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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : C02F 5/08, 5/12, 5/10

A1

(11) International Publication Number: WO 92/19557

(43) International Publication Date: 12 November 1992 (12.11.92)

(21) International Application Number: PCT/GB92/00785

(22) International Filing Date: 29 April 1992 (29.04.92)

(30) Priority data:
9110066.9 9 May 1991 (09.05.91) GB
PCT/GB91/01372 12 August 1991 (12.08.91) WO
(34) Countries for which the regional or international application was filed: AT et al.

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(81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CI (OAPI patent), CM (OAPI patent), CS, DE, DE (European patent), DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), GN (OAPI patent), GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC (European patent), MG, ML (OAPI patent), MN, MR (OAPI patent), MW, NL, NL (European patent), NO, PL, RO, RU, SD, SE, SE (European patent), SN (OAPI patent), TD (OAPI patent), TG (OAPI patent), US.

Published
With international search report.

(54) Title: LIMESCALE REMOVER

(57) Abstract

Known compositions for removing limescasle do not remain in contact with the scale on non-horizontal surfaces for a sufficient time to be effective. The invention provides a limescale remover composition comprising an acid, a desolubiliser and a cationic surfactant. The cationic surfactant increases the viscosity so that the composition does not readily run off non-horizontal surfaces.

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LIMESCALE REMOVER

This invention relates to a composition for removing deposits of scale and the like.

Water hardness is a condition which results when rainwater percolates through rock formations such as limestone or chalk and dissolves inorganic salts, particularly calcium carbonate. Water which contains more than about 100 parts per million of calcium carbonate is usually considered as hard. When hard water evaporates the dissolved calcium carbonate is deposited on the adjacent surface in the form of tiny crystals. This is known as limescale. With time these limescale deposits can build up into quite a large size. Limescale is strongly bonded to the surfaces on which it is deposited and is difficult to remove. Well known examples of limescale deposits are the encrustations around the nozzles of taps, shower heads and around plugholes, the staining of the surfaces of baths, basins and sinks below the taps and the general dulling of the surfaces of such vessels that receive hard water. Limescale deposits can also occur when hard water is heated an example of this being the well known furring of kettles. Deposits can also be formed in washing machines and dishwashing machines.

Limescale removers have been developed in order to deal with these problems. These are generally based on

acid which will react with the deposited scale to form a salt which is more readily soluble in water than calcium carbonate and which can thus be washed away. There are two main types of limescale remover. One type includes a strong acid (e.g. hydrochloric acid, sulphamic acid) so that the pH of the limescale remover composition is about 1.0 or less. As a result of this low pH such compositions have a thin, watery consistency since stable thickening systems have not been previously achievable. Although this type of limescale remover is quite effective it is difficult if not impossible to maintain contact between the limescale remover composition and limescale when the surface being treated is inclined to the horizontal. The other type of limescale remover includes a weak acid, (e.g. citric acid, acetic acid) resulting in a composition having a pH usually in the range of from 3 to 5. With such mild pH conditions such compositions can be easily thickened. While these compositions may remain in contact with a non-horizontal surface to be treated for a longer time than the strong acid type of composition, they have a poor performance. Hence they must remain in contact with the surface being treated for a considerable time for example up to half an hour. Even quite viscous compositions cannot with certainty be expected to remain in contact for that length of time with non-horizontal surfaces, particularly vertical surfaces such as the sides of a bath or on a tap.

The present invention has been made in order to deal with this problem.

According to the invention there is provided a composition for effectively removing deposits of scale and the like from horizontal and inclined surfaces, said composition comprising an acid, a cationic surfactant and a desolubiliser.

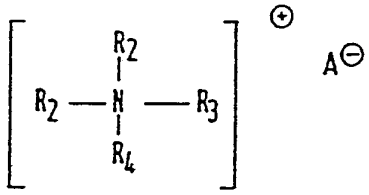
It has been discovered that the combination of cationic surfactant and desolubiliser acts as a thickener providing increased viscosity for example up to 800 cps (Brookfield RV3/25°). Compositions having a viscosity of this order will tend to "cling" to vertical and non-horizontal surfaces thus giving the necessary contact time for effective scale removal.

The acid used in the composition may be one which is used in conventional limescale removers, such as mineral acids, e.g. sulphamic acids, hydrochloric acids, phosphoric acid and organic acids, e.g. acetic acid, hydroxyacetic, citric acid, lactic acid.

The preferred cationic surfactants are (higher alkyl) quaternary ammonium compounds (where higher alkyl means alkyl groups having from 8 to 30 carbons preferably from 11 to 22 carbons). Particularly

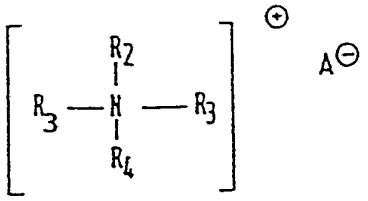
preferred quaternary ammonium compounds are the following:-

(i) acyclic quaternary ammonium salts having the formula:-



I

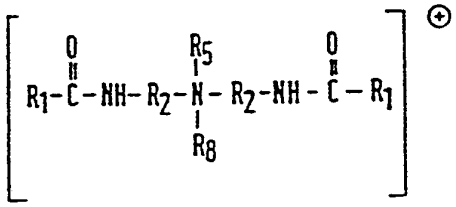
or



II

wherein R_2 is an acyclic aliphatic C_{15}-C_{22} hydrocarbon group. R_3 is a C_1-C_4 saturated alkyl or hydroxyalkyl group, R_4 is selected from R_2 and R_3 and A is an anion,

(ii) diamido quaternary ammonium salts having the formula:-

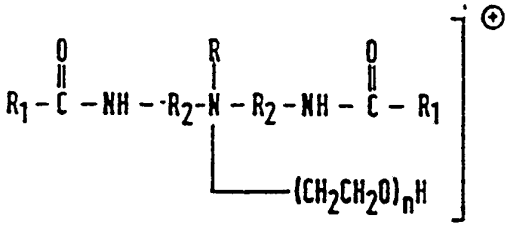


III

wherein R_1 is an acyclic aliphatic C_{15}-C_{21} hydrocarbon

group, R_2 is a divalent alkylene group having 1 to 3 carbon atoms, R_5 and R_8 are C_1-C_4 saturated alkyl or hydroxyalkyl groups and A is an anion,

(iii) diamido alkoxylated quaternary ammonium salts having the formula:-



IV

wherein n is equal to 1 to about 5, R_1, R_2, R_5 and A^- are as defined above;

(iv) quaternary imidazolinium compounds.

Examples of Component (i) include dialkyldimethylammonium salts such as ditallowdimethyl-ammonium chloride, ditallowdimethylammonium methylsulfate, di(hydrogenated tallow) dimethylammonium chloride, distearyldimethylammonium chloride, dibehendyldimethylammonium chloride.

Examples of component (ii) include methylbis(tallowamidoethyl) (2-hydroxyethyl) ammonium

methylsulfate and methylbis(hydrogenated tallowamidoethyl) (2-hydroxyethyl) ammonium methylsulfate and methylbis(hydrogenated tallowamidoethyl) (2-hydroxyethyl) ammonium methylsulfate wherein R_1 is an acyclic aliphatic C_{15}-C_{17} hydrocarbon group. R_2 is an ethylene group, R_5 is a methyl group, R_8 is a hydroxyalkyl group and A is a methylsulfate anion; these materials are available from Sherex Chemical Company under the trade names Varisoft (R) 222 and Varisoft (R) 110, respectively. A particularly preferred cationic surfactant is a compound of Formula II wherein R_2 is as defined above, R_3 is methyl and R_4 is also methyl.

Examples of (iv) include 1-methyl-1-tallowamido-ethyl-2-tallowimidazolinium methylsulfate and 1-methyl-1(hydrogenated tallowamidoethyl)-methylsulfate.

The quaternary ammonium salt (b) preferably comprises from 1% to 20%, more preferably 2% to 20% by weight of the composition herein.

The weight ratio amine (a): quaternary ammonium salt (b) is in the range from 10:1 to 1:10, preferably from 3:1 to 1:3.

The di(higher alkyl)imidazolinium compounds are preferred for use in the invention, in particular the 1-(lower alkyl)-1-(higher alkyl)amidoethyl-2-(higher alkyl) imidazolinium compounds, where "lower alkyl"

means alkyl having from 1 to 4 carbon atoms, and "higher alkyl" means alkyl having from 11 to 22 carbon atoms.

The preferred desolubilisers are for example sodium xylene sulphonate and sodium cumene sulphonate.

The amounts of cationic surfactant and desolubiliser used are chosen having regard to the desired viscosity of the composition. However, amounts in the range 50.0 to 1.0% and 0.0 to 50% (by volume) respectively are preferred.

The composition of the invention may include the usual additives such as perfume, colourant and the like.

The following Example further illustrates the invention:-

EXAMPLE

A limescale remover composition was formulated as follows:-

	% by volume
Sulphamic acid	12.5
Cationic surfactant ("Arquad" 18-50)	6.0
Sodium xylene sulphonate (SXS-40)	4.0
Perfume	0.5
Ink Blue R	0.002
Water	to 100.00

The composition had a viscosity of 200 cps (Brookfield, RV 3 @ 25°C) compared to the viscosity of 10 cps of a known composition having the same formulation as above, but without the cationic surfactant and sodium xylene sulphonate and including 3.0% of emulsifier.

CLAIMS

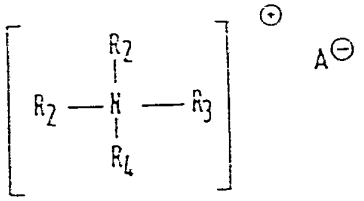
1. A composition for effectively removing deposits of scale and the like from horizontal and inclined surfaces, said composition comprising an acid, a cationic surfactant and a desolubiliser.

2. A composition as claimed in Claim 1, wherein the acid is a mineral acid such as sulphamic acid, phosphoric acid hydrochloric acid or an organic acid such as acetic acid, hydroxy acetic acid and citric acid.

3. A composition as claimed in Claim 1 or Claim 2, wherein the cationic surfactant is a quaternary ammonium compound.

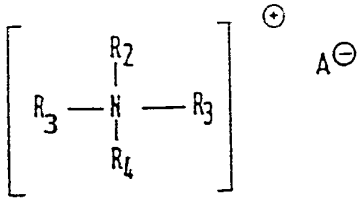
4. A composition as claimed in Claim 3, wherein the cationic surfactant is a (higher alkyl) quaternary ammonium compound where higher alkyl is an alkyl group having from 8 to 30 carbon atoms.

5. A composition as claimed in Claim 4, wherein the quaternary ammonium salt is an acyclic quaternary ammonium salt having the formula



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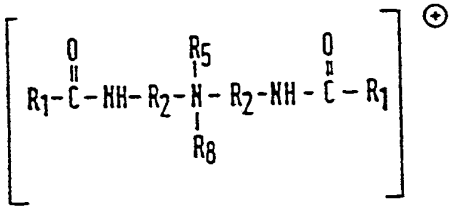
or



II

wherein R_2 is an acyclic aliphatic C_{15}-C_{22} hydrocarbon group. R_3 is a C_1-C_4 saturated alkyl or hydroxyalkyl group, R_4 is selected from R_2 and R_3, and A is an anion,

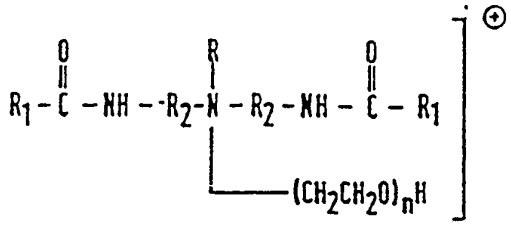
a diamido quaternary ammonium salt having the formula:



III

wherein R_1 is an acyclic aliphatic C_{15}-C_{21} hydrocarbon group. R_2 is a divalent alkylene group having 1 to 3 carbon atoms, R_5 and R_8 are C_1-C_4 saturated alkyl or hydroxyalkyl groups and is an anion

a diamido alkoxylated quaternary ammonium salt having the formula:



IV

wherein n is equal to 1 to about 5, and R_1, R_2, R_5 and A^- are as defined above; or a quaternary imidazolinium compound.

6. A composition as claimed in Claim 5 wherein the quaternary ammonium salt is a compound of Formula II and wherein R_3 and R_4 are methyl groups.

7. A composition as claimed in any preceding claim, wherein the desolubiliser is sodium xylene sulphonate or sodium cumene sulphonate.

8. A composition as claimed in any preceding claim wherein the cationic surfactant and the desolubiliser are present in the proportions of from 15.0 to 1.0% and 1.0 to 15.0% by volume respectively.

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 92/00785

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 C02F5/08; C02F5/12; C02F5/10

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	C02F

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No.[13]
A	EP,A,0 157 552 (CALGON CORPOR.) 9 October 1985 see page 11; claims 1-3	1-3
A	US,A,4 435 303 (KHODABANDEH,A.) 6 March 1984 see column 2, line 62 - column 3, line 10 see column 4, line 48 - line 54	1,2

° Special categories of cited documents : [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
28 JULY 1992	11. 08. 92
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	GONZALEZ ARIAS, M.L.

Form PCT/ISA/210 (second sheet) (January 1985)

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. GB 9200785 SA 58744

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A-0157552	09-10-85	US-A- 4536292	20-08-85
		AU-B- 575384	28-07-88
		AU-A- 4032085	03-10-85
		CA-A- 1233000	16-02-88
		JP-A- 60220197	02-11-85
US-A-4435303	06-03-84	None	