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Patent- und Rechtsanwälte

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(54) **Lubricant composition**

(57) The invention refers to lubricant compositions, said lubricant compositions being particularly preferred for conveyor systems, especially in the foodstuff industry, which are suitable for lubricating, cleaning and disinfecting of the transport chains. More specifically, the invention refers to lubricant compositions for conveyor systems comprising

- a) one or more phosphoric acid esters, and
- b) one or more ether carboxylates, and
- e) water, and
- c) one or more C₆-C₂₂ fatty acids, optionally ethoxylated

with 1 to 20 moles of ethylene oxide, and/or

d) one or more C₆-C₂₂ fatty alcohols, optionally ethoxylated with 1 to 20 moles of ethylene oxide wherein the weight ratio of component (a) to component (b) is in the range of 9:1 to 1:3.

Said lubricant compositions can be used in conveyor systems for glass and/or plastic bottles, such as polyethylen terephthalate (PET) or polycarbonate (PC); cans, glass containers, drums, cardboard containers and similar items.

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Description**Technical field**

[0001] The present invention refers to lubricant compositions, said lubricant compositions being particularly preferred for conveyor systems, especially in the foodstuff industry, which are suitable for lubricating, cleaning and disinfecting of the transport chains. More specifically, the invention refers to the use of these compositions as lubricants, particularly in conveyor systems for glass and/or plastic bottles, such as polyethylen terephthalate (PET) or polycarbonate (PC); cans, glass containers, drums, cardboard containers and similar items.

Prior Art

[0002] Usually, in bottle and barrel plants of drinks' manufacturers and in food packaging, articulated plate conveyor belts or other transport systems are used. Said systems are maintained lubricated to reduce the mechanical strength of the bottles and containers, and cleaned to remove dirt and to avoid contamination by micro-organisms, with the aid of appropriate aqueous lubricating agents, preferentially applied with automatic lubrication systems for conveyor belts or other transport systems, equipped with a sprayer system.

[0003] Normally, for this purpose soap-based lubricants (based on inorganic or organic alkaline salts of a fatty acid or a mixture of fatty acids that contain a minimum of 8 carbon atoms) have been used.

[0004] However, soap-based lubricants present several disadvantages:

- To complex the water hardness the lubricants must contain the corresponding amounts of ethylenediaminetetraacetic or nitylotriacetic acid. This prevents the formation of calcium salts that can block the nozzle of the lubrication system.
- For harder waters, larger amounts of complexing agent are required in the lubricant compositions, making it necessary to reduce the soap contents in the finished product. However, this reduces the lubricant effect of the preparation.
- Soap-based lubricant compositions have a relatively intense foam production since it is very difficult to defoam soaps that have already formed. The excess foam produced by the lubricant is lost when lubricating the conveyor belts and can penetrate the goods transported.

On the other hand, foam production on conveyor belts hinders the automatic control of these recipients.

- The use of softened water to prevent calcium soap foam formation in products with no complexing agent or with only a reduced amount increases the cost of using these products.
- The compound ethylenediaminetetraacetic acid (EDTA) is not readily biodegradable in standard biodegradability tests (ASTM or OECD criteria for ready or inherent biodegradability)

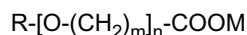
[0005] Because of these drawbacks, soap-based lubricants have been increasingly replaced by

- lubricants based on fatty amines and/or diamines, or
- lubricants based on phosphoric esters.

[0006] Furthermore, alkyl ether carboxylic acids or carboxylates have also been used in lubricant compositions for conveyor systems either alone or in combination with other chemicals.

[0007] For example, EP-A-0044458 describes mainly soap free lubricants adapted for use as conveyor belt lubricants that consist of:

- a) a non ionic carboxylate compound of general formula

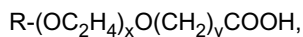


wherein R is a saturated or unsaturated alkyl group, $m=2-3$, $n=3-7$ and M is H, an alkaline metal or an alkanol amine cation,

b) an acylsarcosinate of general formula $RCON(CH_3)CH_2COOM$ wherein R is an alkyl or alkenyl group $C_{11}-C_{19}$, and M is H, an alkaline metal or alkanol amine cation, and

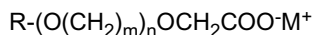
c) water, and optionally a conventional non-ionic surfactant that presents a HLB value between 10 and 12 to improve the detergency.

[0008] DE-A-4244536 describes lubricant compositions for bottle conveyor belts that contain an N-alkyldiamine, its salt obtained with an organic acid and, optionally, an organic acid and an ether carboxylate of formula



wherein R is an C₁₀-C₂₀ alkyl group (preferably C₁₆-C₁₈) x=1-20 (preferably 5-15) and finally y=0-5 (preferably 1).

[0009] DE-A-19642598 describes a lubricant concentrate for conveyor belt installations in the food industry, based on amines comprised by: i) one or more amines, ii) one or more ether carboxylates, iii) one or more polyethyleneglycols and iv) up to 99% in weight of the usual additives and adjuvants. The ether carboxylates described are compounds of general formula

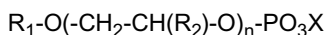


wherein

R is a saturated alkyl residue, linear or branched containing from 1 to 22 carbon atoms or an alkylaryl residue or mono alkenyl or polyunsaturated linear or branched residue contained from 2 to 22 carbon atoms, or a mono aryl residue or an alkyl poly C₁-C₂₂, mono or poly C₂-C₂₂ alkenyl or alkenyl residue; m is 2 or 3; n is a positive whole number between 1 and 30; and M is hydrogen or an alkaline metal.

[0010] US-A-5062979 describes an aqueous, optically clear, substantially soap free lubricant composition having a pH value in the range from 6 to 8, comprising water and:

- (a) from 0.02 to 15% by weight based on the total composition of alkyl benzene sulfonate molecules containing 10 to 18 carbon atoms in the alkyl part and having cations that are selected from the group consisting of alkali metal ions, ammonium ions and alkanolammonium ions containing 1 to about 14 carbon atoms in the alkanolamine part;
- (b) from 0.02 to 15% by weight based on the total composition of partially esterified phosphonic acid or phosphate molecules corresponding to general formula

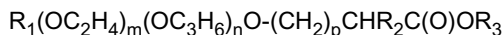


in which R₁ is selected from the group consisting of aliphatic monovalent hydrocarbon radicals containing about 12 to about 18 carbon atoms, R₂ is H or CH₃, X is hydrogen or an alkali metal, and n is an integer in the range of about 8 to about 12; and

- (c) from 0.01 to 10% by weight of the total composition of molecules selected from the group consisting of aliphatic carboxylic acids containing about 6 to about 22 carbon atoms and having a titer of not more than 20°C; and, optionally,
- (d) conventional solubilizers, solvents, foam inhibitors, disinfectants, or mixtures thereof, component (a) and component (b) being present in a ratio by weight of about 3:1 to about 1:3 and component (c) being present in a ratio by weight to the sum of components (a) and (b) of from about 1:20 to about 1:4.

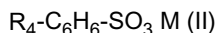
[0011] DE-A-19846991 describes a chain lubricant for conveyor and transport systems comprising water, a surfactant selected from the group consisting of

- a) a monoalkyl-polyalkyleneglycol ether carboxylic acid of the following formula



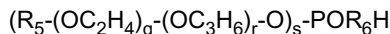
wherein R₁ is a saturated linear or branched C₁-C₂₂-alkyl radical, a mono- or polyunsaturated linear or branched alkenyl or alkynyl radical with 2 to 22 carbon atoms or an aryl radical optionally substituted one or more times by C₁-C₂₂-alkyl or alkenyl or alkynyl groups; m is a number in the range of 0 to 30; n is a number in the range of 0 to 30; p is a number in the range of 1 to 4; R₂ is a hydroxyl group or a hydrogen and R₃ is hydrogen, a methyl group or an alkali metal;

- b) an alkyl-benzenesulphonic acid or one of its salts of the following general formula



wherein R₄ is a saturated linear or branched C₁-C₂₂-alkyl radical or a mono- or poly-unsaturated linear or branched alkenyl or alkynyl radical with 2 to 22 carbon atoms and M is hydrogen or an alkali metal;

- c) a monoalkyl-polyalkyleneglycol phosphoric acid mono or diester of the general formula

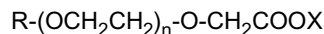


wherein R₅ is a saturated linear or branched C₁-C₂₂-alkyl radical, a mono- or polyunsaturated linear or branched

alkenyl or alkynyl radical with 2 to 22 carbon atoms or an aryl radical optionally substituted one or more times by C₁-C₂₂-alkyl or alkenyl or alkynyl groups; q is a number in the range of 0 to 30; r is a number in the range of 0 to 30; s is 1 or 2; R₆ is hydroxyl if s is 1 and, if s is 2, R₆ is not present; and
d) mixtures thereof;

and disinfection agents, as well as adjuvant and additive materials, wherein said disinfection agent comprises chlorine dioxide.

[0012] Finally, ES-A-2206052 describes the use as a lubricant of ether carboxylates of formula



wherein R is an alkyl, alkenyl or alkynyl residue containing from 12 to 22 carbon atoms; n is a number between 0.3 and 15; X is hydrogen, an alkaline metal, an ammonium cation or an hydroxyalkylammonium cation.

[0013] According to ES-A-2206052, the described ether carboxylates can be specifically used in conveyor systems.

[0014] However, fatty amines and/or diamines are chemicals of environmental concern. In order to protect the environment and human health, chemicals are tested and classified according to their potential hazard. An important criterion is the classification into Water Hazard Classes of the Federal Environmental Agency of Germany (Umweltbundesamt). Three Water Hazard Classes (WGK) are defined:

- 1: low hazard to water
- 2: hazard to water
- 3: severe hazard to water

[0015] One of the more commonly used diamines in conveyor systems, oleyl diamine (N-Oleyl-1,3-diaminopropane) has been classified as a chemical of severe hazard to water (Water Hazard Class 3)

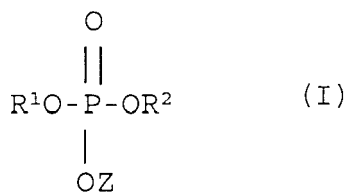
[0016] On the other hand, phosphoric esters present stability problems (2 phases formation) when they are diluted from a concentrated composition and are sensitive to water hardness. Furthermore, phosphoric esters alone do not show sufficient lubricity in conveyor systems for plastic bottles, such as polyethylen terephthalate (PET) or polycarbonate (PC).

[0017] It can be concluded from the existing prior art that the industry still requires improvements in the field of lubricant compositions for conveyor systems, which are free from fatty amines and/or diamines, which can be obtained by dilution from a concentrated composition without stability problems, which do not present water hardness problems and which can be applied to different materials (glass, PET, cans, etc.) being more versatile.

Summary of the invention

[0018] The present invention offers an efficient solution to the problems encountered in the prior art, by providing a lubricant composition comprising the following elements,

- a) one or more phosphoric acid esters of formula (I)



wherein

- R¹ represents a linear or branched, saturated or unsaturated C₆-C₂₂ alkyl and/or alkenyl group, or a R³(OCH₂CH₂)_m group;
- R² represents hydrogen, a linear or branched, saturated or unsaturated C₆-C₂₂ alkyl and/or alkenyl group, or a R³(OCH₂CH₂)_m group;
- R³ represents hydrogen or a linear or branched, saturated or unsaturated C₆-C₂₂ alkyl and/or alkenyl group;
- m represents a number of from 1 to 10; and

- Z represents hydrogen or an appropriate cation

b) one or more ether carboxylates of formula (II)



wherein

- R represents a linear or branched, saturated or unsaturated C₆-C₂₂ alkyl and/or alkenyl group;
 - m represents a number of from 0.5 to 20, and
 - M represents hydrogen or an appropriate cation, selected from the group consisting of an alkali metal, an alkaline earth metal, ammonium, an alkylammonium, an alkanolammonium or a glucammonium; and
- e) water; and
- c) one or more C₆-C₂₂ fatty acids, optionally ethoxylated with 1 to 20 moles of ethylene oxide; and/or
- d) one or more C₆-C₂₂ fatty alcohols, optionally ethoxylated with 1 to 20 moles of ethylene oxide

wherein the weight ratio of component (a) to component (b) is in the range of 9:1 to 1:3, preferably in the range of 5:1 to 1:3, more preferably in the range of 2:1 to 1:2.

[0019] The subject matter of the present invention both includes concentrated aqueous lubricant compositions and diluted aqueous lubricant compositions obtained by diluting the previous lubricant compositions.

[0020] The present invention also provides a method for lubricating conveyor systems consisting of applying an aqueous lubricant diluted composition according to the invention to a conveyor system continuously or at intervals.

[0021] The present invention also provides the use of the lubricant compositions for lubricating conveyor systems.

Detailed description of the invention

The phosphoric acid esters

[0022] The phosphoric acid esters according to the invention may be prepared by reacting in aqueous media C₆-C₂₂ fatty alcohols with phosphorous pentoxide (P₂O₅).

[0023] The C₆-C₂₂ fatty alcohols are preferably derived from natural fat and oil as well as synthetic origin. Preferred fats and oils include palm oil, coconut oil, sunflower oil, rapeseed oil, castor oil, olive oil, soybean oil; and animal fat such as tallow, bone oil; fish oil, hardened oils and semihardened oils thereof; and mixtures thereof. As a result of its natural origin, the C₆-C₂₂ fatty alcohols that react with the phosphorous pentoxide (P₂O₅) may contain a great variety of alkyl and/or alkenyl groups, said groups being linear or branched, saturated or unsaturated.

[0024] Particularly preferred are C₆-C₂₂ fatty alcohols are derived from coconut oil, palm oil and olive oil. It is particularly preferred that the C₆-C₂₂ fatty alcohols to be reacted with the phosphoric acid esters are derived from olive oil.

[0025] The phosphoric acid esters obtained by reacting in C₆-C₂₂ fatty alcohols with phosphorous pentoxide (P₂O₅) are a mixture of phosphoric mono-esters (mono-alkyl esters) and phosphoric di-esters (di-alkyl esters) and the products obtained and the reaction are well known to the skilled person (O'Lenick et al., Soap Cosmetics and Chemical Specialities, July 1986, p. 26.)

[0026] According to the invention it is preferred that the weight ratio phosphoric mono-esters to phosphoric di-esters is from 50:50 to 95:5, more preferred from 55:45 to 90:10.

[0027] According to the invention in the phosphoric acid esters of formula (I) Z represents hydrogen or an appropriate cation, said cation preferably being selected from the group consisting of an alkali metal, an alkaline earth metal, ammonium, an alkylammonium, an alkanolammonium or a glucammonium. It is further preferred that Z represents hydrogen or an alkali metal, preferably lithium, sodium or potassium.

[0028] According to the invention, it is also preferred that the C₁₆-C₁₈ proportion in the alkyl and/or alkenyl groups of the phosphoric acid esters is higher than 70%, preferably higher than 80%, even more preferably higher than 85%.

[0029] Optionally, the C₆-C₂₂ fatty alcohols are ethoxylated, having an average ethoxylation degree from 1 to 10, preferably from 2 to 8.

[0030] Examples of commercially available phosphoric acid esters are FOSFODET[®] 20 M (potassium salt of phosphoric ester of lauric alcohol, mono-ester to di-ester ratio 80:20); FOSFODET[®] 20 D (potassium salt of phosphoric ester of lauric alcohol, mono-ester to di-ester ratio 50:50), FOSFODET[®] 8050 (phosphoric ester of hydrogenated tallow, mono-ester to di-ester ratio 60:40), FOSFODET[®] FJZ 903 (phosphoric ester of ethoxylated (3 EO) oleyl alcohol, mono-ester to di-ester ratio 55:45), all marketed by KAO Chemicals Europe.

The ether carboxylates

[0031] Ether carboxylates of formula (II) are products well known in the art. They are usually obtained by alkoxylation and subsequent carboxymethylation of fatty alcohols as described by Meijer and Smid in Polyether Carboxylates; Anionic Surfactants; Surfactant Science Series, Vol. 56 (p. 313-361), edited by Helmut W. Stache, ISBN: 0-8247-9394-3.

[0032] The process is divided into two steps. The first one is the alkoxylation of alcohols under standard conditions known by the skilled in the art. For instance, the polyoxyethylene group is obtained by addition of ethylene oxide to fatty alcohols, mostly with an alkaline catalyst such as NaOH, KOH or NaOCH₃, giving a broad polyoxyethylene oxide distribution (broad ethoxylation degree). For special applications the ethoxylation can be catalyzed by Lewis acids or by using metallic Na or NaH to achieve a narrow range distribution (narrow ethoxylation degree).

[0033] However, one may also start from commercially available ethoxylated alcohols.

[0034] In the second step, the ethoxylated alcohols are reacted with a strong base, like sodium or potassium hydroxide, in presence of a reducing agent, i.e. sodium borohydride, to obtain the corresponding alkoxyate, which is carboxymethylated with sodium monochloroacetate (SMCA).

[0035] The ether carboxylates of formula (II) are derived from C₆-C₂₂ fatty alcohols, which are preferably derived from natural fat and oil as well as synthetic origin. Preferred fats and oils include palm oil, coconut oil, sunflower oil, rapeseed oil, castor oil, olive oil, soybean oil; and animal fat such as tallow, bone oil; fish oil, hardened oils and semihardened oils thereof; and mixtures thereof. As a result of its natural origin, the C₆-C₂₂ fatty alcohols that are alkoxyated and subsequently carboxymethylated may contain a great variety of alkyl and/or alkenyl groups, said groups being linear or branched, saturated or unsaturated.

[0036] Particularly preferred are C₆-C₂₂ fatty alcohols are derived from coconut oil, palm oil and olive oil. It is particularly preferred that the C₆-C₂₂ fatty alcohols that are alkoxyated and subsequently carboxymethylated are derived from olive oil.

[0037] According to the invention, it is preferred that in the ether carboxylates of formula (II) n has a value in the range of 1 to 10, preferably in the range of 1 to 7, and M is hydrogen, sodium or potassium.

[0038] Furthermore, it is also preferred that in the C₆-C₂₂ alkyl and/or alkenyl group in the ether carboxylates of formula (II) the C₁₆-C₁₈ proportion is higher than 80%, more preferred higher than 80%, even more preferred higher than 85%.

[0039] Examples of commercially available ether carboxylates of formula (II) are AKYPO® RO 10 VG (Oleic ether carboxylic acid with an average ethoxylation degree of 1), AKYPO® RO 20 VG (Oleic ether carboxylic acid with an average ethoxylation degree of 2), AKYPO® RO 50 VG (Oleic ether carboxylic acid with an average ethoxylation degree of 5), and AKYPO® RO 90 VG (Oleic ether carboxylic acid with an average ethoxylation degree of 9), all marketed by KAO Chemicals Europe.

The fatty acids

[0040] According to the invention, the C₆-C₂₂ fatty acids can be selected from natural and/or synthetic origin. Accordingly, natural fatty acids may also be used in addition to synthetic fatty acids. The natural acids do not normally occur in pure form and are therefore preferably used for the purposes of the invention in the form of mixtures, which may be obtained from a variety of natural sources. Accordingly, the fatty acids are preferably selected from hexanoic acid, heptanoic acid, octanoic acid, nonanoic acid, 9-hexadecenoic acid, 9,12-octadecadienoic acid, 9,12,15-octadecatrienoic acid, 5,8,11,14-eicosatetraenoic acid, 4,8,12,15,19-docosapentaenoic acid, sperm oil acid, coconut oil acid, oleic acid, tall oil acid, sunflower oil acid, linseed oil acid, and/or rapeseed oil acid.

[0041] The C₆-C₂₂ fatty acids are optionally ethoxylated with 1 to 20 moles of ethylene oxide, preferably with 1 to 10 moles of ethylene oxide.

[0042] It is preferred that the C₁₆-C₁₈ proportion in the fatty acids according to the invention is higher than 70%, preferably higher than 80%, even more preferably higher than 85%.

The fatty alcohols

[0043] Fatty alcohols are aliphatic alcohols derived from natural fats and oils. Due to their amphipathic nature, fatty alcohols behave as nonionic surfactants. They find use as emulsifiers, emollients and thickeners in cosmetics and food industry.

[0044] Fatty alcohols are a common component of waxes, mostly as esters with fatty acids but also as alcohols themselves.

[0045] Examples of C₆-C₂₂ fatty alcohols include capryl alcohol (1-octanol), pelargonic alcohol (1-nonanol), capric alcohol (1-decanol), lauryl alcohol (1-dodecanol), myristyl alcohol (1-tetradecanol), cetyl alcohol (1-hexadecanol), palmitoleyl alcohol (cis-9-hexadecan-1-ol), stearyl alcohol (1-octadecanol), isostearyl alcohol (16-methylheptadecan-1-ol), elaidyl alcohol (9E-octadecen-1-ol), oleyl alcohol (cis-9-octadecen-1-ol), linoleyl alcohol (9Z, 12Z-octadecadien-1-ol),

elaidolinoleyl alcohol (9E, 12E-octadecadien-1-ol), linolenyl alcohol (9Z, 12Z, 15Z-octadecatrien-1-ol), elaidolinolenyl alcohol (9E, 12E, 15-E-octadecatrien-1-ol), ricinoleyl alcohol (12-hydroxy-9-octadecen-1-ol), arachidyl alcohol (1-eicosanol), behenyl alcohol (1-docosanol), and erucyl alcohol (cis-13-docosen-1-ol).

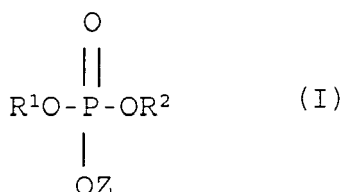
[0046] The C₆-C₂₂ fatty alcohols are optionally ethoxylated with 1 to 20 moles of ethylene oxide, preferably with 1 to 10 moles of ethylene oxide.

[0047] It is preferred that the C₁₆-C₁₈ proportion in the fatty alcohols according to the invention is higher than 70%, preferably higher than 80%, even more preferably higher than 85%.

The lubricant composition

[0048] It is preferred that the lubricant composition according to the invention comprises the following elements,

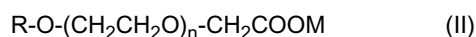
a) one or more phosphoric acid esters of formula (I)



wherein

- R¹ represents a linear or branched, saturated or unsaturated C₆-C₂₂ alkyl and/or alkenyl group, or a R³(OCH₂CH₂)_m group;
- R² represents hydrogen, a linear or branched, saturated or unsaturated C₆-C₂₂ alkyl and/or alkenyl group, or a R³(OCH₂CH₂)_m group;
- R³ represents a linear or branched, saturated or unsaturated C₆-C₂₂ alkyl and/or alkenyl group;
- m represents a number of from 1 to 10; and
- Z represents hydrogen or an appropriate cation

b) one or more ether carboxylates of formula (II)



wherein

- R represents a linear or branched, saturated or unsaturated C₆-C₂₂ alkyl and/or alkenyl group;
- m represents a number of from 0.5 to 20, and
- M represents hydrogen or an appropriate cation, selected from the group consisting of an alkali metal, an alkaline earth metal, ammonium, an alkylammonium, an alkanolammonium or a glucammonium; and

- c) one or more C₆-C₂₂ fatty acids, optionally ethoxylated with 1 to 20 moles of ethylene oxide; and
- d) one or more C₆-C₂₂ fatty alcohols, optionally ethoxylated with 1 to 20 moles of ethylene oxide
- e) water; and

wherein the weight ratio of component (a) to component (b) is in the range of 9:1 to 1:3, preferably in the range of 5:1 to 1:3, more preferably in the range of 2:1 to 1:2.

[0049] The subject matter of the present invention also includes an aqueous lubricant concentrated composition comprising, expressed as weight percentage,

- a) 10-85% of the phosphoric acid esters of formula (I)
- b) 5-60% of the ether carboxylates of formula (II)
- c) 0.1-30% of the fatty acids
- d) 0.1-30% of the fatty alcohols
- e) water add up to 100%.

[0050] According to the invention, it is preferred that in the aqueous lubricant concentrated composition the ether carboxylates of formula (II) are a mixture of

- I) C₆-C₁₀ alkyl and/or alkenyl ether carboxylates having an average ethoxylation degree from 2 to 8
- II) C₁₂-C₁₈ alkyl and/or alkenyl ether carboxylates having an average ethoxylation degree from 1 to 10, preferably from 1 to 7.

[0051] If is further preferred that the aqueous lubricant concentrated composition according to the invention comprises, expressed as weight percentage,

- a) 15-55% of the phosphoric acid esters of formula (I)
- b₁) 5-20% of C₆-C₁₀ alkyl and/or alkenyl ether carboxylates having an average ethoxylation degree from 2 to 8
- b₂) 10-45% of C₁₂-C₁₈ alkyl and/or alkenyl ether carboxylates having an average ethoxylation degree from 1 to 10
- c) 1-20% of the fatty acids
- d) 1-20% of the fatty alcohols
- e) water add up to 100%.

[0052] Preferably, the weight ratio of the C₁₂-C₁₈ alkyl and/or alkenyl ether carboxylates to the C₆-C₁₀ alkyl and/or alkenyl ether carboxylates in the aqueous lubricant concentrated composition according to the invention is in the range of 8:1 to 1:5, preferably in the range of 5:1 to 1:2.

[0053] The active matter content of the aqueous lubricant concentrated composition according to the invention is preferably at least 30% by weight, more preferably at least 50% by weight, even more preferably at least 65% by weight, the active matter of the composition is substantially provided by components (a), (b), (c) and (d).

[0054] According to the invention, an aqueous lubricant diluted composition can be obtained by diluting an aqueous lubricant concentrated composition as described before by a factor of 2 to 10000 by volume, preferably from 5 to 1000. Said dilution can be done directly in one step or through intermediate partially diluted compositions, i.e. starting from a concentrate, diluting it by a factor of 2 to 100, and finally diluting it again to the desirable final concentration. This procedure is commonly used to avoid transport and storage of highly diluted compositions.

[0055] Aqueous lubricant compositions are usually applied in very dilute form such that the active concentration applied in the conveyor systems ranges from 0.01% to 2% by weight. The total active matter (substantially provided by components (a), (b), (c) and (d)) present in the lubricant diluted composition ranges from 0.01 to 1%, preferably from 0.02 to 0.5% by weight. Dilution of the lubricant concentrated composition to obtain lubricant diluted compositions, which are those that are directly applied to the conveyor systems can be done with hard water, semi-hard water or soft water.

[0056] The aqueous lubricant compositions according to the invention can also contain additives such as ionic surfactants, non ionic surfactants, amphoteric surfactants, foam inhibitor agents, foam regulators, foam stabilizers, complexing agents, chelating agents, solubilizers, emulsifiers, biocides, bactericides, disinfectants, fungicides, antioxidants, corrosion inhibitors and pH regulators, either in the form of aqueous lubricant concentrated compositions or aqueous lubricant diluted compositions.

[0057] The pH of these aqueous lubricant compositions for conveyor systems is preferably between 6.0 and 8.5, more preferably between 6.5 and 8.0.

[0058] The viscosity of the aqueous lubricant concentrated composition of the present invention ranges from 50 to 20,000 mPa·s at 20°C, more preferably from 100 to 10,000 mPa·s at 20°C.

[0059] When the aqueous lubricant concentrated composition of the present invention is partially diluted to obtain a partially diluted composition, i.e. in the range from 8 to 10% by weight, the viscosity of said partially diluted ranges from 100 to 6,000 mPa·s at 20°C, and it is preferably less than 1,000 mPa·s at 20°C.

[0060] The aqueous lubricant diluted composition of the present invention has a viscosity equal or similar to the viscosity of water at 20°C.

[0061] As solubilizing agents, the compositions of the invention may contain solubilizing agents that can be mixed with water or that are water-soluble. Preferably, the following solubilizers are used: urea, ethanol, n-propanol, i-propanol, n-butanol, ethyleneglycol and/or butyldiglycol, polyethyleneglycols, vegetable oils, mixtures of alkoxyated glycerides derived from carboxylic acids containing between 6 and 22 carbons and alkoxyated glycerin such as those commercially available under the trademark LEVENOL[®] and marketed by KAO Chemicals Europe, alkoxyated, preferably ethoxyated glycerol, etc., in an amount corresponding to between 10 and 40% by weight of one or several of these solubilizing agents, relative to 100 parts by weight of the total amount of the compounds a), b) c) and d). These solubilizing agents are appropriate, in the context of the present invention, provided that they do not reduce the lubricant effect of the aqueous lubricant compositions.

[0062] The disinfectants that could be contained in the aqueous lubricant compositions for conveyor systems are, for example, those described in the "Guía de Plaguicidas utilizados en Higiene Alimentaria y Salud Pública" published by

the Spanish Health Ministry (ISBN: 84-7607-499-2). Preferably, according to the invention disinfectants should be used when there is a risk of germs in the reserve tanks or on the conveyor systems. These disinfectants or mixtures thereof can be used in amounts of 5 to 50 parts by weight, relative to 100 parts by weight the total amount of the compounds a), b) c) and d). A preferred disinfectant agent according to the invention is chlorine dioxide (ClO₂)

[0063] The subject matter of the present invention also includes a process for lubricating conveyor systems consisting in applying an aqueous lubricant diluted composition according to the invention to a conveyor system continuously or at intervals.

[0064] The conveyor systems, which can be lubricated by the process according to the invention, can be systems for glass bottles, plastic bottles such as polyethylene terephthalate (PET) or polycarbonate (PC) bottles, cans, glass containers, drums, cardboard containers and similar items. Preferably, the systems are suitable for glass bottles, polyethylene terephthalate (PET) bottles, and cans.

[0065] The subject matter of the present invention also includes the use of the aqueous diluted lubricant composition according to the invention for lubricating conveyor systems. Said conveyor systems can be systems for glass bottles, plastic bottles such as polyethylene terephthalate (PET) or polycarbonate (PC) bottles, cans, glass containers, drums, cardboard containers and similar items. Preferably, the systems are suitable for glass bottles, polyethylene terephthalate (PET) bottles, and cans.

[0066] The following examples are given in order to provide a person skilled in the art with a sufficiently clear and complete explanation of the present invention, but should not be considered as limiting of the essential aspects of its subject, as set out in the preceding portions of this description.

Examples

Example 1. Aqueous lubricant compositions

[0067] The following aqueous lubricant compositions were prepared. The values are referred to weight percentage.

Table 1. - Lubricant compositions according to the invention (components as active matter)

	A	B	C	D	E	F
Polyoxyethylene (3) oleyl phosphate ester ¹	72.7	54.1	36.1	32.8	29.5	42.4
Polyoxyethylene (2) oleyl ether carboxylic acid ²	10.4	22.0	33.7	30.7	27.6	39.6
Polyoxyethylene (5) oleyl ether carboxylic acid ³	8.4	6.3	4.2	3.8	3.4	4.9
Polyoxyethylene (8) capryl ether carboxylic acid ⁴				8.4	16.7	
Oleic Acid	4.6	9.7	14.8	13.4	12.1	
Oleyl alcohol	2.7	5.8	8.8	8.1	7.3	10.3
Deionized water	1.8	2.1	2.4	2.9	3.4	2.8
¹ Phosphoric ester of ethoxylated (3 EO) oleyl alcohol, mono-ester to di-ester ratio 55:45						
² Oleic ether carboxylic acid with an average ethoxylation degree of 2						
³ Oleic ether carboxylic acid with an average ethoxylation degree of 2						
⁴ Caprylic ether carboxylic acid with an average ethoxylation degree of 8						

Table 2. - Comparative Experiments (components as active matter)

	C1	C2	C3
Polyoxyethylene (3) oleyl phosphate ester ¹	36.1	99.3	
Oleic Acid	14.8		
Oleyl alcohol	8.8		
Polyoxyethylene (1) oleyl ether carboxylic acid ²			95.0
Sodium dodecyl benzenesulfonate ⁶	37.9		

(continued)

	C1	C2	C3
Deionized water	2.4	0.7	5.0
¹ Phosphoric ester of ethoxylated (3 EO) oleyl alcohol, mono-ester to di-ester ratio 55:45 ² Oleic ether carboxylic acid with an average ethoxylation degree of 2 ³ Oleic ether carboxylic acid with an average ethoxylation degree of 2 ⁴ Caprylic ether carboxylic acid with an average ethoxylation degree of 8 ⁵ Oleic ether carboxylic acid with an average ethoxylation degree of 1 ⁶ As described in US-A-5062979 ¹ Phosphoric ester of ethoxylated (3 EO) oleyl alcohol, mono-ester to di-ester ratio 80:20 ² Oleic ether carboxylic acid with an average ethoxylation degree of 2 ³ Oleic ether carboxylic acid with an average ethoxylation degree of 2 ⁴ Caprylic ether carboxylic acid with an average ethoxylation degree of 8 ⁵ Oleic ether carboxylic acid with an average ethoxylation degree of 1 ⁶ As described in US-A-5062979			

Example 2. Lubrication in conveyor systems for glass bottles.

[0068] Tests to measure friction resistance were performed on a stainless steel bottle conveyor belt under the following conditions:

- Measurement of the resistance of 7 beer bottles type Ale 0.5 L, filled with water, as a tensile force using a dynamometer. These bottles are arranged in a plastic crate for beer that permits their rotation on the belt but prevents them from toppling over.
- Speed of bottles: approximately 0.5 m/s.
- Continuous spraying of the bottle conveyor belt with a lubricant solution of 0.03% by weight.
- Spraying volume of the nozzle: approximately 3.5 L/hour.

[0069] The friction coefficient (μ) is defined as the coefficient between the tensile force measured for a bottle and the weight of this bottle expressed in grams. This coefficient is determined when a constant value is obtained.

[0070] Foam production is controlled visually. The compositions according to the invention present no foam formation or slightly foam formation.

[0071] Dilution of the lubricant compositions according to the invention (Table 1 of Example 1) as well as the comparative experiments (Table 2 of Example 1) was carried out with tap water from Emmerich am Rhein (Germany), specifically of hardness 17°dH (German degrees) according to the regulation UNE-EN 12829.

[0072] Table 3 shows the friction coefficients obtained for the lubricant compositions described in Table 1 and Table 2 of Example 1.

Table 3. - Friction coefficients for glass bottles (μ)

Lubricant compositions	μ
A	0.103
B	0.112
C	0.124
D	0.096
E	0.102
F	0.127
C1	0.160
C2	0.130
C3	0.162

(continued)

Lubricant compositions	μ
C4*	0.166
* Commercial product based on: - N-Oleyl-1,3-diaminopropane, - C ₁₃ branched alcohol with average ethoxylation degree of 8, - Acetic acid and - Oleic ether carboxylic acid with an average ethoxylation degree of 9	

Example 3. Lubrication in conveyor systems for PET bottles.

[0073] Tests to measure friction resistance were performed on a stainless steel bottle conveyor belt under the following conditions:

- Measurement of the resistance of 6 PET bottles type "weiße Brunnen-Einheitsflaschen 0.5L" (Rostiprimpac), filled with water, as a tensile force using a dynamometer. These bottles are arranged in a steel frame for the PET bottles that permits their rotation on the belt but prevents them from toppling over.
- Speed of bottles: approximately 0.5 m/s.
- Continuous spraying of the bottle conveyor belt with a lubricant solution of 0.03% by weight.
- Spraying volume of the nozzle: approximately 3.5 L/hour.

[0074] The friction coefficient (μ) is defined as the coefficient between the tensile force measured for a bottle and the weight of this bottle expressed in grams. This coefficient is determined when a constant value is obtained. Foam production is controlled visually. The compositions according to the invention present no foam formation or slightly foam formation.

[0075] Dilution of the lubricant compositions according to the invention (Table 1 of Example 1) as well as the comparative experiments (Table 2 of Example 1) was carried out with tap water from Emmerich am Rhein (Germany), specifically of hardness 17°dH (German degrees) according to the regulation UNE-EN 12829.

[0076] Table 4 shows the friction coefficients obtained for the lubricant compositions described in Table 1 and Table 2 of Example 1.

Table 4. - Friction coefficients for PET bottles (μ)

Lubricant compositions	μ
A	0.147
B	0.130
C	0.127
D	0.112
E	0.131
F	0.156
C1	0.169
C2	0.195
C3	0.179

[0077] From the experimental results it can be shown that the lubricant compositions according to the invention permit to reduce the friction over the conveyor system (lower friction coefficients) in comparison with the comparative experiments both for glass bottles and for PET bottles.

[0078] Thus, more versatile lubricant compositions for conveyor systems can be obtained.

[0079] Compositions A and B are particularly advantageous for glass bottles.

[0080] Furthermore, Compositions D and E, where the ether carboxylic acid is a mixture of

- I) C₈ ether carboxylic acid having an average ethoxylation degree of 8, and
 II) oleyl ether carboxylic acid having an average ethoxylation degree of 2, and
 III) oleyl ether carboxylic acid having an average ethoxylation degree of 5

are particularly advantageous for both glass and PET bottles.

Example 4. Viscosity of the lubricant compositions for conveyor systems.

[0081] Some of the aqueous lubricant compositions for conveyor systems of Table 1 of Example 1 were slightly diluted to obtain intermediate partially diluted compositions (8 % by weight on active matter). Their viscosity at 20°C was measured a Brookfield viscometer LVT (supplied by Brookfield Engineering Laboratories Inc. Stoughton, MA, USA) in accordance with DIN 1341 (spindle 2 at 30 rpm for viscosities in the range of up to 1,000 mPa.s; spindle 3 at 12 rpm for viscosities in the range of 1,000 to 7,000 mPa.s; spindle 4 at 12 rpm for viscosities in the range of more than 7,000 mPa. s)

[0082] Dilution of the lubricant compositions according to the invention was carried out with tap water from Emmerich am Rhein (Germany), specifically of hardness 17°dH (German degrees) according to the regulation UNE-EN 12829.

Table 5. - Viscosity values (20°C)

Lubricant compositions (8 wt.% a.m.)	Viscosity (mPa.s)
A	5100
B	500
C	300
D	150

[0083] All the compositions were visually clear without formation of any deposit, precipitation or oil layer.

[0084] From the experimental results it can be concluded that the aqueous lubricant compositions for conveyor systems according to the invention are pumpable and homogeneous at room temperature. Furthermore, it has to be remarked that the compositions where the ether carboxylic acid is a mixture of

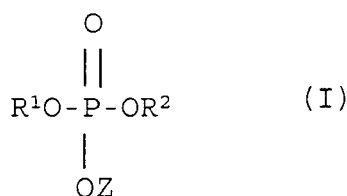
- I) C₈ ether carboxylic acid having an average ethoxylation degree of 8, and
 II) oleyl ether carboxylic acid having an average ethoxylation degree of 2, and
 III) oleyl ether carboxylic acid having an average ethoxylation degree of 5

are particularly advantageous from the viscosity point of view (better pumpability)

Claims

1. A lubricant composition comprising the following essential elements,

a) one or more phosphoric acid esters of formula (I)



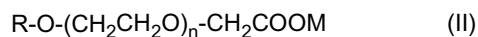
wherein

- R¹ represents a linear or branched, saturated or unsaturated C₆-C₂₂ alkyl and/or alkenyl group, or a R³ (OCH₂CH₂)_m group;
- R² represents hydrogen, a linear or branched, saturated or unsaturated C₆-C₂₂ alkyl and/or alkenyl group,

or a $R^3(OCH_2CH_2)_m$ group;

- R^3 represents hydrogen or a linear or branched, saturated or unsaturated C_6 - C_{22} alkyl and/or alkenyl group;
- m represents a number of from 1 to 10; and
- Z represents hydrogen or an appropriate cation

b) one or more ether carboxylates of formula (II)



wherein

- R represents a linear or branched, saturated or unsaturated C_6 - C_{22} alkyl and/or alkenyl group;
- m represents a number of from 0.5 to 20, and
- M represents hydrogen or an appropriate cation, selected from the group consisting of an alkali metal, an alkaline earth metal, ammonium, an alkylammonium, an alkanolammonium or a glucammonium; and

e) water; and

- c) one or more C_6 - C_{22} fatty acids, optionally ethoxylated with 1 to 20 moles of ethylene oxide; and/or
- d) one or more C_6 - C_{22} fatty alcohols, optionally ethoxylated with 1 to 20 moles of ethylene oxide

wherein the weight ratio of component (a) to component (b) is in the range of 9:1 to 1:3.

2. An aqueous lubricant composition according to claim 1, wherein the weight ratio of component (a) to component (b) is in the range of 5:1 to 1:3.

3. An aqueous lubricant composition according to claim 1 or 2, wherein the phosphoric acid esters of formula (I) comprise a mixture of mono- and di-esters.

4. An aqueous lubricant composition according to claim 3, wherein the weight ratio phosphoric mono-esters to phosphoric di-esters is from 50:50 to 95:5.

5. An aqueous lubricant composition according to claims 1 to 3, wherein the C_{16} - C_{18} proportion in the alkyl and/or alkenyl groups of the phosphoric acid esters is higher than 70%.

6. An aqueous lubricant composition according to any of the preceding claims, wherein the phosphoric acid esters of formula (I) are ethoxylated having an average ethoxylation degree from 2 to 8.

7. An aqueous lubricant composition according to any of the preceding claims, wherein in the ether carboxylates of formula (II) n has a value in the range of 1 to 10 and M is hydrogen, sodium or potassium.

8. An aqueous lubricant composition according to any of the preceding claims, wherein the C_{16} - C_{18} proportion in the fatty acids is higher than 70%.

9. An aqueous lubricant composition according to any of the preceding claims, wherein the C_{16} - C_{18} proportion in the fatty alcohols is higher than 70%.

10. An aqueous lubricant composition according to any of the preceding claims, comprising, expressed as weight percentage,

- a) 10-85% of the phosphoric acid esters of formula (I)
- b) 5-60% of the ether carboxylates of formula (II)
- c) 0.1-30% of the fatty acids
- d) 0.1-30% of the fatty alcohols
- e) water add up to 100%.

11. An aqueous lubricant composition according to any of the preceding claims, wherein the ether carboxylates of formula (II) are a mixture of

- I) C₆-C₁₀ alkyl and/or alkenyl ether carboxylates having an average ethoxylation degree from 2 to 8
- II) C₁₂-C₁₈ alkyl and/or alkenyl ether carboxylates having an average ethoxylation degree from 1 to 10

12. An aqueous lubricant composition according to claim 11, comprising, expressed as weight percentage,

- a) 15-55% of the phosphoric acid esters of formula (I)
- b₁) 5-20% of C₆-C₁₀ alkyl and/or alkenyl ether carboxylates having an average ethoxylation degree from 2 to 8
- b₂) 10-45% of C₁₂-C₁₈ alkyl and/or alkenyl ether carboxylates having an average ethoxylation degree from 1 to 10
- c) 1-20% of the fatty acids
- d) 1-20% of the fatty alcohols
- e) water add up to 100%.

13. An aqueous lubricant concentrated composition according to claims 11 or 12, wherein the weight ratio of the C₁₂-C₁₈ alkyl and/or alkenyl ether carboxylates to the C₆-C₁₀ alkyl and/or alkenyl ether carboxylates is in the range of 8:1 to 1:5.

14. An aqueous lubricant composition obtainable by diluting an aqueous lubricant composition according to claims 10 to 13 by a factor of 2 to 10000 by volume, preferably from 5 to 1000.

15. Process for lubricating conveyor systems consisting of applying an aqueous lubricant diluted composition according to any one of the preceding claims to a conveyor system continuously or at intervals.

16. Process according to claim 15 wherein the conveyor system is for glass bottles, plastic bottles such as polyethylene terephthalate (PET) or polycarbonate (PC) bottles, cans, glass containers, drums, cardboard containers and similar items.

17. Use of an aqueous lubricant diluted composition according to any one of the preceding claims for lubricating conveyor systems.

18. Use according to claim 17 wherein the conveyor system is for glass bottles, plastic bottles such as polyethylene terephthalate (PET) or polycarbonate (PC) bottles, cans, glass containers, drums, cardboard containers and similar items.



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Place of search Munich		Date of completion of the search 30 August 2006	Examiner Kazemi, P
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