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(72) Schmitz, Karl-Heinz, DE
(72) Boewing, Walter G., DE
(72) Falter, Wolfgang, BE
(73) HENKEL KOMMANDITGESELLSCHAFT AUF AKTIEN, DE

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(54) **LUBRIFIANT ET SON UTILISATION**

(54) **LUBRICANT AND USE THEREOF**

(57) A lubricant is disclosed which is based on amines and optionally the usual diluents or auxiliary and additive substances, and contains at least one secondary and/or tertiary amine and/or salts of these amines, wherein the proportion of the amines to the total formulation is 1 to 100 % by weight. These lubricants are preferably used as chain lubricants in the food industry, particularly for automatic chain and belt lubricators.

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Abstract

Lubricant and it use

A lubricant is disclosed which is based on amines and optionally the usual diluents or auxiliary and additive substances, and contains at least one secondary and/or tertiary amine and/or salts of these amines, wherein the proportion of the amines to the total formulation is 1 to 100 % by weight. These lubricants are preferably used as chain lubricants in the food industry, particularly for automatic chain and belt lubricators.

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Lubricant and its use

The present invention relates to a lubricant which is based on amines and optionally the usual diluents or auxiliary and additive substances and contains at least one secondary and/or tertiary amine and/or salts of these amines.

The invention also relates to the use of this lubricant as a chain-lubricant in the food industry. The lubricants according to the invention are used here in particular for the lubrication, cleaning and disinfection of automatic chain and belt lubricators which are used in the filling of comestibles, preferably beverages, into glass and plastic bottles, jars, glasses, barrels, beverage containers (KEG), paper and cardboard containers and the like.

Flat-conveyor belts or other conveyor devices are generally used in the bottle cellars and barrel cellars of beverage factories and also during the filling of comestibles into containers, for conveying the corresponding vessels, and are lubricated and kept clean with suitable aqueous lubricant preparations by means of dip-lubricators or more recently also by means of automatic belt-lubrication systems.

While dip-lubricators cause hardly any problems with regard to application properties for the choice of lubricant, precipitations of poorly soluble salts and microbiological deposits in the jets and filters of the central lubrication equipment can considerably impair the continuous operation of the filling of comestibles, particularly beverages, into containers so that the machines must always be switched off and cleaned after a certain period of operation.

The chain-lubricants previously used as lubricants are based either on fatty acids in the form of their water-soluble alkali- or alkanolamine salts or on fatty amines in the form of their organic or inorganic salts.

While both classes of substances can be used without problem in splash-lubrication, they have a number of disadvantages when used in the central chain-lubrication systems usual today. German Offenlegungsschrift 23 13 330, for example, describes lubricants based on soaps, which contain aqueous mixtures of C_{16}-C_{18}-fatty acid salts and surface-active substances. Such soap-based lubricants have the following disadvantages:

1. They react with water-hardness, i.e. with the alkaline-earth ions and other substances contained in water, to form poorly soluble metallic soaps, the so-called primary alkaline-earth soaps.
2. A reaction takes place between these soap-based lubricants and the carbon dioxide dissolved in the water or in the substance to be bottled.
3. The application solution thus produced always encourages germs.
4. When hard water is used, ion-exchangers, an additional source of germs, are required or the use of products with high contents of complexing agents is necessary, which is also ecologically unsound.
5. There is increased foam formation which particularly causes problems at the "bottle inspector" (automatic bottle inspection device) and can lead to the penetration of this lubricant into the conveyed units.
6. Most of these products contain solvents.

7. The cleaning effect of these products is poor and a separate discontinuous cleaning process is therefore always required.
8. The performance of such soap-based lubricant preparations is pH-dependent.
9. Soap-based lubricant preparations are also water-temperature dependent.
10. Soap-based lubricants have only poor storage stability, particularly at lower temperatures.
11. The EDTA (ethylene diamine tetraacetate) contained in many products is known to be only poorly biodegradable.
12. Such soap-based lubricant preparations are not suitable for all the plastic goods that are conveyed, because when these substances are used environmental stress-cracking results in many cases on the goods conveyed.

Other than these soap-based lubricants, mainly only lubricants based on primary fatty amines are used. For example, German Offenlegungsschrift 36 31 953 describes a process for lubricating chain-form bottle conveyor belts in beverage-bottling factories, particularly in breweries, and also for cleaning the belts by means of a liquid cleaning agent, which is characterized in that the chain-form bottle conveyor belts are lubricated with belt-lubricants based on neutralized primary fatty amines, which preferably have 12 to 18 carbon atoms and contain an unsaturated part of more than 10 %, the bottle conveyor belts are cleaned with cationic cleaning agents, namely quaternary ammonium compounds such as alkyltrimethylammonium chlorides, dialkyldimethylammonium chlorides and alkyldimethylbenzylammonium chlorides or organic acids.

The main disadvantages of this process are:

1. The reaction with anions of water, particularly with sulfates, bicarbonates, phosphates and carbonates from alkaline water, and also with other water contents.
2. A vigorous reaction with carbonic acid dissolved in water to form poorly soluble ammonium carbonates, for example, in the case of drinks containing carbonic acid.
3. Solubilizers must be used.
4. The cleaning of the spray and distribution system is necessary at regular intervals; otherwise the entire system blocks and thus becomes unusable.
5. Continuous 24-hour operation is not possible with lubricants based on primary fatty amines.
6. The use of corrosion-promoting and corrosive acids for cleaning the system leads to corrosion damage to the components of the spray system, some of which consist only of chromium steels or non-ferrous metals.
7. A high expenditure on equipment is always required for the regular cleaning of the spray and distribution system.
8. When these primary fatty amines are used as lubricants, plants can only be operated with a small degree of flexibility, and in many cases this process cannot be used because existing plants often have pre-mix containers.
9. The use of primary fatty amines and the two process stages required here - first lubrication, then cleaning - require a high investment in equipment.
10. Finally, the use of the primary amines and the lower alkyl acids, such as acetic acid, which are necessary for the cleaning stage, also results in an odor which is a considerable nuisance.

The main disadvantages of the aforementioned processes are therefore the high water-dependence of the soap-based lubricants and the system-cleaning regularly required when lubricants based on primary amines are used. The precipitations, which form in both processes of the prior art, must be removed. A simple acid-alkali reaction is used for this removal. In the case of the soap products based on fatty acids, alkaline cleaning agents containing complexing agents are used for this purpose, and as the industrial equivalents, organic or inorganic acids are used as cleaning agents when products based on primary fatty amines are used.

Finally, other chain lubricants are known in the prior art which do not have the disadvantages described above. For example, the European Patent Specification 0,044,458 describes lubricant preparations which are practically free of fatty acid soaps and which furthermore contain a carboxylated non-ionic surfactant and an acyl sarcosinate. The pH value of these products is from 7 to 11 and is therefore preferably in the neutral to alkaline range.

German Patent Application P 38 31 448.7 (unpublished) relates, finally, to aqueous, clear-water soluble, soap-free lubricant preparations, a process for their preparation and the use of the lubricant preparations of the invention, in particular as lubricants for the transport of glass bottles or polyethylene terephthalate bottles. The essentially neutral aqueous lubricant preparations (pH in the range of 6 to 8) contain alkylbenzene sulfonates, alkoxylated alkanol phosphates and alkane carboxylic acids, possibly together with the usual solubilizers, solvents, defoaming agents and disinfectants.

However, even these two products described above have the following three disadvantages:

1. They are microbiologically unfavorable because they create excellent growth conditions for micro-organisms.
2. In addition, they have only a low cleaning power.
3. Finally, their foaming behavior is difficult to control.

The present invention makes available a new lubricant preparation, particularly a chain lubricant, which contain at least one secondary and/or tertiary amine and/or salts of these amines, which does not have or at least lessens the disadvantages of the prior art, i.e. such lubricants have a good coefficient of friction, and thus an excellent lubricating effect, a low foaming behavior, a good cleaning effect and a good microbicidal effect.

Surprisingly, the lubricants according to the invention do not have the disadvantages which are associated with lubricants based on primary fatty amines. This is all the more unexpected because secondary and tertiary amines usually exhibit only gradual differences in comparison with the properties of primary amines.

The present invention consequently relates to a lubricant based on amines and optionally the usual diluents or auxiliary and additive substances, characterized in that it contains at least one secondary and/or tertiary amine and/or a salt of these amines, whereby the

proportion of the amines to the total formulation is 1 to 100 % by weight.

These lubricants are either clearly soluble or opalescent in aqueous solution.

As regards their application properties, the lubricants according to the invention have a good coefficient of friction, low foaming behavior, a good cleaning effect as well as good microbicidal properties.

According to an embodiment of the present invention the lubricant contains at least one secondary amine of the general formula (Ia) or (Ib)

$$R\text{-}NH\text{-}R^1 \qquad (Ia)$$

$$R\text{-}N^+H_2\text{-}R^1\ X^- \qquad (Ib)$$

wherein the radicals R and R^1, each independently of the other, represent:

- a substituted or unsubstituted, linear or branched, saturated or mono- or polyunsaturated alkyl radical with 6 to 22 carbon atoms, which can have as substituents at least one amine, imine, hydroxy, halogen and/or carboxy radical,
- a substituted or unsubstituted phenyl radical, which can have as substituents at least one amine, imine, hydroxy, halogen, carboxy radical and/or a linear or branched, saturated or mono- or polyunsaturated alkyl radical with 6 to 22 carbon atoms,

and X^- represents an anion from the group comprised of amidosulphonate,

nitrate, halide, sulfate, hydrogencarbonate, carbonate, phosphate or

R^2-COO$^-$

wherein the radical R^2 represents

- hydrogen,
- a substituted or unsubstituted, linear or branched alkyl radical with 1 to 20 carbon atoms or an alkenyl radical with 2 to 20 carbon atoms, which can have as substituents at least one hydroxy, amine or imine radical, or
- a substituted or unsubstituted phenyl radical, which can have as substituent an alkyl radical with 1 to 20 carbon atoms.

In the general formulae (Ia) and (Ib) given above the following radicals are thus possible as the substituents R and R^1:

n-hexyl, n-heptyl, n-octyl, n-nonyl, n-decyl, n-undecyl, n-dodecyl, n-tridecyl, n-tetradecyl, n-pentadecyl, n-hexadecyl, n-heptadecyl, n-octadecyl, n-nonadecyl, n-eicosyl, n-uneicosyl and n-docosyl and also the branched-chain isomers of the alkyl radicals mentioned. Instead of the saturated alkyl radicals, R and R^1 can also represent the corresponding (mono- or poly-)unsaturated alkyl radicals, which can equally be linear or branched. The radicals listed above can also be substituted, with one or more amine, imine, hydroxy, halogen or carboxy groups possible as substituents. Furthermore, the radicals R and R^1 can also represent phenyl radicals, which can likewise be substituted with one or more amine, imine, hydroxy, halogen or carboxy groups. Alkyl phenyl radicals can also be considered for R and R^1, where the alkyl radical can contain 6 to 22 carbon atoms and can equally be linear or branched, saturated or mono- or polyunsaturated. Chlorine and bromine are preferred in all cases as the halogen substituents.

The following are examples of secondary amines of the type of general formula (Ia), which are preferred in the framework of the present invention: di-cocconut oil fatty alkyl amine, distearyl amine and di-tallow fatty alkyl amine.

As anion X^-, in addition to the inorganic anions already listed, anions of organic acids of the type R^2-COO^- can also be used. The radical R^2 can also represent hydrogen and lower alkyl or alkenyl radicals here; other than this the above explanations for R and R^1 apply in an analogous manner.

Examples of organic anions X^- of the type R^2-COO^- are: formiate, acetate, oleate, glycolate, lactate, gluconate, benzoate and salicylate.

The compounds listed above of the type of general formula (Ia) in the form of their salts with the aforementioned organic anions can be considered as examples of secondary amines of the type of general formula (Ib) which are also preferred in the present invention.

According to a further embodiment of the present invention the lubricant contains at least one secondary diamine of the general formulae (IIa), (IIb) or (IIc)

$$R\text{-}NH\text{-}(CH_2)_3NH_2 \qquad \text{(IIa)}$$

$$R\text{-}NH\text{-}(CH_2)_3N^+H_3\ X^- \qquad \text{(IIb)}$$

$$R\text{-}N^{+}H_2\text{-}(CH_2)_3\text{-}N^{+}H_3\ 2X^{-} \quad \text{(IIc)}$$

wherein the radicals R and X^- each have the meanings given above for the general formulae (Ia) and (Ib).

Examples of secondary diamines of the type with the general formulae (IIa), (IIb) and (IIc), which are preferred in the framework of the present invention, are: N-lauryl-propylene diamine and N-tallow-fatty alkyl-propylene diamine, each in the form of the free amines and also in the form of the acetate salts.

According to a third embodiment of the present invention, the lubricant contains at least one tertiary amine of the general formula (IIIa) or (IIIb)

$$R\text{-}NR^3R^4 \quad \text{(IIIa)}$$

$$R\text{-}N^{+}HR^3R^4\ X^{-} \quad \text{(IIIb)}$$

wherein the radicals R and X^- each have the meanings given for the general formulae (Ia) and (Ib) and the radicals R^3 and R^4, each independently of the other, represent:

- a substituted or unsubstituted, linear or branched alkyl radical with 1 to 20 carbon atoms or an alkenyl radical with 2 to 20 carbon atoms, which can have as substituents at least one hydroxy, amine, or imine radical, or
- a substituted or unsubstituted phenyl radical, which can have as substituent an alkyl radical with 1 to 20 carbon atoms.

The previous explanations in connection with the radicals R and R^1 logically also apply to the radicals R^3 and R^4.

Examples of tertiary amines of the type of the general formulae (IIIa) and (IIIb), which are preferred in the framework of the present invention, are: N,N-dipropyl-N-laurylamine and the corresponding acetate salt.

In this third embodiment it is further preferred that the lubricant contains at least one tertiary amine of the general formula (IVa) or (IVb)

$$R\text{-}N(CH_3)_2 \qquad \text{(IVa)}$$

$$R\text{-}N^+H(CH_3)_2\ X^- \qquad \text{(IVb)}$$

wherein the radicals R and X^- each have the meanings given for the general formulae (Ia) and (Ib).

Examples of tertiary amines of the type of the general formulae (IVa) and (IVb), which are also preferred in the invention, are: N,N-dimethyl-N-laurylamine, N,N-dimethyl-N-hexadecylamine, N,N-dimethyl-N-coconut-oil-fatty-alkyl-amine, N,N-dimethyl-N-cetyl-amine and also the corresponding acetate salts.

Secondary and tertiary amines, which correspond to the general formulae given above, can be produced according to processes known in the literature and some are also available as commercial products, for example, from Hoechst AG, Frankfurt am Main, Germany, under the name

GENAMIN^R or from the Lonza Co., Basle, Switzerland, under the name LONZABAC^R 12.

According to a preferred embodiment of the present invention the lubricants contain secondary and/or tertiary amines of the general formulae (Ia) to (IVb) given above, wherein the radicals R, R^1, R^2, R^3, R^4 and X^- have the following meanings:

- R and R^1 represent, each independently of the other, a linear or branched, saturated or mono- or polyunsaturated alkyl radical with 12 to 18 carbon atoms,
- R^3 and R^4 represent, each independently of the other, a linear or branched alkyl radical with 1 to 6 carbon atoms or an alkenyl radical with 2 to 6 carbon atoms,
- X^- represents the radical R^2-COO^-, wherein R^2 means hydrogen, CH_3-, HO-CH_2- or CH_3-CH(OH)-.

According to the invention lubricants are further preferred which contain

5 to 40 % by weight, particularly 10 to 20 % by weight, of secondary and/or tertiary amines and/or salts of these amines and also

95- to 60 % by weight, particularly 90 to 80 % by weight, of water as a diluent and optionally auxiliary or additive substances,

each percentage referred to the total formulation.

Solubilizers can be considered as auxiliary and/or additive substances in the present invention, for example, alcohols, polyalcohols, ethers or polyethers, particularly isopropanol, butylglycol, butyldiglycol or ethyleneglycolether. The amount of solubilizer to be used depends on the amine used in each individual case, the expert will determine the

required amount of solubilizer in the individual case by trial and error. In general, it is sufficient to add from 5 to 20 % by weight of solubilizers, referred to the total formulation.

As auxiliary and/or additive substances in the present invention, nonionic and/or anionic surfactants also come particularly into consideration, for example, alkoxylated fatty amines, fatty alcohols, alkoxylated fatty alcohols and alkylbenzene sulfonates soluble in hydrophilic solvents. These surfactants can improve the wetting of the chains and flat-conveyor belts, provided this is necessary in the individual case. In general, additions of surfactants from 5 to 10 % by weight, referred to the total formulation are sufficient for this.

The lubricants according to the invention preferably have a pH value from 4 to 11, particularly from 5 to 8. If the pH value of the lubricant is not already in this range, then it can be adjusted to the desired value by adding an acid, preferably an acid with the anion X^- defined above, e.g. with acetic acid or formic acid.

According to the invention it is further preferred that the lubricants have a dynamic viscosity of less than 300 mPa.s, particularly of less than 150 mPa.s and particularly preferred from 20 to 100 mPa.s - each at 20°C. A specific adjustment of the viscosity to the values mentioned is generally not necessary, or may take place by the addition of suitable amounts of the diluent, water, or a solubilizer.

The lubricants according to the invention can be produced by simply mixing the amine components, possibly with the addition of water and the auxiliary or additive substances mentioned.

According to a particularly preferred embodiment of the present invention, the lubricants contain:

a) 2 to 10 % by weight of a secondary amine of the general formulae (IIb) and/or (IIc),

b) 2 to 10 % by weight of a tertiary amine of the general formulae (IIIb) and/or (IVb),

c) remainder: water and possibly auxiliary or additive substances,

wherein the components a and b are in a weight ratio of a to b of 1 : 2 to 3 : 1, preferably 2 : 1. Such a combination has proved to be particularly effective with regard to the lubricating effect and foam inhibition. For an example of such a combination refer to Example 8 below.

The present invention relates finally to the use of lubricants of the aforementioned type as chain lubricants in the food industry, particularly for automatic chain and belt lubricators. In particular the present invention relates to the use of the lubricants described above in the form of a 5 to 40 % by weight, preferably 10 to 20 % by weight, aqueous solution as a chain lubricant for automatic chain and belt lubricators.

In addition, the lubricants according to the invention can, however, also be used advantageously as so-called cutting oils or cooling lubricants in metal-working.

The products according to the invention, unlike standard soap products, cause no environmental stress cracking and can therefore be used without problem for PET and PC casks. (PET = polyethylene

terephthalate, PC = polycarbonate). PH values < 8.5 are particularly preferred for clear-water soluble concentrates.

When used on conveyor belts in the food industry, this product and process have an additional advantage. If a cleaning agent based on organic or inorganic acids is substituted for the lubricant at the end of production and the conveyors, i.e. chains or belts, are allowed to run distributing the acid, then a creamy foam forms on the belts and in places which are otherwise difficult to access. After an adequate exposure time, the foam can be rinsed away with water using the same system. This automatic process eliminates the need for "foaming" and rinsing with low-pressure, medium-pressure and high-pressure equipment which otherwise is frequently carried out regularly by hand.

Examples

The present invention is explained in more detail by the following examples. Examples 1 to 4 and 8 to 17 according to the invention illustrate the friction resistance and the foaming behavior of the lubricant formulations according to the invention. Examples 5 to 7 show the effective microbicidal action of the lubricant formulations according to the invention. Comparative Examples 1 to 6, which relate to products from the state of the art, serve for comparison purposes.

All percentages in the following formulation examples refer to percentages by weight.

The tests to measure the friction resistance, termed "coefficient of friction" in the following, were carried out on a pilot-plant bottle

conveyor belt under the following conditions:

Measurement of the friction resistance of twenty 0.5-litre Euro-beer-bottles filled with water as tensile stress with a dynamometer.

Bottle-conveyance rate: approx. 1 m/sec.

Spraying of bottle conveyor belt with 0.3 % solution of belt-lubricant.

Cycle times: 20 sec. spraying/20 sec. pause.

Spray output of jets: 5 l/hr.

The coefficient of friction "μ" in the following results from the ratio of the measured tensile stress for one bottle to the weight of the bottle in grams.

Furthermore, the products are tested with hard water (16 °d) according to the provisions of DIN 53 902.

The foaming behavior is judged according to the following categories:

0 = no foam

1 = isolated foam bubbles

2 = little foam, not troublesome

3 = foam, troublesome

4 = heavy foam, not acceptable, foam under the belt

Example 1:

15 % lauryl-propylene-diamine

85 % water

Coefficient of friction: μ = 0.11, foaming behavior = 1-2

Example 2:

15 % lauryl-propylene-diammonium-acetate

85 % water

Coefficient of friction: μ = 0.11, foaming behavior = 1-2

Example 3:

15 % N,N-dipropyl-N-laurylamine

85 % water

Coefficient of friction: μ = 0.13, foaming behavior = 2

Example 4:

15 % N,N-dipropyl-N-lauryl-ammonium-acetate

85 % water

Coefficient of friction: μ = 0.13, foaming behavior = 1-2

Comparative Example 1:

(Soap product according to German Offenlegungsschrift 23 13 330)

14 % fatty acid with a chain distribution of 18 % C 14-18, 25 % C-18',
48 % C-18", 7 % C-18"' and 2 % C-20$^+$

4 % KOH

12 % triethanol amine

15 % dodecylbenzosulfonate-triethanolamine salt

3 % ethylene-diamine-30EO-60PO

1 % oleyl-cetyl alcohol

3 % monoethanol amine

2 % ethylene diamine tetraacetate (EDTA)

5 % iso-propanol

41 % water

Coefficient of friction: μ = 0.11, foaming behavior = 4

Comparative Example 2:

(Fatty amine product according to German Offenlegungsschrift 36 31 953)

18 % acetic acid

50 % coconut amine

11 % triethanol amine

5 % nonylphenol-10-EO

16 % water

Coefficient of friction: μ = 0.09, foaming behavior = 0

Comparative Example 3:

(Soap-free products, according to German Patent Application P 38 31 448.7)

12 % $C_{12/18}$-fatty alcohol-10-EO-phosphate

9 % dodecyl sulfonate

10 % urea

10 % iso-propanol

59 % water

Coefficient of friction: μ = 0.10, foaming behavior = 2

For the above Comparative Examples: EO = ethylene oxide, PO = propylene oxide.

The cleaning effect of the products on the belts can be visually judged

as good in Examples 1, 2, 3 and 4, but inadequate in Comparative Examples 1 and 3.

All the proposed lubricants are suitable for commercial use since the coefficient of friction is $\mu < 0.15$.

Disinfectant effect:

The lubricants according to the invention have an extremely good microbicidal effect, as shown by the suspension tests carried out according to DVG (Deutsche Veterinaermedizinische Gesellschaft):

Example 5:

Lauryl-propylene-diamine (15 % by weight in water), as in Example 1

Test strains	germ count	Destruction times in minutes at 20°C Concentration in %:			
		0.07	0.33	0.66	1.67
Staphylococcus aureus K 3212	$4x10^8$	5	5	5	5
Streptococcus faecium K 3343	$5x10^8$	5	5	5	5
Proteus mirabilis K 2910	$5x10^8$	5	5	5	5
Pseudomonas K1111	$1x10^9$	15	5	5	5
Escherichia Coli K 2114	$6x10^8$	15	5	5	5
Candida albicans K 6710	$1x10^8$	15	5	5	5

Example 6:

Lauryl-propylene-diammonium-acetate (15 % by weight in water), according to Example 2

Test strains	germ count	Destruction times in minutes at 20°C Concentration in %: 0.07	0.33	0.66	1.67
Staphylococcus aureus K 3212	$9x10^8$	5	5	5	5
Streptococcus faecium K 3343	$6x10^8$	5	5	5	5
Proteus mirabilis K 2910	$1x10^9$	5	5	5	5
Pseudomonas K 1111	$8x10^8$	5	5	5	5
Escherichia Coli K 2114	$4x10^8$	5	5	5	5
Candida albicans K 6710	$3x10^8$	5	5	5	5

Example 7:

N,N-dipropyl-N-laurylamine (15 % by weight in water), according to Example 3

Qualitative DGHM-test (Deutsche Gesellschaft fuer Hygiene und Mikrobiologie) 20°C

Test germ	Germ density	Concentration			
		0.33	0.066	0.033	0.0066
		Time:			
		5'15'30'60'	5'15'30'60'	5'15'30'60'	5'15'30'60'
Pseudom.					
K 1111	$3x10^9$	- - - -	- - - -	- - - -	+ + + +
Esch.C.					
K2114	$2x10^9$	- - - -	- - - -	+ + + -	+ + + +
Staph.					
aur.	$2.5x10^9$	- - - -	+ + - -	+ + + +	+ + + +
Prot.					
mir.	$1x10^9$	- - - -	- - - -	+ + + +	+ + + +
Cand.					
alb.	$1x10^7$	- - - -	- - - -	- - - -	+ + + -

Comparative Example 4:

(For composition see Comparative Example 1)

Test strains	germ count	Destruction times in minutes at 20°C Concentration: 0.33 %
Pseudomonas K 1111	$3x10^8$	> 60
Escherichia Coli K 2114	$2x10^8$	> 60
Klebsiella aerogenes K 2530	$5x10^8$	> 60
Lactobacillus brevis K 4111	$4x10^8$	> 60
Saccharomyces cerev. K 5011	$3x10^7$	> 60
Hansenula anomala K 5411	$5x10^7$	> 60
Aspergillus niger K 7441	$9x10^6$	> 60

Comparative Example 5:

(For composition see Comparative Example 2)

Suspension test according to DLG (Deutsche Lebensmittel-Gesellschaft) at 20°C

Test strains	Germ count	Destruction times in minutes at 20°C Concentration: 0.3 %
Pseudomonas K 1111	$3x10^8$	1
Escherichia Coli K 2114	$2x10^8$	1
Klebsiella aerogenes K 2530	$5x10^8$	1
Lactobacillus brevis K 4111	$4x10^8$	1
Saccharomyces cerev. K 5011	$3x10^7$	2.5
Hansenula anomala K 5411	$5x10^7$	10
Aspergillus niger K 7441	$9x10^6$	20

Comparative Example 6:

(For composition see Comparative Example 3)

Test strains	germ count	Destruction times in minutes at 20°C Concentration: 0.3 %
Pseudomonas K 1111	$3x10^8$	> 60
Escherichia Coli K 2114	$2x10^8$	> 60
Klebsiella aerogenes K 2530	$5x10^8$	> 60
Lactobacillus brevis K 4111	$4x10^8$	> 60
Saccharomyces cerev. K 5011	$3x10^7$	> 60
Hansenula anomala K 5411	$5x10^7$	> 60
Aspergillus niger K 7441	$9x10^6$	> 60

These values show that the lubricant according to the invention can combine the advantages of the soap-free lubricants (water-quality-independent) with those of the lubricants based on primary amines (cleaning and disinfection). The disadvantages, particularly the regular removal of precipitates, can be prevented with these lubricants of the invention.

Example 8:

10 % Lauryl-propylene-diammonium-acetate
5 % N,N-dimethyl-N-cetylammonium-acetate
85 % water

Coefficient of friction: μ = 0.09, foaming behavior = 0

Example 9:

8 % Lauryl-propylene-diammonium-acetate

4 % N,N-dipropyl-N-lauryl-ammonium-acetate

88 % water

Coefficient of friction: μ = 0.12, foaming behavior = 2 - 3

Example 10:

8 % Lauryl-propylene-diammonium-acetate

4 % N,N-dimethyl-N-lauryl-ammonium-acetate

88 % water

Coefficient of friction: μ = 0.10, foaming behavior = 0 - 1

Example 11:

8 % Lauryl-propylene-diammonium-acetate

4 % N,N-dimethyl-N-cocoonut-oil-fatty-ammonium-acetate

88 % water

Coefficient of friction: μ = 0.11, foaming behavior = 1

Example 12:

8 % Lauryl-propylene-diammonium-acetate

4 % N,N-dimethyl-N-hexadecyl-ammonium-acetate

88 % water

Coefficient of friction: $\mu = 0.11$, foaming behavior = 0

Example 13:

8 % Lauryl-propylene-diammonium-acetate

4 % Tallow-fatty-propylene-diammonium-acetate

88 % water

Coefficient of friction: $\mu = 0.11$, foaming behavior = 2

Example 14:

8 % N,N-dipropyl-N-lauryl-ammonium-acetate

4 % N,N-dimethyl-N-lauryl-ammonium-acetate

88 % water

Coefficient of friction: $\mu = 0.12$, foaming behavior = 1 - 2

Example 15:

8 % N,N-dipropyl-N-lauryl-ammonium-acetate

4 % N,N-dimethyl-N-cocoonut-oil-fatty-ammonium-acetate

88 % water

Coefficient of friction: $\mu = 0.12$, foaming behavior = 1 - 2

Example 16:

8 % N,N-dipropyl-N-lauryl-ammonium-acetate

4 % N,N-dimethyl-N-hexadecyl-ammonium-acetate

88 % water

Coefficient of friction: μ = 0.12, foaming behavior = 1

Example 17:

8 % N,N-dipropyl-N-lauryl-ammonium-acetate

4 % tallow-fatty-propylene-diammonium-acetate

88 % water

Coefficient of friction: μ = 0.11, foaming behavior = 2

CLAIMS:

1. The use of secondary or tertiary amines or salts thereof or a combination of said amines or salts thereof corresponding to general formulae (Ia), (Ib), (IIa), (IIb), (IIc), (IIIa) and (IIIb):

$R-NH-R^1$ (Ia)

$R-N^+H_2-R^1\ X^-$ (Ib)

$R-NH-(CH_2)_3NH_2$ (IIa)

$R-NH-(CH_2)_3N^+H_3\ X^-$ (IIb)

$R-N^+H_2-(CH_2)_3-N^+H_3\ 2X^-$ (IIc)

$R-NR^3R^4$ (IIIa)

$R-N^+HR^3R^4\ X^-$ (IIIb)

wherein R and R^1, independently of one another, represent:

(i) a substituted or unsubstituted, linear or branched, saturated or mono- or polyunsaturated C_{6-22} alkyl radical, wherein the substituent is selected from the group consisting of at least one amine group, imine group, hydroxy group, halogen atom, carboxy group and a combination thereof; or

(ii) a substituted or unsubstituted phenyl radical, wherein the substituent is selected from the group consisting of at least one amine group, imine group, hydroxy group, halogen atom, carboxy group and a linear or branched, saturated or mono- or polyunsaturated C_{6-22} alkyl radical;

wherein X represents an anion selected from the group consisting of amidosulfonate, nitrate, halide, sulfate, hydrogen carbonate, carbonate, phosphate and R^2-COO-, wherein R^2 represents:

(iii) H;

(iv) a substituted or unsubstituted, linear or branched C_{1-20} alkyl radical or C_{2-20} alkenyl radical, wherein the substituent is selected from the group consisting of at least one hydroxy, amine and imine group; or

(v) a C_{1-20} alkyl substituted or unsubstituted phenyl group; and

wherein R^3 and R^4, independently of one another, represent:

(vi) a substituted or unsubstituted, linear or branched C_{1-20} alkyl radical or C_{2-20} alkenyl radical, wherein the substituent is selected from the group consisting of at least one hydroxy, amine and imine group; or

(vii) a C_{1-20} alkyl substituted or unsubstituted phenyl radical;

in quantities of 1 to 100% by weight, optionally together with typical diluents or auxiliaries or additives, as chain lubricants for automatic chain and belt lubrication systems in the food industry which are used for the transport of plastic containers of polyethylene terephthalate or polycarbonate.

2. The use claimed in Claim 1, wherein:
R and R^1, independently of one another, represent a linear or branched, saturated or mono- or polyunsaturated C_{12-18} alkyl radical;
R^3 and R^4, independently of one another, represent a linear or branched C_{1-6} alkyl radical or C_{2-6} alkenyl radical; and
X represents the group R^2-COO-, wherein R^2 is H, CH_3-, HO-CH_2- or CH_3-CH(OH)-.

3. The use claimed in Claim 1 or 2, wherein at least one tertiary amine corresponding to general formula (IVa) or (IVb):

$R-N(CH_3)_2$ (IVa)

$R-N^+H(CH_3)_2\ X^-$ (IVb)

wherein R and X are as defined in claim 1 or 2, is used as the tertiary amine.

4. The use claimed in Claim 1, 2 or 3, wherein a formulation containing 5 to 40% by weight of amines and 95 to 60% by weight of water, auxiliaries, additives or combinations thereof based on the formulation as a whole, is used.

5. The use claimed in Claim 4, wherein the formulation contains 10 to 20% by weight of amines and 90 to 80% by weight of water, auxiliaries, additives or combinations thereof.

6. The use claimed in Claim 4 or 5, wherein a solubilizer is used as the auxiliary or additive.

7. The use claimed in Claim 4 or 5, wherein a nonionic surfactant, an anionic surfactant or a combination thereof is used as the auxiliary or additive.

8. The use claimed in any one of Claims 1 to 7, wherein a formulation with a pH value of 4 to 11 is used.

9. The use claimed in Claim 8, wherein the pH is 5 to 8.

10. The use claimed in any one of Claims 1 to 9, wherein a formulation with a dynamic viscosity of less than 300 mPa.s is used.

11. The use claimed in claim 10, wherein the dynamic viscosity is in the range from 20 to 100 mPa.s.

12. The use claimed in any one of claims 1 to 11, wherein a formulation containing:

a) 2 to 10% by weight of a secondary amine corresponding to general formulae (IIb), (IIc) or a combination thereof;

b) 2 to 10% by weight of a tertiary amine corresponding to general formulae (IIIb), (IVb) or a combination thereof; and

c) remainder: water and optionally auxiliaries and additives;

wherein components a) and b) are present in a ratio by weight of a) to b) of 1:2 to 3:1 is used.

13. The use claimed in Claim 12, wherein the ratio of a) to b) is 2:1.