

(19)



(11)

EP 2 042 587 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

01.04.2009 Bulletin 2009/14

(51) Int Cl.:

C10M 173/02 (2006.01) C10M 141/10 (2006.01)

(21) Application number: **07018934.5**

(22) Date of filing: **26.09.2007**

(84) Designated Contracting States:

**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE
SI SK TR**

Designated Extension States:

AL BA HR MK RS

(71) Applicant: **KAO CHEMICALS GmbH**

46446 Emmerich (DE)

(72) Inventors:

- **Vierbaum, Melanie**
46446 Emmerich (DE)

• **De Rijk, Ben**

46446 Emmerich (DE)

• **Meijer, Hamke**

46446 Emmerich (DE)

(74) Representative: **HOFFMANN EITLE**

Patent- und Rechtsanwälte

Arabellastraße 4

81925 München (DE)

(54) **Lubrication of conveyor systems**

(57) The invention refers to a method for lubricating conveyor systems consisting of applying, continuously or at intervals, a lubricant composition comprising the following essential elements,

- a) one or more phosphoric acid esters,
- b) one or more ether carboxylates;
- c) one or more C₆-C₂₂ fatty acids, optionally ethoxylated with 1 to 20 moles of ethylene oxide,
- d) one or more C₆-C₂₂ fatty alcohols, optionally ethoxylated with 1 to 20 moles of ethylene oxide,
- e) an inert solvent or mixture thereof,

wherein the active matter concentration of said lubricant partially diluted composition ranges from 1 to 99% by weight.

Said method is particularly preferred in conveyor systems for glass bottles, plastic bottles such as polyethylene terephthalate (PET) or polycarbonate (PC) bottles, cans, glass containers and cartons containers and similar items. Said conveyor systems can particularly be found in the foodstuff industry.

EP 2 042 587 A1

Description**Technical field**

[0001] The present invention refers to a method for lubricating conveyor systems consisting of applying a lubricant composition wherein the active matter concentration of said lubricant composition ranges from 1 to 99% by weight. Said method is particularly preferred in conveyor systems for glass bottles, plastic bottles such as polyethylene terephthalate (PET) or polycarbonate (PC) bottles, cans, glass containers and cartons containers and similar items. Said conveyor systems can particularly be found in the foodstuff industry.

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] Typically, a lubricant concentrated composition is diluted with water to form a lubricant diluted composition (i.e., dilution factors of 2 to 10000, preferably 5 to 1000 by volume), and copious amounts of lubricant diluted compositions are typically applied to the conveyor systems or containers using spray or pumping equipment on a continuous basis. The lubricant diluted composition can be collected in drip trays, which discharge into drainage systems and then to the effluent plant for disposals.

[0004] These lubricant diluted compositions permit high-speed operation of the conveyor system and limit marring of the containers or labels, but also have some disadvantages:

- The high quantity of water required on the conveying line (a normal lubrication spray nozzle has a capacity of 5 L/min; with a 50% spray and 50% pause time, each nozzle uses 2.5 L of lubricant diluted compositions per hour)
- Spillages on floors caused by frothing of the lubricant diluted compositions result in hazardous working conditions and slippery floors around the packaging lines.
- Some lubricant diluted compositions can promote the growth of microorganisms, which has to be prevented by using biocides.
- The lubricant diluted composition, which has been collected in drip trays, has to be treated in the effluent treatment plants before disposal. However, the presence of biocides may affect the bacteria in the wastewater treatment facilities.
- By requiring dilution of the lubricant concentrated dilution errors can occur, leading to variations and errors in concentration of the lubricant diluted solution.
- By requiring water from the plant, variations in the water can have negative side effects on the lubricant diluted composition. For example, alkalinity in the water can lead to environmental stress cracking in PET bottles.

[0005] "Dry lubricants" have been described as a solution to the disadvantages of the diluted lubricant compositions. A "dry lubricant" historically has referred to a lubricant composition with low water content, preferably less than 50 wt. %, which was applied to a container or conveyor system without dilution. However, this application typically required special dispensing equipment and nozzles and energized nozzles in particular. Energized nozzles refer to nozzles where the lubricant stream is broken into a spray of fine droplets by the use of energy, which may include high pressures, compressed air, or sonication to deliver the lubricant.

[0006] Dry lubricants based on silicone materials and/or polymers (i.e. Teflon) are very common. However, silicone is primarily effective at lubricating plastics such as PET bottles, and has been observed to be less effective at lubricating on glass or metal containers, particularly on a metal surface. If a plant is running more than one type of container on a line, the conveyor lubricant will have to be switched before the new type of container can be run. Alternatively, if a plant is running different types of containers on different lines, the plant will have to stock more than one type of conveyor lubricant. Both scenarios are time consuming and inefficient for the plant.

[0007] Furthermore, silicone materials and certain polymers are not biodegradable and may contaminate the effluents.

[0008] In the applicant's International patent application PCT/EP2007/002772, which is awaiting publication and which

is hereby incorporated by reference, a description is given of lubricant compositions comprising, expressed as weight percentage,

- a) 10-85% of one or more phosphoric acid esters;
- b) 5-60% of one or more ether carboxylates;
- c) 0.1-30% of one or more C₆-C₂₂ fatty acids, optionally ethoxylated with 1 to 20 moles of ethylene oxide;
- d) 0.1-30% of one or more C₆-C₂₂ fatty alcohols, optionally ethoxylated with 1 to 20 moles of ethylene oxide; and
- e) water add up to 100%.

[0009] Said International patent application describes both concentrated and diluted lubricant compositions, which are obtained by diluting the previous lubricant concentrated compositions. Furthermore, said European patent application also describes a method for lubricating conveyor systems consisting in applying a lubricant diluted composition (0.03% by weight) obtained by diluting the lubricant concentrated composition described above to a conveyor system. The use of the lubricant diluted composition for lubricating conveyor systems is also described.

[0010] Said dilution can be carried out either 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.

[0011] It can be concluded that the industry still requires improvements in the field of lubricating conveyor systems by applying lubricant non-diluted compositions, which avoids the drawbacks mentioned before and which allows applied to different materials (glass, PET, cans, etc.) being more versatile.

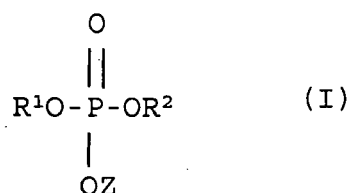
Summary of the invention

[0012] The authors of the present invention have surprisingly found that, the lubricant compositions described in the International patent application PCT/EP2007/002772, if applied directly or in the form of partially diluted compositions, wherein the active matter concentration of the lubricant composition ranging from 1 to 99% by weight, to conveyor systems, not only provide appropriate lubricant properties, but also provide an efficient solution to the problems mentioned before: said composition can be applied without further dilution with standard application equipments (i.e. non-energized nozzles) resulting in drier lubrication of the conveyor systems and drier conveyor line and working area, reduced lubricant usage, reduced waste, cleanup and disposal problems, and avoiding dilution problems.

[0013] Furthermore, said lubricant compositions have a better ecotoxicological profile than existing concentrated (dry) lubricant compositions based on silicone materials and/or polymers.

[0014] Thus, the present invention provides a method for lubricating conveyor systems consisting of applying, continuously or at intervals, a lubricant composition comprising the following essential elements,

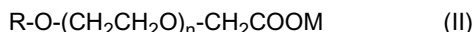
- a) one or more phosphoric acid esters of formula (I)



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 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 15; 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;
- n 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) an inert solvent or mixture thereof,

wherein the active matter concentration of said lubricant composition ranges from 1 to 99% by weight.

[0015] The present invention also provides the use of the lubricant composition defined above for lubricating conveyor systems.

Detailed description of the invention

The phosphoric acid esters

[0016] The phosphoric acid esters of formula (I) may be prepared by reacting in aqueous media C₆-C₂₂ fatty alcohols with phosphorous pentoxide (P₂O₅).

[0017] 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.

[0018] 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.

[0019] 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.)

[0020] 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.

[0021] 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.

[0022] 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%.

[0023] Optionally, the C₆-C₂₂ fatty alcohols are ethoxylated, having an average ethoxylation degree from 1 to 10, preferably from 2 to 8.

[0024] 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

[0025] 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.

[0026] 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).

[0027] However, one may also start from commercially available ethoxylated alcohols.

[0028] 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 alkoxylate, which is carboxymethylated with sodium monochloroacetate (SMCA).

[0029] 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 alkoxylated and subsequently carboxymethylated may contain a great variety of alkyl and/or alkenyl groups, said groups being linear or branched, saturated or unsaturated.

[0030] 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 alkoxylated and subsequently carboxymethylated are derived from olive oil.

[0031] 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.

[0032] 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%.

[0033] 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

[0034] 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.

[0035] 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.

[0036] 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

[0037] 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.

[0038] Fatty alcohols are a common component of waxes, mostly as esters with fatty acids but also as alcohols themselves.

[0039] 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).

[0040] 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.

[0041] 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

[0042] The active matter content of the lubricant composition preferably ranges from 2 to 75% by weight, more preferably from 3 to 50% by weight, even more preferably from 4 to 25% by weight. The active matter of the lubricant composition is substantially provided by components (a), (b), (c) and (d).

[0043] The lubricant composition can be applied directly or in the form of partially diluted compositions. Said partially diluted compositions can be obtained by diluting a lubricant concentrated composition as described in the International patent application PCT/EP2007/002772 or, alternatively, can be prepared in situ, depending on its active matter content. Dilution from a lubricant concentrated composition is preferred to avoid transport and storage of diluted compositions.

[0044] Dilution of the lubricant concentrated composition to obtain the lubricant partially diluted composition can be done with an appropriate inert solvent or mixture thereof.

[0045] Examples of appropriate inert solvents are mineral oils, paraffin and waxes derived from petroleum, animal and vegetable oils (like beef tallow, lard, horse grease, yolk oil, olive oil, lanolin, jojoba oil, rapeseed oil and soybean oil), natural waxes (like carnauba wax), C_1 - C_6 alcohols (like methanol, ethanol, n-propanol, i-propanol, n-butanol, n-pentanol or n-hexanol), C_6 - C_{22} fatty alcohols as described before, C_6 - C_{22} fatty acids as described before, ether carboxylates as described before, water (hard water, semi-hard water or soft water), or polyols (polyhydric alcohol having two or more hydroxyl groups in its molecule) like ethylene glycol, 1,2-propylene glycol, 1,3-propylene glycol, 1,3-butylene glycol, 1,4-butylene glycol, dipropylene glycol, polyethylene glycol with a weight average molecular weight in the range from 100 to 1000, glycerol, alkoxylated (preferably ethoxylated) glycerol, polyglycerol, and mixtures thereof.

[0046] According to the invention it is preferred that in the lubricant composition the weight ratio of component (a) (phosphoric acid esters) to component (b) (ether carboxylates) is in the range of 9:1 to 1:6, preferably in the range of 5:1 to 1:5, more preferably in the range of 3:1 to 1:3.

[0047] According to the invention it is preferred that in the lubricant composition the ether carboxylates of formula (II) are a mixture of

I) C_6 - C_{10} alkyl and/or alkenyl ether carboxylates having an average ethoxylation degree from 2 to 8

II) C_{12} - C_{18} alkyl and/or alkenyl ether carboxylates having an average ethoxylation degree from 1 to 10, preferably from 1 to 7.

[0048] Preferably, the weight ratio of the C_{12} - C_{18} alkyl and/or alkenyl ether carboxylates to the C_6 - C_{10} alkyl and/or alkenyl ether carboxylates in the lubricant composition is in the range of 10:1 to 1:5, preferably in the range of 8:1 to 1:3.

[0049] The subject matter of the present invention also refers to a method for lubricating conveyor systems consisting of applying, continuously or at intervals, a lubricant composition comprising the following essential elements, expressed as weight percentage,

a) 0.1-85% of the phosphoric acid esters of formula (I)

b) 0.1-60% of the ether carboxylates of formula (II)

c) 0.1-30% of the fatty acids

d) 0.1-30% of the fatty alcohols

e) up to 100% of an inert solvent or mixture thereof,

wherein the active matter concentration of the lubricant composition ranges from 1 to 99% by weight, preferably from 2 to 75% by weight.

[0050] The subject matter of the present invention also refers to a method for lubricating conveyor systems consisting of applying, continuously or at intervals, a lubricant composition comprising the following essential elements, expressed as weight percentage,

a) 0.1-25%, preferably 0.5-15% of the phosphoric acid esters of formula (I)

b) 0.1-20%, preferably 0.5-15% of the ether carboxylates of formula (II)

c) 0.1-10%, preferably 0.3-5% of the fatty acids

d) 0.1-10%, preferably 0.3-5% of the fatty alcohols

e) up to 100% of an inert solvent or mixture thereof,

wherein the active matter concentration of the lubricant composition ranges from 3 to 50% by weight, even more preferably from 4 to 25% by weight.

[0051] The subject matter of the present invention also refers to a method for lubricating conveyor systems consisting of applying, continuously or at intervals, a lubricant composition comprising the following essential elements, expressed as weight percentage,

- a) 0.1-25%, preferably 0.5-15% of the phosphoric acid esters of formula (I)
 b₁) 0.1-15%, preferably 0.5-10% of one or more of the C₆-C₁₀ alkyl and/or alkenyl ether carboxylates having an average ethoxylation degree from 2 to 8,
 b₂) 0.1-15%, preferably 0.5-10% of one or more of the C₁₂-C₁₈ alkyl and/or alkenyl ether carboxylates having an average ethoxylation degree from 1 to 10,
 c) 0.1-10%, preferably 0.3-5% of one or more of the C₆-C₂₂ fatty acids,
 d) 0.1-10%, preferably 0.3-5% of one or more of the C₆-C₂₂ fatty alcohols,
 e) up to 100% of an inert solvent or mixture thereof,

wherein the active matter concentration of the lubricant composition ranges from 3 to 50% by weight, even more preferably from 4 to 25% by weight.

[0052] The lubricant composition can be applied to the conveyor systems continuously or at intervals (intermittently). According to the invention, intermittent application of the lubricant composition is preferred because of the reduced lubricant usage. The ratio to application time to non-application time may be from 3:1 to 1:500, depending if the lubricant composition maintains an appropriate coefficient of friction in between lubricant applications. Specifically, the lubricant composition may be applied for a period of time and then not applied for at least 15 minutes, at least 30 minutes, or at least 45 minutes or longer. The application period may be long enough to spread the composition over the conveyor belt (i.e. one revolution of the conveyor belt).

[0053] The lubricant composition is preferably applied to the conveyor surface at a location that is not populated by packages or containers. For example, it is preferable to apply the lubricant spray upstream of the package or container flow or on the inverted conveyor surface moving underneath and upstream of the container or package.

[0054] Application of the lubricant composition can be carried out using any suitable technique including spraying, wiping, brushing, drip coating, roll coating, and other methods for application of a thin film.

[0055] The subject matter of the present invention also includes the use of the lubricant composition defined above for lubricating conveyor systems.

[0056] A variety of kinds of conveyors systems and conveyor parts can be lubricated with the lubricant composition. Parts of the conveyor that support or guide or move the containers and thus are preferably coated with the lubricant composition include belts, chains, gates, chutes, sensors, and ramps having surfaces made of fabrics, metals, plastics, composites, or combinations of these materials.

[0057] The conveyor systems, which can be lubricated by the process according to the invention, can be systems for a variety of materials including glasses; plastics (e.g., polyolefins such as polyethylene and polypropylene; polystyrenes; polyesters such as polyethylene terephthalate (PET) and polyethylene naphthalate (PEN); polyamides, polycarbonates (PC); and mixtures or copolymers thereof); metals (e.g., aluminum, tin or steel); papers (e.g., untreated, treated, waxed or other coated papers); cartons (like the commercially available Tetra Pack[®] or SIG Combibloc[®] containers); (ceramics; and laminates or composites of two or more of these materials (e.g., laminates of PET, PEN or mixtures thereof with another plastic material). The containers can have a variety of sizes and forms, including cartons (e.g., waxed cartons, Tetra Pack[®] or SIG Combibloc[®] containers), cans, bottles, drums and the like. Preferably, the systems are suitable for glass bottles, plastic bottles such as polyethylene terephthalate (PET) or polycarbonate (PC) bottles, cans, glass containers and cartons containers (i.e. Tetra Pack[®] or SIG Combibloc[®] containers) and similar items. Said conveyor systems can particularly be found in the foodstuff industry.

[0058] The lubricant composition 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.

[0059] The pH of the lubricant composition is preferably between 2.0 and 7.0, more preferably between 4.0 and 6.0.

[0060] The viscosity of the lubricant composition ranges from 50 to 20,000 mPa·s at 20°C, more preferably from 100 to 10,000 mPa·s at 20°C.

[0061] As solubilizing agents, the lubricant partially diluted composition may contain solubilizing agents that can be mixed with water or that are water-soluble. Preferably, the following solubilizers are used:

- urea;
- C₁-C₆ alcohols, like methanol, ethanol, n-propanol, i-propanol, n-butanol;
- ethylene glycol and/or butyl diglycol;
- propylene glycol;
- polyethylene glycol;
- lower and higher molecular weight polyethyleneglycols [HO-(CH₂-CH₂-O)_n-H] such as PEG-150, PEG-300, PEG-500, PEG-2000, PEG-3500 or PEG-8000;
- methoxy polyethylene glycols [CH₃O-(CH₂-CH₂-O)_n-H] having an average molecular weight ranging from 150 to 5000, such as MPEG-350, MPEG-500, MPEG-750, MPEG-1000, MPEG-2000, MPEG-3000 or MPEG-5000;

- vegetable oils,
- mixtures of alkoxyated glycerides derived from carboxylic acids containing between 6 and 22 carbons and alkoxyated glycerin, as described in the European patent applications EP-A-0579887, EP-A-0586323, and EP-A-1045021, and those commercially available under the trademark LEVENOL[®] and marketed by KAO Chemicals Europe like Glycereth-2 Cocoate; Glycereth-7 Cocoate and Glycereth-17 Cocoate;
- ethoxylated rapeseed fatty acid amide, preferably Polyoxyethylene (4) Rapeseedamide;
- alkoxyated, preferably ethoxylated glycerol with 1 to 30 moles of ethylene oxide, like Glycereth-6, Glycereth-7 or Glycereth-26;
- products of the addition of 1 to 30 moles of ethylene oxide and/or 0 to 5 moles of propylene oxide onto linear C₆-C₂₂ fatty alcohols, C₁₂-C₂₂ fatty acids and alkyl phenols containing 8 to 15 carbon atoms in the alkyl group and alkylamines containing 8 to 22 carbon atoms in the alkyl group;
- alkyl and/or alkenyl oligoglycosides containing 8 to 22 carbon atoms in the alkyl group and ethoxylated analogs thereof;
- addition products of 1 to 15 moles of ethylene oxide with castor oil and/or hydrogenated castor oil;
- addition products of 15 to 60 moles of ethylene oxide with castor oil and/or hydrogenated castor oil;
- partial esters of glycerol and/or sorbitan with unsaturated, linear or saturated, branched fatty acids containing 12 to 22 carbon atoms and/or hydroxycarboxylic acids containing 3 to 18 carbon atoms and addition products thereof with 1 to 30 moles of ethylene oxide like, PEG 18 Glyceryl Oleate / Cocoate;
- partial esters of polyglycerol (average degree of self-condensation 2 to 8), polyethylene glycol (weight average molecular weight 400 to 5000), trimethylolpropane, pentaerythritol, sugar alcohols (for example sorbitol), alkyl glucosides (for example methyl glucoside, butyl glucoside, lauryl glucoside) and polyglucosides (for example cellulose) with saturated and/or unsaturated, linear or branched fatty acids containing 12 to 22 carbon atoms and/or hydroxycarboxylic acids containing 3 to 18 carbon atoms and addition products thereof with 1 to 30 moles of ethylene oxide;
- mixed esters of pentaerythritol, fatty acids, citric acid and fatty alcohol and/or mixed esters of fatty acids containing 6 to 22 carbon atoms, methyl glucose and polyols, preferably glycerol or polyglycerol;

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 lubricant partially diluted composition.

[0062] The disinfectants that could be contained in the lubricant partially diluted composition 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). 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 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. Lubricant partially diluted compositions

[0064] The lubricant partially diluted compositions of Table 2 were prepared. The lubricant concentrated composition, which is diluted to obtain the lubricant partially diluted compositions of Table 2 is described in Table 1. The values are referred to weight percentage.

Table 1. - Lubricant concentrated composition (components as active matter)

	Amount
Polyoxyethylene (3) oleyl phosphate ester ¹	29.5
Polyoxyethylene (2) oleyl ether carboxylic acid ²	27.6
Polyoxyethylene (5) oleyl ether carboxylic acid ³	3.4
Polyoxyethylene (8) capryl ether carboxylic acid ⁴	16.7
Oleic Acid	12.1

(continued)

	Amount
Oleyl alcohol	7.3
Deionized water	3.4
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 5 ⁴ Caprylic ether carboxylic acid with an average ethoxylation degree of 8	

Table 2. - Lubricant partially diluted compositions (components as active matter)

	Composition	Concentration
1	Concentrated composition of Table 1	10 wt.% dilution in water*
2	Concentrated composition of Table 1	10 wt.% dilution in oleyl alcohol
3	Concentrated composition of Table 1	10 wt.% dilution in mineral oil
* tap water from Emmerich am Rhein (Germany), specifically of hardness 17°dH (German degrees) according to the regulation UNE-EN 12829		

Example 2. Lubrication in conveyor systems

[0065] Tests to measure friction resistance were performed for glass bottles, PET bottles and drinking cans on a stainless steel conveyor belt under the following conditions:

- Speed of bottles/drinking cans: approximately 0.5 m/s.
- Continuous/discontinuous spraying of the conveyor belt with a lubricant composition as indicated in Table 3.
- Spraying concentration of the nozzle: approximately 15 g/hour.
- For glass bottles: 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.
- For PET bottles: measurement of the resistance of 6 PET bottles type "weiße Brunnen-Einheitsflaschen 0.5 L" (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.
- For drinking cans: measurement of resistance of 5 Coca-Cola drinking cans 0.33 L, original filled, as a tensile force using a dynamometer. These drinking cans are arranged in a plastic frame for drinking cans that permits their rotation on the belt but prevents them from toppling over.

[0066] The dynamic friction coefficient (μ) is defined as the coefficient between the tensile force measured for a bottle or drinking can and the weight of this bottle or drinking can expressed in grams. This coefficient is determined when a constant value is obtained.

[0067] Foam production is controlled visually. The compositions according to the invention present no foam formation or slightly foam formation.

[0068] Table 3 shows the friction coefficients obtained for the lubricant compositions described in Table 2 of Example 1 as well as for comparative experiment (C1)

Table 3. - Friction coefficients (μ)

Lubricant composition	Friction coefficients (μ)			Spraying
	Glass bottles	PET bottles	Drinking cans	
1	0.11	0.08	0.13	Continuous dosage over 60 min
2	0.11	0.08	0.11	Continuous dosage over 60 min
	0.11	0.08	0.11	After 30 min drying time without further dosage
3	0.13	0.10	0.12	Continuous dosage over 60 min
	0.13	0.10	0.11	After 30 min drying time without further dosage
C1*	0.38	0.13	0.30	Continuous dosage over 60 min
* Dry lubricant commercially available (Teflon in mineral oil)				

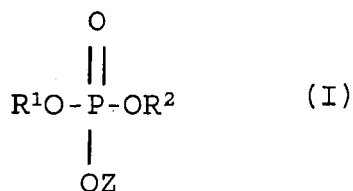
[0069] From the experimental results it can be shown that the method according to the invention permit to reduce the friction over the conveyor system (lower friction coefficients) in comparison with the comparative experiment for glass bottles, PET bottles and drinking cans. Thus, more versatile lubricant compositions for conveyor systems can be obtained.

[0070] Additionally, the friction coefficient obtained with the lubricant partially diluted compositions 2-5 was maintained stable for 30 minutes after said compositions were applied to the conveyor belt for the different type of recipients (glass bottles, PET bottles and drinking cans)

Claims

1. Method for lubricating conveyor systems consisting of applying, continuously or at intervals, a lubricant composition comprising the following essential elements, expressed as weight percentage,

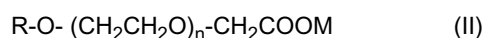
- a) one or more phosphoric acid esters of formula (I)



wherein

- R^1 represents a linear or branched, saturated or unsaturated $\text{C}_6\text{-C}_{22}$ alkyl and/or alkenyl group, or a $\text{R}^3(\text{OCH}_2\text{CH}_2)_m$ group;
- R^2 represents hydrogen, a linear or branched, saturated or unsaturated $\text{C}_6\text{-C}_{22}$ alkyl and/or alkenyl group, or a $\text{R}^3(\text{OCH}_2\text{CH}_2)_m$ group ;
- R^3 represents hydrogen or a linear or branched, saturated or unsaturated $\text{C}_6\text{-C}_{22}$ alkyl and/or alkenyl group;
- m represents a number of from 1 to 15; 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;
- n 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;

- c) one or more C₆-C₂₂ fatty acids, optionally ethoxylated with 1 to 20 moles of ethylene oxide;
- d) one or more C₆-C₂₂ fatty alcohols, optionally ethoxylated with 1 to 20 moles of ethylene oxide,
- e) an inert solvent or mixture thereof,

wherein the active matter concentration of said lubricant composition ranges from 1 to 99% by weight.

2. Method according to claim 1, wherein the active matter concentration of the lubricant composition ranges from 2 to 75% by weight, preferably from 3 to 50% by weight.

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

4. Method 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.

5. Method 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.

6. Method according to any of the preceding claims, comprising, wherein the lubricant composition comprises the following essential elements, expressed as weight percentage,

- a) 0.1-85% of the phosphoric acid esters of formula (I)
- b) 0.1-60% of the ether carboxylates of formula (II)
- c) 0.1-30% of the fatty acids
- d) 0.1-30% of the fatty alcohols
- e) up to 100% of an inert solvent or mixture thereof,

wherein the active matter concentration of the lubricant composition ranges from 1 to 99% by weight.

7. Method 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.

8. Method according to claim 7, 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 10:1 to 1:5.

9. Method according to any of the preceding claims 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.

10. Use of a lubricant composition according to any one of the preceding claims for lubricating conveyor systems.

11. Use according to claim 10 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.



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 01 8934

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	"Lubricant compositions" June 2006 (2006-06), RESEARCH DISCLOSURE, MASON PUBLICATIONS, HAMPSHIRE, GB , XP007136289 ISSN: 0374-4353 * abstract *	1-11	INV. C10M173/02 C10M141/10
E	EP 1 840 196 A (KAO CHEMICALS GMBH [DE]) 3 October 2007 (2007-10-03) * the whole document *	1-11	
Y	EP 1 690 920 A (JOHNSON DIVERSEY INC [US]) 16 August 2006 (2006-08-16) * paragraphs [0046] - [0063], [0087] - [0095]; claims 1,2,6,8,10,12,13; examples C1,5,6 *	1-11	
Y	EP 1 123 969 A (MOBIL OIL FRANCE [FR]) 16 August 2001 (2001-08-16) * claim 10; table 1 *	1-11	
Y	US 5 080 814 A (AWAD SAMI B [US]) 14 January 1992 (1992-01-14) * claims 1,8,11 *	1-11	TECHNICAL FIELDS SEARCHED (IPC) C10M
Y	US 5 062 979 A (SCHARF ROLF [DE] ET AL) 5 November 1991 (1991-11-05) * examples 1-4 *	1-11	
Y	EP 1 652 909 A (THEUNISSEN HELMUT [DE]) 3 May 2006 (2006-05-03) * example 3; table 2 *	1-11	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 21 November 2007	Examiner Pöllmann, Klaus
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

5

EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 07 01 8934

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

21-11-2007

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 1840196	A	03-10-2007	WO 2007112917 A2	11-10-2007
EP 1690920	A	16-08-2006	AU 2006214666 A1	24-08-2006
			CA 2597538 A1	24-08-2006
			WO 2006088658 A1	24-08-2006
EP 1123969	A	16-08-2001	AT 277151 T	15-10-2004
			AU 3924901 A	20-08-2001
			BR 0108158 A	21-01-2003
			CA 2397228 A1	16-08-2001
			CN 1398293 A	19-02-2003
			DE 60105777 D1	28-10-2004
			DE 60105777 T2	23-02-2006
			WO 0159045 A1	16-08-2001
			JP 2003522281 T	22-07-2003
			US 2003158049 A1	21-08-2003
US 5080814	A	14-01-1992	NONE	
US 5062979	A	05-11-1991	CA 1331175 C	02-08-1994
			DE 3831448 A1	22-03-1990
			EP 0359145 A1	21-03-1990
			ES 2045316 T3	16-01-1994
			GR 3003605 T3	16-03-1993
			IE 62493 B1	08-02-1995
			JP 2115296 A	27-04-1990
			JP 2763345 B2	11-06-1998
EP 1652909	A	03-05-2006	AR 055503 A1	22-08-2007
			AU 2005296748 A1	27-04-2006
			WO 2006042730 A1	27-04-2006

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 2007002772 W [0008] [0012] [0043]
- EP 0579887 A [0061]
- EP 0586323 A [0061]
- EP 1045021 A [0061]

Non-patent literature cited in the description

- Polyether Carboxylates; Anionic Surfactants. **MEIJER ; SMID**. Surfactant Science Series. vol. 56, 313-361 [0025]
- Guía de Plaguicidas utilizados en Higiene Alimentaria y Salud Pública. Spanish Health Ministry [0062]