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(54) **CHAIN LUBRICANTS**

KETTENGLEITMITTEL

LUBRIFIANTS DE CHAÎNE

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**WO-A-02/20380 DE-A- 19 934 170**  
**US-A- 3 213 024 US-A1- 2002 115 573**

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**EP 1 646 706 B1**

**Description**

**[0001]** The present invention is directed to a concentrate and lubricant solution for the use as a lubricant for the lubrication of conveyor belt systems in food and beverage plants.

**[0002]** In the food industry, in particular in beverage plants, the containers that are to be filled in the filling plants are transported by means of conveyors in a wide variety of designs and materials, for example by means of apron conveyors or chain-type arrangements, which will be referred to in general terms below as conveyor chains. The conveyor chains are made of different materials, i.e. plastic or metal. The conveyors link the various optional treatment stages of the filling process, such as e.g. unpacker, bottle washing machine, filler, sealer, labeler, packer, etc. The containers can come in a wide variety of forms, in particular glass and plastic bottles, cans, jars, casks, drink containers (KEG), paper and cardboard containers. To ensure that the operation proceeds smoothly, the conveyor chains must be lubricated by suitable means such that excessive friction on the containers is avoided. Diluted aqueous solutions containing suitable antifriction agents are conventionally used for lubrication. The conveyor chains are brought into contact with the aqueous solutions by immersion or spraying, for example, whereby reference is then made to splash lubrication plants or automatic belt lubrication systems.

**[0003]** In order to minimize the abrasion of the chains, a lubricant is applied to the surface of the chains, whereby the friction coefficient of the chain with the container should not exceed a specific value. Otherwise the chain will be damaged involving further costs. Moreover, the container can fall down on the chains during transportation which will result in ceasing of filling said container since such bottles and cans have to be removed manually. Thus, a reliable lubrication of the chains with the lubricant used is very important.

**[0004]** The chain lubricants that have been used so far and are still used today as lubricating agents for conveyor belt systems are mainly based on fatty acids in the form of their water-soluble alkali or alkanol amine salts or on fatty amines, preferably in the form of their organic or inorganic salts, i.e. their acetates. Such lubricants are for example described in DE-A-36 31 953, EP-A-0 372 628, DE-A-39 05 548, DE-A-42 06 506, and WO 94/03562.

**[0005]** Also, amine-free lubricants are known and described for example in WO 03/027217 A1. This document relates to the use of an oil-in-water emulsion for lubricating a conveyor belt system. It contains wax esters, like cetyl palmitate, hydrogenated castor oil, glyceryl stearate, ethoxylated behenyl alcohol, formic acids and betaines as zwitterionic amphoteric surfactants. E-P-A-1 197 544 discloses emulsions for lubricating chains and conveyors.

**[0006]** From the point of view of the user, however, the chain lubricants used still present the problem that they either adhere too poorly to the chains or attach too strongly to the chains.

**[0007]** Where chain lubricants adhere too poorly to the chains they drip onto the ground soon after application, with the result that the lubricating effect on the chains, which are several meters in length, is extremely dependent on the proximity to the metering point. The same problem occurs at places where there is a risk of the lubrication film rapidly being removed from the surface by spilled beverage. The consequence is that very different qualities of lubrication can occur from one section to another. In critical sections this commonly leads to bottles falling over and even to interruption of the filling operation.

**[0008]** Where chain lubricants adhere very well to the chains, as is the case with fluoro groups containing surfactants, for example, which have very good wetting properties, a firmly adhering film is formed on the conveyor chains, which cannot easily be removed by rinsing with water.

**[0009]** Residues and abraded material can collect in this film and lead to hygiene problems and breakdowns in operation.

**[0010]** Generally, container are made of glass or a plastic material such as a polyester. Poly(ethylene terephthalate) (PET) is very often used to manufacture plastic bottles.

**[0011]** In case that glass bottles are transported the lubrication of the composition according to the state of the art is not sufficient. Glass bottles can fall off the conveyor chain and thus a secure transportation of glass bottles can not be assured. Furthermore, due to an insufficient lubrication the abrasion of the chains used is not acceptable.

**[0012]** Other lubricants known in the prior art show a similar behavior. They are either suitable as lubricant for transporting container made of a plastic material or container made of glass. None of the compositions known in the prior art are capable of serving as lubricant in a bottling plant for all types of container material such as glass bottles, plastic bottles as well as cans.

**[0013]** For convenience reasons a manufacturer of for instance beverage wants to fill all kinds of containers like glass bottles, plastic bottles as well as cans with the same bottling plant. At present he has to use a specific lubricant for each type of container to be filled. Thus, further costs and a significant downtime of the bottling plant are due to the specific selection or exchange of lubricants for each type of container to be filled.

**[0014]** The technical problem underlying the present invention is the provision of a lubricant suitable for container such as bottles made of glass, bottles made of a plastic material such as polyester or cans in a bottling plant, whereby the chains used in the bottling plant may be made of a metal and/or a plastic material. Furthermore, the lubricant shall provide good adhesion to the chains, display good lubricating properties and shall form a film on the chains that can

easily be removed, if necessary.

**[0015]** The technical problem underlying the present invention is solved by a concentrate for use as chain lubricant as defined in claim 1.

**[0016]** Preferably, R<sup>1</sup> is an alkyl group having 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21 or 22 carbon atoms or R<sup>1</sup> is an alkenyl group having 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, or 22 carbon atoms.

**[0017]** Preferably, R<sup>2</sup> is an alkyl group having 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21 or 22 carbon atoms or R<sup>2</sup> is an alkenyl group having 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, or 22 carbon atoms.

**[0018]** Preferably R<sup>3</sup> is an alkylene group having 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, or 16 carbon atoms.

**[0019]** The concentrate comprises at least one amphoteric surfactant.

**[0020]** In a preferred embodiment the sum of carbon atoms present in R<sup>1</sup>, R<sup>2</sup> and R<sup>3</sup> of each monoester or diester is at least 12, even more preferred at least 15, and most preferred at least 20.

**[0021]** The concentrate is an emulsion or microemulsion being preferably an oil-in-water or a water-in-oil emulsion.

**[0022]** 0,1 to 12 wt.-%, even more preferred 0,15 to 10 wt.-%, preferably 0,2 to 8 wt.-% and even more preferred 0,25 to 6 wt.-% of the ester is present in the concentrate.

**[0023]** 0,2 to 8 wt. % and most preferred 0,25 to 6 wt.-% of the anionic surfactant is present in the concentrate.

**[0024]** 0,2 to 8 wt. % and most preferred 0,25 to 6 wt.-% of the amphoteric surfactant is present in the concentrate.

**[0025]** The ester is preferably selected from the group consisting of methyl ester or isopropyl ester of fatty acids having 12 to 22 carbon atoms, methyl laurate, methyl stearate, methyl oleate, methyl erucate, isopropyl palmitate, isopropyl myristate, isopropyl stearate, n-butyl stearate, n-hexyl laurate, n-decyl oleate, isooctyl stearate, isononyl palmitate, isononyl isononanoate, 2-ethylhexyl palmitate, 2-ethylhexyl laurate, 2-hexyldecyl stearate, 2-octyldecyl palmitate, oleyl oleate, oleyl erucate, erucyl erucate, cetyl palmitate, beheneth-10, esters of technical aliphatic alcohol mixtures with technical aliphatic carboxylic acids, esters of saturated and/or unsaturated fatty alcohols having 12 to 22 carbon atoms with saturated and/or unsaturated fatty acids having 12 to 22 carbon atoms, naturally occurring monoester or waxy ester mixtures as occurring in jojoba oil or sperm oil, di-n-butyl adipate, di-n-butyl sebacate, di-(2-ethylhexyl) adipate, di-(2-hexyldecyl) succinate, di-isotridecyl acealate, ethylenglycol dioleate, ethylenglycol-di-isotridecanoate, propyleneglycol-di-(2-ethylhexanoate), butanediol-di-isostearate, neopentylglycol-di-caprylate and mixtures thereof.

**[0026]** The anionic surfactant is selected from the group consisting of sulfonate salt, alkali sulfonate salt, alkyl benzene sulfonic acid, alkali alkyl benzene sulfonate, alkyl sulfonic acid, alkali alkyl sulfonate, alkali alkyl sulfate, alkali alkenyl sulfate, fatty acid ether sulfate, fatty alcohol sulfonate, secondary alkane sulfonate sodium salt and mixtures thereof.

**[0027]** The amphoteric surfactant is selected from the group consisting of ampholyte, betaine, alkylbetaine, N-alkylbetaine, glycinate, amphodiacetate, hydroxysultaine, amine oxide, lecithine, carboxylic acid, sphingomyceline, amino alkene acid, sodium alkyl iminopropionate and mixtures thereof.

**[0028]** Optionally, the concentrate further comprises at least one glyceride selected from the group consisting of triglyceride, diglyceride, monoglyceride, fatty acid triglyceride of fatty acids having 8 to 22 carbon atoms, glyceryl stearate and mixtures thereof. The glycerides can be naturally occurring vegetable oils such as olive oil, rapeseed oil, sunflower oil, soy oil, peanut oil, almond oil, palm kernel oil or the fluid part of coconut oil or palm kernel oil. Moreover the glycerides can be of animal occurrence. In a preferred embodiment the glycerides are castor oil, preferably hydrogenated castor oil. Preferably, the mono and diesters and glycerides as oily components of the composition according to the present invention are liquid at a temperature of 20 °C. It is also possible that higher melting fats and esters of the general formulae (1), (2) or (3) as given above are used in an amount so that the mixture of the oily compounds is liquid at a temperature of 20 °C.

**[0029]** Preferably, the concentrate according to the present invention comprises of from 0,015 to 15 wt.-% of the glyceride.

**[0030]** Preferably, 0,05 to 10 wt.-%, even more preferred 0,1 to 5 wt.-%, even more preferred 0,2 to 3 wt.-% and most preferred 0,3 to 2 wt.-% of the glyceride is present in the concentrate.

**[0031]** In a preferred embodiment the concentrate further comprises a hydrocarbon oil, whereby preferably 0,01 to 15 wt.-% of the hydrocarbon oil, more preferred 0,015 to 10 wt.-%, even more preferred 0,05 to 5 wt.-%, most preferred, 0,1 to 3 wt.-% of the hydrocarbon oil is present in the concentrate. In a further preferred embodiment 0,2 to 2 wt.-% and even more preferred 0,3 to 1,5 wt.-% of the hydrocarbon oil is present in the concentrate.

**[0032]** The concentrate may comprise at least one further emulsifier being different from the compounds as defined above.

**[0033]** Preferably, the emulsifier is selected from the group consisting of nonionic emulsifier, ethylene oxide adducts with fatty alcohols having 16 to 22 carbon atoms, partial esters of polyols having 3 to 6 carbon atoms with fatty acids having 14 to 22 carbon atoms and mixtures thereof.

**[0034]** In case the further emulsifier is present in the concentrate according to the present invention, preferably 0,005 to 20 wt.-% of the emulsifier is present in the concentrate. Preferably 0,01 to 15 wt.-%, more preferred 0,025 to 10 wt.-%, even more preferred 0,05 to 5 wt.-% and most preferred 0,075 to 3 wt.-% of the emulsifier is present in the concentrate.

**[0035]** The concentrate may comprise a further co-emulsifier, whereby the co-emulsifier is preferably of the type of a

saturated fatty alcohol having 16 to 22 carbon atoms and/or a partial ester of polyols having 3 - 6 carbon atoms with a fatty acid having 14 to 22 carbon atoms.

**[0036]** The concentrate may further comprise at least one additive selected from the group consisting of disinfectant, preservative, thickener, solubilizer, antifoaming agent, corrosion inhibitor, alkaline substance, sequestering agent, complexing agent and mixtures thereof.

**[0037]** Preferred preservatives are formic acid, benzoic acid, and peracetic acid.

**[0038]** Another suitable additive is preferably glyceride stearate, glycerine diglycerine, a diglycerine monoester, a glycerine diester, glycerine and mixtures thereof.

**[0039]** A preferred disinfectant is selected from the group of alcohols, aldehydes, antimicrobial acids, carboxylic acid esters, acid amides, phenols, phenol derivatives, biphenylenes, biphenyl alkanes, urea derivatives, oxygen acetals, nitrogen acetals, oxygen formales, nitrogen formales, benzamidines, isothiazolines, phthalimide derivatives, pyridine derivatives, antimicrobial surface active compounds, guanidines, antimicrobial amphoteric compounds, quinolines, 1,2-dibromo-2,4-dicyano butane, iodo-2-propynyl-butyl-carbamate, iodine, iodophores, peroxides, peracids, peracetic acid, ClO<sub>2</sub>, quaternary ammonium compounds, glucoprotamine and mixtures thereof.

**[0040]** The present invention is directed further to a lubricant solution comprising the concentrate as defined above and a suitable diluent.

**[0041]** The diluent is preferably water and a degree of dilution of the concentrate with water is preferably of from 1:20 to 1:5.000. In another preferred embodiment the degree of dilution of the concentrate with water is of from 1:30 to 1:2000, more preferred 1:40 to 1:1000 and most preferred 1:50 to 1:500.

**[0042]** The concentrate or the lubricant solution according to the present invention can be used as a lubricant.

**[0043]** Preferably, a chain being preferably a part of a bottling plant which is preferably a conveyer chain or a conveyer belt is lubricated with the concentrate or lubricant solution according to the present invention.

**[0044]** In a preferred embodiment the chain has an outer surface comprising a metal and/or a plastic material. With said chain container such as bottles and/or cans are transported.

**[0045]** In case that container such as bottles are transported with the chain, the container or bottles are preferably made of glass or a plastic material, being preferably a polyester such as poly(ethylene terephthalate) or polycarbonate, poly(ethylene naphthenate) or polyurethane. Preferably, the container such as cans are made of a metal. It is preferred that the bottle is a refillable bottle being preferably a refillable plastic bottle such as a refillable poly(ethylene terephthalate) bottle (REFPET).

**[0046]** Preferably, when transported with the chain the container being preferably bottles and/or cans are empty or filled with preferably food or beverage

**[0047]** Preferably, the concentrate or lubricant solution is used as antistatic agent.

**[0048]** A further object of the present invention is the provision of a process of conveying container being preferably bottles and/or cans on a chain being preferably a conveyer chain or a conveyer belt, whereby the concentrate or lubricant solution is applied to the chain, preferably on the area of the chain with which the container being preferably bottles and/or cans are transported.

**[0049]** The concentrate or lubricant solution can be applied to the chain by application means customary to a person skilled in the art. Preferably, the concentrate or lubricant solution is sprayed to the chain by means of a nozzle or applied by immersion of the chain. Alternatively, the concentrate or lubricant solution can be applied to the bottom of the container to be conveyed. This can be done by spraying or immersing the bottom of the container in the concentrate or lubricant solution.

**[0050]** In a preferred process, the concentrate or lubricant solution is not applied continuously but periodically to the chain. Preferably, for each period the time in which the concentrate or lubricant solution is applied to the chain is shorter than the time in which no concentrate or lubricant solution is applied to the chain. Preferably, the time in which no concentrate or lubricant solution is applied to the chain is twice as long, preferably three times as long, more preferred four times as long and most preferred five times as long as the time in which the concentrate or lubricant solution is applied to the chain. Preferably, for each period the sum of the time in which the concentrate or lubricant solution is applied to the chain with the time in which the concentrate or lubricant solution is not applied to the chain is less than 10 minutes, more preferred less than 8 minutes, even more preferred less than 6 minutes and most preferred less than 4 minutes.

**[0051]** The concentrate and lubricant solution according to the present invention is superior compared with the compositions known in the prior art. Due to an extremely high lubricant persistency on the chains such as conveyor chains or conveyor belts compared with conventional state of the art techniques the lubricant dosage can be adjusted very flexibly to approximately 1 minute dosage and 5 minutes pause. The frequency of dosing can be extended according to the customer's condition and demands to a wider time frame or to a combination of lubrication dosage, followed by pure water dosage until the lubrication film is used up.

**[0052]** Unexpectedly, the concentrate and lubricant solution according to the present invention has an excellent emergency lubrication behavior, which means that a dried lubrication film is capable of lubricating sufficiently. Moreover, a

dried lubrication film can be reanimated only with a small amount of water.

**[0053]** Advantageously, the formulations according to the present invention are foam-free or very low on foam so that very high use-concentrations during the application are possible.

**[0054]** In a preferred embodiment a cleaning and/or disinfecting substance can be integrated into the concentrate or lubricant solution.

**[0055]** A further advantage of the concentrate and lubricant solution according to the present invention is that the lubricant comprises compounds only which are compatible with milk, soft-drinks and beer.

**[0056]** Due to the flexible dosage concept, the new concentrate and lubricant solution offers an environmentally favorable concept with significant lubricant and water savings up to 70 to 80 % which influences also, to a large extent, waste water treatment costs and provides energy saving opportunities.

**[0057]** Unexpectedly, there is no influence of the water hardness on the capability of the concentrate and lubricant solution according to the present invention over a wide range of water hardnesses, i.e. between 0° and 25° German hardness.

**[0058]** The new concentrate and lubricant solution according to the invention displays a new range of amine free lubricants for all kind of containers and is suitable for plastic and metal conveyors. It can be applied as a one part solution with integrated disinfectants as well as a two component system in combination with a disinfecting product. The lubrication is excellent compared to the known amine acetate lubricants. Furthermore, when using the product according to the invention in the case of PET bottles and plastic container reduced stress cracking is observed. The lubricant has high water hardness and ion compatibility.

**[0059]** The following examples describe the invention in more detail without limiting it to the specific scope mentioned in the examples.

## Examples

### 1. Preparation of the concentrate and lubricant solution

**[0060]** The concentrate was manufactured by mixing the ingredients given in table 1 according to methods known to a person skilled in the art. First, Lamesoft® PW 45 BENZ, the alkyl betaine and the secondary alkane sulfonate sodium salt are mixed. Subsequently water is added and the obtained solution is stirred. At last formic acid is added under stirring. Optionally, the concentrate can be filtered at any step of production of the concentrate.

Table 1

Compound	Parts by weight [wt-%]
Lamesoft® PW 45 BENZ <sup>1)</sup>	6
alkyl betain, amphoteric surfactant	2
secondary alkane sulfonate sodium salt, anionic surfactant	2,4
Formic acid	0,2
Water	rest
1) Lamesoft® PW 45 BENZ was purchased from Cognis Deutschland GmbH & Co. KG and is produced according to the teaching of EP 0 345 586, (emulsion of nonionic wax-like constituents and emulsifier comprising >20-40 wt-% cetyl palmitate, >5-10 wt-% beheneth-10, >1-5 wt-% hydrogenated castor oil, >1-5 wt-% glyceryl stearate, > 40-70 wt-% water, 0,2 wt-% benzoic acid). Alternatively, Lamesoft® PW 45 can be used (same composition as Lamesoft® PW 45 BENZ with the exception that formic acid is present instead of benzoic acid)	

**[0061]** The concentrate according to table 1 was diluted with water in a ratio of concentrate to water of 1:333 (0,3 wt-% of the concentrate in water) to obtain a lubricant solution for use as lubricant in the test run.

### 2. Test run in a bottling plant

**[0062]** The obtained lubricant solution was applied to a conveyor chain of a bottling plant by means of a nozzle. The bottling plant had a conveyor chain made of metal. An obstacle having a load cell was positioned at the end of the conveyor chain so as to measure the tensile stress of the bottles pushed against said obstacle. Either bottles made of glass or refillable bottles made of poly(ethylene terephthalate) (REFPET; 1 L or 1,5L volume) were transported with the conveyor chain. The lubricant solution was either dosed for 50 seconds to the chain and subsequently 50 seconds no

lubricant solution was applied to the chain or the lubricant solution was applied for 1 minute to the chain followed by a 5 minute pause of dosage. The friction coefficient is the quotient of the tensile stress measured with the weight of the bottles pushed against the obstacle (table 2, 4<sup>th</sup> column).

**[0063]** The friction coefficient for the emergency run was measured as follows: The obtained lubricant solution was applied for 5 minutes to the running conveyor chain. Subsequently, for each test run several test bottles characterized in table 2 were positioned on the conveyor chain. The bottles were transported on the conveyor chain and pushed against the obstacle positioned at the end of the conveyor chain. For 35 minutes the lubricant solution was applied to the chain in a 10 second dosage / 10 second pause sequence.

**[0064]** Subsequently, the dosage of the lubricant solution was ceased and after 15 minutes the tensile stress of the bottles with the obstacle was measured. The friction coefficient for the emergency run is the quotient of the measured tensile stress with the weight of the bottles pushed against the obstacle (table 2, 5<sup>th</sup> column).

Table 2

chain material	bottle material	Dosage	friction coefficients [1]	friction coefficient of emergency run [1]
Metal	glass	50 s lubricant solution / 50 s pause	0,35-0,06	0,06
Metal	glass	1 min lubricant solution / 5 min pause	0,05-0,06	0,07-0,09
Metal	REFPET, 1L volume	50 s lubricant solution / 50 s pause	0,05-0,06	0,08-0,1
Metal	REFPET, 1L volume	1 min lubricant solution / 5 min pause	0,06-0,07	0,08-0,1
Metal	REFPET, 1,5 L volume	50 s lubricant solution / 50 s pause	0,04-0,05	0,07-0,09
Metal	REFPET, 1,5 L volume	1 min lubricant solution / 5 min pause	0,06-0,07	0,07-0,1

**[0065]** As can be seen from table 2 the friction coefficients measured do not significantly depend on the material of the bottle. The lubrication of the conveyor chain was sufficient in the entire test run. Furthermore the emergency run, which means that the application of lubricant to the chain was ceased, was successful over a sufficient period of time (15 minutes), since the friction coefficient was sufficiently low. A further test exhibited that the emergency run was successful for a longer period of time such as 1,5 to 2 hours. Furthermore, no bottle fell down onto the chain during the entire test runs.

**[0066]** Since the lubrication solution is applied to the chain in a 50 second lubrication dosage followed by a 50 second pause or, alternatively, in a 1 minute lubrication dosage followed by a 5 minute pause the lubricant solution according to the present invention offers a superior dosing concept.

**[0067]** Due to said novel dosage concept, the amount of lubricant necessary is decreased significantly which results in a waste water reduction and, thus, in a significant cost reduction. Furthermore, a persistent film build up after drying of the lubricant solution on the surface of the conveyor chain. Said film can easily be reactivated by spraying water onto said film.

**[0068]** The efficiency of the concentrate and lubricant solution according to the present invention was not depending on the hardness of the water used.

### 3. TNO test

**[0069]** The TNO method was performed to determine the material compatibility (TNO Nutrition and Food Research, Code of Practice, "Guidelines for an Industrial Code of Practice for Refillable Polyester Based Bottles", Edition 2, 2000).

**[0070]** Three new test bottles made of PET are filled with tap water. The bottom of the bottles is dipped for a short moment (approx. 5 s) in the concentrate of table 1 so that the whole bottom of the bottle is in contact with the concentrate (approx. 5 cm deep). Excess concentrate is drained off the bottle (approx. 10s). Subsequently, each test bottle is pressurized with carbon dioxide via a connecting tube and the pressure is increased to approx. 7,5 bar for 30 s. The test bottles are stored under a constant pressure of  $7,5 \pm 0,2$  bar for 72 hours at room temperature and afterwards the pressure is decreased in approx. 30 s to zero. The bottles are emptied and rinsed thoroughly, first with tap water and

finally with demineralized water. After drying, the bottom of each bottle is examined visually whether deviations (e.g. haziness, whitening, cracks) occurred.

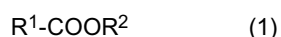
**[0071]** The concentrate of the present invention exhibited a superior test result comparable with the best lubricants known in the prior art. The test bottles were not detrimentally affected by the concentrate of the present invention. No cracks in the test bottles occurred. The test bottles remained clear which means that no haziness occurred during testing. Thus, the concentrate of the present invention is superior compared with the compositions known in the prior art.

## Claims

1. A concentrate for use as chain lubricant comprising:

i. 0,1 to 12 wt-% of at least one ester selected from the group consisting of monoesters and diesters represented by the

1. general formula (1)



2. general formula (2)



3. general formula (3)



and mixtures thereof,

whereby  $R^1$  is a  $C_1$ - $C_{22}$ -alkyl group or a  $C_8$ - $C_{22}$ -alkenyl group,

$R^2$  is a  $C_1$ - $C_{22}$ -alkyl group or a  $C_8$ - $C_{22}$ -alkenyl group,

$R^1$  and  $R^2$  being the same or a different,

$R^3$  is a  $C_2$ - $C_{16}$ -alkylene group, and

the sum of carbon atoms present in  $R^1$ ,  $R^2$  and  $R^3$  of each monoester or diester being at least 10, and

ii. 0,2 to 8 wt-% of at least one anionic surfactant, wherein the anionic surfactant is selected from the group consisting of sulfonate salt, alkali sulfonate salt, alkyl benzene sulfonic acid, alkali alkyl benzene sulfonate, alkyl sulfonic acid, alkali alkyl sulfonate, alkali alkyl sulfate, alkali alkenyl sulfate, fatty acid ether sulfate, fatty alcohol sulfonate, secondary alkane sulfonate sodium salt and mixtures thereof and 0,2 to 8 wt-% of at least one amphoteric surfactant wherein the amphoteric surfactant is selected from the group consisting of ampholyte, betaine, alkylbetaine, N-alkylbetaine, glycinate, amphodiacetate, hydroxysultaine, amine oxide, lecithine, carboxylic acid, sphingomyeline, amino alkene acid, sodium alkyl iminopropionate and mixtures thereof and wherein the concentrate is an emulsion or microemulsion being preferably an oil-in-water or a water-in-oil emulsion.

2. The concentrate according to any of the preceding claims, **characterized in that** the ester is selected from the group consisting of methyl ester or isopropyl ester of fatty acids having 12 to 22 carbon atoms, methyl laurate, methyl stearate, methyl oleate, methyl erucate, isopropyl palmitate, isopropyl myristate, isopropyl stearate, n-butyl stearate, n-hexyl laurate, n-decyl oleate, isooctyl stearate, isononyl palmitate, isononyl isononanoate, 2-ethylhexyl palmitate, 2-ethylhexyl laurate, 2-hexyldecyl stearate, 2-octyldodecyl palmitate, oley oleate, oleyl erucate, erucyl erucate, cetyl palmitate, beheneth-10, esters of technical aliphatic alcohol mixtures with technical aliphatic carboxylic acids, esters of saturated and/or unsaturated fatty alcohols having 12 to 22 carbon atoms with saturated and/or unsaturated fatty acids having 12 to 22 carbon atoms, naturally occurring monoester or waxy ester mixtures as occurring in jojoba oil or sperm oil, di-n-butyl adipate, di-n-butyl sebacate, di-(2-ethylhexyl) adipate, di-(2-hexyldecyl) succinate, di-isotridecyl acealate, ethylenglycol dioleate, ethylenglycol-di-isotridecanoate, propyleneglycol-di-(2-ethylhexanoate), butanediol-di-isostearate, neopentylglycol-di-caprylate and mixtures thereof.

3. The concentrate according to any of the preceding claims, **characterized in that** the concentrate further comprises at least one glyceride selected from the group consisting of triglyceride, diglyceride, monoglyceride, fatty acid trig-

lyceride of fatty acids having 8 to 22 carbon atoms, glyceryl stearate and mixtures thereof.

4. The concentrate according to claim 3, **characterized in that** the concentrate comprises of from 0,01 to 15 wt-% of the glyceride.
5. The concentrate according to any of the preceding claims, **characterized in that** the concentrate further comprises a hydrocarbon oil.
6. The concentrate according to claim 5, **characterized in that** the concentrate comprises of from 0,01 to 15 wt-% of the hydrocarbon oil.
7. The concentrate according to any of the preceding claims, **characterized in that** the concentrate further comprises at least one emulsifier being different from the compounds defined in the preceding claims.
8. The concentrate according to claim 7, **characterized in that** the emulsifier is selected from the group consisting of nonionic emulsifier, ethylene oxide adducts with fatty alcohols having 16 to 22 carbon atoms, partial esters of polyols having 3 to 6 carbon atoms with fatty acids having 14 to 22 carbon atoms and mixtures thereof.
9. The concentrate according to claim 7 or 8, **characterized in that** the concentrate comprises of from 0,005 to 20 wt-% of the emulsifier.
10. The concentrate according to any of the preceding claims, **characterized in that** concentrate further comprises at least one additive selected from the group consisting of disinfectant, preservative, thickener, solubilizer, anti-foaming agent, corrosion inhibitor, alkaline substance, sequestering agent, complexing agent and mixtures thereof.
11. A lubricant solution comprising the concentrate according to any of the preceding claims and a suitable diluent.
12. The lubricant solution according to claim 11, **characterized in that** the diluent is water and the degree of dilution of the concentrate with water is preferably of from 1:20 to 1:5000.
13. Use of the concentrate or the lubricant solution according to any of the preceding claims as lubricant.
14. Use of the concentrate or the lubricant solution according to claim 13, **characterized in that** a chain being preferably a conveyor chain or a conveyor belt is lubricated.
15. Use of the concentrate or the lubricant solution according to claim 13 or 14, **characterized in that** the chain has an outer surface comprising a metal and/or a plastic material.
16. Use of the concentrate or lubricant solution according to any of the claims 15 to 16, **characterized in that** container such as bottles and/or cans are transported with the chain.
17. Use of the concentrate or lubricant solution according to claims 16, **characterized in that** the container such as bottles are made of glass or a plastic material being preferably a polyester such as poly(ethylene terephthalate) or polycarbonate, poly(ethylene naphthenate), polyurethane.
18. Use of the concentrate or lubricant solution according to claims 16, **characterized in that** the container such as cans are made of a metal.
19. Use of the concentrate or lubricant solution according to any of the claims 16 to 18, **characterized in that** the container being preferably bottles and/or cans are empty or filed with preferably food and/or beverage.
20. Process of conveying container being preferably bottles and/or cans on a chain being preferably a conveyor chain or a conveyor belt, whereby the concentrate or lubricant solution according to any of the claims 1 to 12 is applied to the chain, preferably on the area of the chain with which the container being preferably bottles and/or cans are transported.
21. The process according to claim 20, **characterized in that** the concentrate or lubricant solution is not applied continuously to the chain.

22. The process according to claim 21, **characterized in that** the time in which the concentrate or lubricant solution is applied to the chain is shorter than the time in which no concentrate or lubricant solution is applied to the chain.

## Patentansprüche

1. Ein Konzentrat zur Verwendung als Kettenschmiermittel, umfassend:

i. 0,1 bis 12 Gew.-% wenigstens eines Esters ausgewählt aus der Gruppe bestehend aus Monoestern und Diestern gemäß

1. der allgemeinen Formel (1)



2. der allgemeinen Formel (2)



3. der allgemeinen Formel (3)



und Mischungen davon,

wobei  $R^1$  eine  $C_1$ - $C_{22}$ -Alkylgruppe oder eine  $C_8$ - $C_{22}$ -Alkenylgruppe ist,

$R^2$  eine  $C_1$ - $C_{22}$ -Alkylgruppe oder eine  $C_8$ - $C_{22}$ -Alkenylgruppe ist,

$R^1$  und  $R^2$  gleich oder verschieden sind,

$R^3$  eine  $C_2$ - $C_{16}$ -Alkylengruppe ist, und

die Summe der in  $R^1$ ,  $R^2$  und  $R^3$  eines jeden Monoesters oder Diesters vorhandenen Kohlenstoffatome mindestens 10 ist, und

ii) 0,2 bis 8 Gew.-% wenigstens eines anionischen Tensids, wobei das anionische Tensid ausgewählt ist aus der Gruppe bestehend aus Sulfonsäuresalz, Alkalisulfonsäuresalz, Alkylbenzolsulfonsäure, Alkali Alkylbenzolsulfonat, Alkylsulfonsäure, Alkali Alkylsulfonat, Alkali Alkylsulfat, Alkali Alkenylsulfat, Fettsäureethersulfat, Fettalkoholsulfonat, sekundäres Alkansulfonat Natriumsalz und Mischungen davon, und 0,2 bis 8 Gew.-% wenigstens eines amphoteren Tensids, wobei das amphotere Tensid ausgewählt ist aus der Gruppe bestehend aus Ampholyt, Betain, Alkylbetain, N-Alkylbetain, Glycinat, Amphodiacetat, Hydroxysultain, Aminoxid, Lecithin, Carbonsäure, Sphingomyelin, Aminoalkensäure, Natriumalkyliminopropionat und Mischungen davon und wobei das Konzentrat eine Emulsion oder Mikroemulsion ist, bevorzugt eine Öl-in-Wasser- oder Wasser-in-Öl-Emulsion.

2. Das Konzentrat gemäß einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Ester ausgewählt ist aus der Gruppe bestehend aus Methylester oder Isopropylester von Fettsäuren mit 12 bis 22 Kohlenstoffatomen, Methyllaurat, Methylstearat, Methyloleat, Methylerucat, Isopropylpalmitat, Isopropylmyristat, Isopropylstearat, n-Butylstearat, n-Hexyl-laurat, n-Decyl-oleat, Isooctylstearat, Isononylpalmitat, Isononylisononanoat, 2-Ethylhexyl-palmitat, 2-Ethylhexyl-laurat, 2-Hexyldecyl-stearat, 2-Octyldodecyl-palmitat, Oleyloleat, Oleylerucat, Erucylerucat, Cetylpalmitat, Beheneth-10, Ester von technischen aliphatischen Alkoholmischungen mit technischen aliphatischen Carbonsäuren, Ester von gesättigten und/oder ungesättigten Fettalkoholen mit 12 bis 22 Kohlenstoffatomen mit gesättigten und/oder ungesättigten Fettsäuren mit 12 bis 22 Kohlenstoffatomen, natürlich vorkommende Monoester oder Wachsestermischungen wie sie in Jojobaöl oder Walratöl vorkommen, Di-n-butyl-adipat, Di-n-butyl-sebacat, Di-(2-ethylhexyl)-adipat, Di-(2-ethylhexyl)-succinat, Di-isotridecyl-acealat, Ethylenglycol-dioleat, Ethylenglycol-di-isotridecanoat, Propylenglycol-di-(2-ethylhexanoat), Butandiol-di-isostearat, Neopentylglycol-di-caprylat und Mischungen davon.
3. Das Konzentrat gemäß einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Konzentrat außerdem wenigstens ein Glycerid ausgewählt aus der Gruppe bestehend aus Triglycerid, Diglycerid, Monoglycerid, Fettsäuretriglycerid von Fettsäuren mit 8 bis 22 Kohlenstoffatomen, Glycerinstearat und Mischungen davon umfasst.

4. Das Konzentrat gemäß Anspruch 3, **dadurch gekennzeichnet, dass** das Konzentrat 0,01 bis 15 Gew.-% Glycerid umfasst.
- 5 5. Das Konzentrat gemäß einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Konzentrat außerdem ein Mineralöl umfasst.
6. Das Konzentrat gemäß Anspruch 5, **dadurch gekennzeichnet, dass** das Konzentrat 0,01 bis 15 Gew.-% Mineralöl umfasst.
- 10 7. Das Konzentrat gemäß einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Konzentrat außerdem wenigstens einen Emulgator umfasst, der nicht zu den in den vorhergehenden Ansprüchen definierten Verbindungen gehört.
- 15 8. Das Konzentrat gemäß Anspruch 7, **dadurch gekennzeichnet, dass** der Emulgator ausgewählt ist aus der Gruppe bestehend aus nichtionischem Emulgator, Addukte von Ethylenoxid und Fettalkoholen mit 16 bis 22 Kohlenstoffatomen, partielle Ester von Polyolen mit 3 bis 6 Kohlenstoffatomen mit Fettalkoholen mit 14 bis 22 Kohlenstoffatomen und Mischungen davon.
- 20 9. Das Konzentrat gemäß einem der Ansprüche 7 oder 8, **dadurch gekennzeichnet, dass** das Konzentrat 0,005 bis 20 Gew.-% Emulgator umfasst.
- 25 10. Das Konzentrat gemäß einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Konzentrat außerdem wenigstens ein Additiv ausgewählt aus der Gruppe bestehend aus Desinfektionsmittel, Konservierungsmittel, Verdickungsmittel, Lösungsvermittler, Entschäumer, Korrosionsschutzmittel, alkalische Substanz, Sequestriermittel, Komplexbildner und Mischungen davon umfasst.
- 30 11. Eine Schmiermittellösung umfassend das Konzentrat gemäß einem der vorhergehenden Ansprüche und ein geeignetes Verdünnungsmittel.
- 35 12. Die Schmiermittellösung gemäß Anspruch 11, **dadurch gekennzeichnet, dass** das Verdünnungsmittel Wasser ist und der Verdünnungsgrad des Konzentrats mit Wasser vorzugsweise 1:20 bis 1:500 beträgt.
13. Verwendung des Konzentrats oder der Schmiermittellösung gemäß einem der vorhergehenden Ansprüche als Schmiermittel.
- 40 14. Verwendung des Konzentrats oder der Schmiermittellösung gemäß Anspruch 13, **dadurch gekennzeichnet, dass** eine Kette, bevorzugt eine Förderkette oder ein Förderband, geschmiert wird.
15. Verwendung des Konzentrats oder der Schmiermittellösung gemäß einem der Ansprüche 13 oder 14, **dadurch gekennzeichnet, dass** die Kette eine äußere Oberfläche umfassend ein Metall oder ein Kunststoffmaterial aufweist.
- 45 16. Verwendung des Konzentrats oder der Schmiermittellösung gemäß einem der Ansprüche 15 bis 16, **dadurch gekennzeichnet, dass** Behälter wie zum Beispiel Flaschen und/oder Dosen mit der Kette transportiert werden.
- 50 17. Verwendung des Konzentrats oder der Schmiermittellösung gemäß Anspruch 16, **dadurch gekennzeichnet, dass** die Behälter wie zum Beispiel Flaschen aus Glas oder Kunststoff, vorzugsweise einem Polyester wie zum Beispiel Polyethylenterephthalat oder Polycarbonat, Polyethylenaphthenat, Polyurethan, gefertigt sind.
- 55 18. Verwendung des Konzentrats oder der Schmiermittellösung gemäß Anspruch 16, **dadurch gekennzeichnet, dass** die Behälter wie zum Beispiel Dosen aus einem Metall gefertigt sind.
19. Verwendung des Konzentrats oder der Schmiermittellösung gemäß einem der Ansprüche 16 bis 18, **dadurch gekennzeichnet, dass** die Behälter, die bevorzugt Flaschen und/oder Dosen sind, leer oder mit vorzugsweise Lebensmitteln und/oder Getränken gefüllt sind.
20. Verfahren zum Transport von Behältern, bevorzugt Flaschen und/oder Dosen, auf einer Kette, bevorzugt einer Förderkette oder einem Förderband, wobei das Konzentrat oder die Schmiermittellösung gemäß einem der Ansprüche 1 bis 12 auf die Kette aufgetragen werden, vorzugsweise auf den Bereich der Kette, mit dem die Behälter,

bevorzugt Flaschen und/oder Dosen, transportiert werden.

21. Das Verfahren nach Anspruch 20, **dadurch gekennzeichnet, dass** das Konzentrat oder die Schmiermittellösung nicht kontinuierlich auf die Kette aufgetragen werden.

22. Das Verfahren nach Anspruch 21, **dadurch gekennzeichnet, dass** der Zeitraum, in der dem das Konzentrat oder die Schmiermittellösung auf die Kette aufgetragen werden, kürzer ist als der Zeitraum, in dem kein Konzentrat oder Schmiermittellösung aufgetragen werden.

## Revendications

1. Concentré destiné à être utilisé comme lubrifiant de chaîne comprenant :

i. 0,1 à 12 % en poids d'au moins un ester choisi dans le groupe constitué de monoesters et de diesters représentés par la

1. formule générale (1)



2. formule générale (2)



3. formule générale (3)



et des mélanges de ceux-ci,

où  $R^1$  est un groupe alkyle en  $C_1-C_{22}$  ou un groupe alcényle en  $C_8-C_{22}$ ,

$R^2$  est un groupe alkyle en  $C_1-C_{22}$  ou un groupe alcényle en  $C_8-C_{22}$ ,

$R^1$  et  $R^2$  étant identiques ou différents,

$R^3$  est un groupe alkylène en  $C_2-C_{16}$ , et

la somme des atomes de carbone présents dans  $R^1$ ,  $R^2$  et  $R^3$  de chaque monoester ou diester étant d'au moins 10, et

ii. 0,2 à 8 % en poids d'au moins un tensioactif anionique, dans lequel le tensioactif anionique est choisi dans le groupe constitué de sel de sulfonate, de sel de sulfonate alcalin, d'acide sulfonique d'alkyl benzène, de sulfonate d'alkyl benzène alcalin, d'acide sulfonique d'alkyle, de sulfonate d'alkyle alcalin, de sulfate d'alkyle alcalin, de sulfate d'alcényle alcalin, de sulfate d'éther d'acide gras, de sulfonate d'alcool gras, de sel de sodium d'alcane-sulfonate secondaire et de mélanges de ceux-ci et 0,2 à 8 % en poids d'au moins un tensioactif amphotère, dans lequel le tensioactif amphotère est choisi dans le groupe constitué d'ampholyte, de bétaine, d'alkylbétaine, de N-alkylbétaine, de glycinate, d'amphodiacétate, d'hydroxysultaine, d'oxyde d'amine, de lécithine, d'acide carboxylique, de sphingomyéline, d'acide amino-alcène, d'iminopropionate d'alkyle sodique et de mélanges de ceux-ci et dans lequel le concentré est une émulsion ou microémulsion, de préférence une émulsion huile dans eau ou eau dans huile.

2. Concentré selon la revendication précédente, **caractérisé en ce que** l'ester est choisi dans le groupe constitué d'ester méthylique ou d'ester isopropylique d'acides gras ayant 12 à 22 atomes de carbone, de laurate de méthyle, de stéarate de méthyle, d'oléate de méthyle, d'érucate de méthyle, de palmitate d'isopropyle, de myristate d'isopropyle, de stéarate d'isopropyle, de stéarate de n-butyle, de laurate de n-hexyle, d'oléate de n-décyle, de stéarate d'isooctyle, de palmitate d'isononyl, d'isononanoate d'isononyl, de palmitate de 2-éthylhexyle, de laurate de 2-éthylhexyle, de stéarate de 2-hexyldécyle, de palmitate de 2-octyldodécyle, d'oléate d'oléyle, d'érucate d'oléyle, d'érucate d'érucyle, de palmitate de cétyle, de béhéneth-10, d'esters de mélanges d'alcools aliphatiques techniques avec des acides carboxyliques aliphatiques techniques, d'esters d'alcools gras saturés et/ou insaturés ayant 12 à 22 atomes de carbone avec des acides gras saturés et/ou insaturés ayant 12 à 22 atomes de carbone, de monoester d'origine naturelle ou de mélanges d'esters cireux tels qu'on les trouve dans l'huile de jojoba ou l'huile de spermaceti,

d'adipate de n-butyle, de sébacate de di-n-butyle, d'adipate de di-(2-éthylhexyle), de succinate de di-(2-hexyldécyle), d'acélate de di-isotridécyle, de dioléate d'éthylèneglycol, de di-isotridécanoate d'éthylèneglycol, de di-(2-éthylhexanoate) de propylèneglycol, de di-isostéarate de butanediol, de di-caprylate de néopentylglycol et de mélanges de ceux-ci.

- 5 3. Concentré selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le concentré comprend en outre au moins un glycéride choisi dans le groupe constitué de triglycéride, de diglycéride, de monoglycéride, de triglycéride d'acide gras d'acides gras ayant 8 à 22 atomes de carbone, de stéarate de glycéryle et de mélanges de ceux-ci.
- 10 4. Concentré selon la revendication 3, **caractérisé en ce que** le concentré comprend de 0,01 à 15 % en poids du glycéride.
- 15 5. Concentré selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le concentré comprend en outre une huile hydrocarbonée.
- 20 6. Concentré selon la revendication 5, **caractérisé en ce que** le concentré comprend de 0,01 à 15 % en poids de l'huile hydrocarbonée.
- 25 7. Concentré selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le concentré comprend en outre au moins un émulsifiant différent des composés définis dans les revendications précédentes.
- 30 8. Concentré selon la revendication 7, **caractérisé en ce que** l'émulsifiant est choisi dans le groupe constitué d'émulsifiant non ionique, d'adduits d'oxyde d'éthylène avec des alcools gras ayant 16 à 22 atomes de carbone, d'esters partiels de polyols ayant de 3 à 6 atomes de carbone avec des acides gras ayant 14 à 22 atomes de carbone et de mélanges de ceux-ci.
- 35 9. Concentré selon la revendication 7 ou 8, **caractérisé en ce que** le concentré comprend de 0,005 à 20 % en poids de l'émulsifiant.
- 40 10. Concentré selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le concentré comprend en outre au moins un additif choisi dans le groupe constitué de désinfectant, de conservateur, d'épaississant, d'agent solubilisant, d'agent anti-mousse, d'inhibiteur de corrosion, de substance alcaline, d'agent séquestrant, d'agent complexant et de mélanges de ceux-ci.
- 45 11. Solution lubrifiante comprenant le concentré selon l'une quelconque des revendications précédentes et un diluant adéquat.
- 50 12. Solution lubrifiante selon la revendication 11, **caractérisée en ce que** le diluant est de l'eau et le degré de dilution du concentré avec l'eau va de préférence de 1:20 à 1:5000.
- 55 13. Utilisation du concentré ou de la solution lubrifiante selon l'une quelconque des revendications précédentes en tant que lubrifiant.
14. Utilisation du concentré ou de la solution lubrifiante selon la revendication 13, **caractérisée en ce qu'une** chaîne, de préférence une chaîne transporteuse ou une bande transporteuse, est lubrifiée.
15. Utilisation du concentré ou de la solution lubrifiante selon la revendication 13 ou 14, **caractérisée en ce que** la chaîne a une surface externe comprenant un métal et/ou une matière plastique.
16. Utilisation du concentré ou de la solution lubrifiante selon l'une quelconque des revendications 15 à 16, **caractérisée en ce que** des récipients tels que des bouteilles et/ou des bidons sont transportés avec la chaîne.
17. Utilisation du concentré ou de la solution lubrifiante selon la revendication 16, **caractérisée en ce que** les récipients tels que des bouteilles sont composés de verre ou d'une matière plastique, de préférence d'un polyester tel que du polyéthylène téréphtalate ou du polycarbonate, du polyéthylène naphthénate, du polyuréthane.
18. Utilisation du concentré ou de la solution lubrifiante selon les revendications 16, **caractérisée en ce que** les récipients

tels que des bidons sont composés d'un métal.

5 19. Utilisation du concentré ou de la solution lubrifiante selon l'une quelconque des revendications 16 à 18, **caractérisée en ce que** les récipients, de préférence des bouteilles et/ou des bidons, sont vides ou remplis de préférence avec des aliments et/ou une boisson.

10 20. Procédé de transport de récipients, de préférence de bouteilles et/ou de bidons, sur une chaîne, de préférence une chaîne transporteuse ou une bande transporteuse, où le concentré ou la solution lubrifiante selon l'une quelconque des revendications 1 à 12 est appliqué(e) à la chaîne, de préférence sur la zone de la chaîne avec laquelle les récipients, de préférence des bouteilles et/ou des bidons, sont transportés.

21. Procédé selon la revendication 20, **caractérisé en ce que** le concentré ou la solution lubrifiante n'est pas appliqué(e) en continu à la chaîne.

15 22. Procédé selon la revendication 21, **caractérisé en ce que** la durée pendant laquelle le concentré ou la solution lubrifiante est appliqué(e) à la chaîne est plus courte que la durée pendant laquelle aucun concentré ou solution lubrifiante n'est appliqué(e) à la chaîne.

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## REFERENCES CITED IN THE DESCRIPTION

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