systems.

The compositions of this invention are aqueous dispersion containing the long chain aliphatic amine, preferably octadecyl amine, and the diquaternary diamine, preferably of N-phenylstearyl-1,3-propylene diamine quaternary dichloride, with the balance of the composition essentially being water, although additional ingredients, such as a surfactant, may be included when deemed advantageous. The weight ratio of the aliphatic amine to such diquaternary diamine is preferably about 5:1. Such a dispersion is normally prepared by the manufacturer and shipped to the user. Normally, although not necessarily, the user dilutes the dispersion with from about 4 to about 24 parts of water, generally 9 to 19 parts of water, to form a diluted dispersion which is thereupon injected into the steam condensate system for the purpose of inhibiting corrosion therein. Typically, sufficient diluted dispersion is added as by a proportioning pump, to the system to provide in the range of from about 0.1 to about 5 parts per million of long chain aliphatic amine in the steam. The addition of the diluted dispersion may be made to the system at a point where the heat transfer water is in the liquid phase, e.g. to the boiler feed water, or to the water in the vapor phase, such as in the steam conduit downstream from the boiler.

The preferred process of making the aforesaid dispersion is to mix together the entire amount of diamine quaternary with about 50 percent of the water to be used for the dispersion. This solution is heated to about 170° F. at atmospheric pressure and the aliphatic amine added to the solution while the solution is stirred or otherwise agitated and the temperature is maintained at about 150–175° F. After the fatty monoamine has been dispersed in the solution, the remainder of the water, which is normally at room temperature, is added and the resultant dispersion is stirred while it cools to a temperature of less than about 125° F., after which stirring may be discontinued.

An alternative process of preparing the dispersion is to mix together the aliphatic amine and the diamine quaternary and then melting the two ingredients by heating them to about 120–125° F. The melted ingredients are added to the required amount of water, which is used at about 150–175° F. The mixture is then stirred while maintaining the elevated temperature until the desired dispersion has achieved a uniform homogeneous appearance. Thereafter, it is cooled to about 120–130° F., stirring being continued until such temperature is reached and thereafter stirring may be discontinued. The prepared compositions of this invention may be packaged for shipment while hot, or allowed to cool no lower than their solidification points prior to such packaging.

The effectiveness of using a typical diquaternary diamine to maintain a typical fatty amine, namely octadecyl amine uniformly dispersed has been evaluated and compared against a number of alternative compounds. Dispersions were prepared by the foregoing preferred method using 8 or 9 percent octadecyl amine and 1 or 2 percent of various other compounds and the characteristics of the resulting dispersions and their ease of dilution, at a ratio of 10 or 20 to 1, in distilled water (at about 120° F.) were observed. The dispersions were considered to be satisfactory if no solid phase aliphatic amine separated therefrom within 24 hours after dilution, i.e. use, occurred. This data is set forth in the following table:

TABLE I

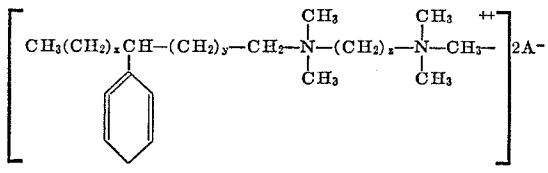
Dispersant for aliphatic amine		Octadecyl amine, percent	Observance
Name	Percent		
N-phenylstearyl-1,3-propylene diamine quaternary dichloride.	2	8	Excellent viscous milk-white concentrate; easily diluted in distilled water.
Do	1	9	Good concentrate but with some infrequent particles of octadecyl amine in the solid phase; difficult to dilute, with some separation of octadecyl amine particles.
Do	2	9	Excellent viscous milk-white concentrate; readily diluted without phase separation for 24 hours.
Dodecyl trimethly ammonium chloride	2	8	Very poor concentrate; waxy layer of octadecyl amine appeared on top of liquid.
Octadecyl trimethyl ammonium chloride	2	8	Fair concentrate, with some particles of octadecyl separated out; poor dilution with additional amine separating out within 24 hours.
1-hexadecyl pyridinium chloride	2	8	Do.
Ammonium chloride phenylstearyl trimethyl quaternary.	2	8	Concentrate not homogeneous.
Ammonium chloride diphenyl dimethyl quaternary.	2	8	Very poor stability with large lumps of octadecyl amine in concentrate.
Polyethoxylated (5) phenylstearyl methyl quaternary ammonium chloride.	2	8	Ineffective; octadecyl amine formed on surface of liquid.
Polyethoxylated (15) phenylstearyl methyl quaternary ammonium chloride.	2	8	Concentrate unacceptable, since octadecyl amine was dispersed as visible solid phase particles.

Since certain changes may be made in the above products, compositions and processes without departing from the scope of the invention herein involved, it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A water dispersible composition for inhibiting corrosion, comprising:

a long chain aliphatic hydrocarbon amine having from 8 to 22 carbon atoms and a diquaternary diamine of the formula



wherein

$x+y$ is 13–17

$z=2$ to 4, and

A is selected from the group consisting of halide, hydroxy and nitrate ions.

2. The composition of claim 1 wherein the ratio of diquaternary diamine to aliphatic amine is from 0.20:1 to 1:1.

3. The composition of claim 2 wherein the diquaternary diamine is N-phenylstearyl-1, 3-propylene diamine dichloride.

4. The composition of claim 3 wherein the aliphatic amine is octadecyl amine.

5. A process for inhibiting corrosion of metal surfaces in contact with an aqueous system, comprising:

adding to the aqueous system the composition of claim 2.

6. A process for inhibiting corrosion of metal surfaces in contact with an aqueous system comprising:

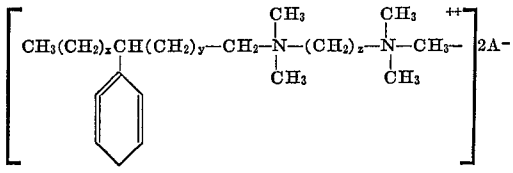
adding to the aqueous system the composition of claim 1.

7. A process for inhibiting corrosion in a steam condensate system, comprising:

adding to the steam condensate system the composition of claim 1.

8. A composition for inhibiting corrosion, comprising:

a long chain aliphatic hydrocarbon amine having from 8 to 22 carbon atoms; a diquaternary diamine of the formula:



wherein

$x+y$ is 13–17

$z=2$ to 4, and

A is selected from the group consisting of halide, hydroxy and nitrate ions; and water, said aliphatic hydrocarbon amine and diquaternary diamine being dispersed in said water.

9. The composition of claim 8 wherein the ratio of diquaternary diamine to aliphatic amine is from 0.20:1 to 1:1.

10. The composition of claim 9 wherein the diquaternary diamine is N-phenylstearyl-1, 3-propylene diamine dichloride.

11. The composition of claim 10 wherein the aliphatic amine is octadecyl amine.

12. A process for inhibiting the corrosion of metal surfaces in contact with an aqueous system, comprising:

adding to the aqueous system the composition of claim 8.

13. A process for inhibiting corrosion in steam condensate system, comprising:

adding to the steam condensate system the composition of claim 8.

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ROBERT F. BURNETT, Primary Examiner

M. E. McCAMISH, Assistant Examiner

U.S. Cl. X.R.

21—2.7; 134—2, 41; 210—58, 59; 252—8.55 B, 8.55 E, 390