(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 370 547 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
**25.10.2017 Bulletin 2017/43**

(21) Application number: **09792457.5**

(22) Date of filing: **11.09.2009**

(51) Int Cl.:
***C10G 33/04*** *(2006.01)* ***B01D 17/04*** *(2006.01)*

(86) International application number:
**PCT/US2009/056644**

(87) International publication number:
**WO 2010/030867 (18.03.2010 Gazette 2010/11)**

(54) **Use of an anhydride demulsifier formulation for resolving a water external emulsion of water and oil or a complex emulsion of water and oil and a method for resolving a water external emulsion of water and oil or a complex emulsion of water and oil using an anhydride demulsifier formulation**

Verwendung von einer Anhydrid-Demulgatorformulierung zum trennen von einer Öl-in-Wasser-Emulsion oder einer komplexen Emulsion von Wasser und Öl und Verfahren zum trennen von einer Öl-in-Wasser-Emulsion oder einer komplexen Emulsion von Wasser und Öl unter Verwendung von einer Anhydrid-Demulgatorformulierung

Utilisation d'une formulation de désémulsifiant anhydride pour résoudre une émulsion huile-dans-eau ou une émulsion complexe d'eaud et d'huile et procédé pour résoudre une émulsion huile-dans-eau ou une émulsion complexe d'eau et d'huile en présence d'une formulation de désémulsifiant anhydride

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR**

(30) Priority: **12.09.2008 US 209845**

(43) Date of publication of application:
**05.10.2011 Bulletin 2011/40**

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## Description

### TECHNICAL FIELD

**[0001]** This invention relates to the use of a demulsifier composition comprising one or more anhydrides for resolving a water external emulsion of water and oil or a complex emulsion of water and oil and methods for resolving water external emulsions of water and oil and complex emulsions of water and oil comprising adding an effective amount of a demulsifier composition comprising one or more anhydrides to the emulsion. This invention has particular applicability in cold climates where low temperature stability is required.

### BACKGROUND

**[0002]** Crude oil produced from geological formations can contain various amounts of water. Water and crude oil are naturally non-miscible; however, when naturally occurring interfacial active compounds are present, these compounds can aggregate on the water and oil interface and cause water to form droplets within the bulk oil phase. During crude oil lifting through production tubings, the water and oil encounters an increased mixing energy from rapid flow through chokes and bends. This additional mixing energy can emulsify the water and oil. Such an oil external, water internal two-phase system is commonly referred to as a crude oil emulsion, which can be quite stable. The presence of water in crude oil, however, can interfere with refining operations, induce corrosion, increase heat capacity, and result in reduced handling capacity of pipelines and refining equipment. Therefore, the crude oil that is to be shipped out of the oilfield should be practically free of water and usually has a maximum water content limit of about 0.5 to 3% by total weight, depending on the type of crude and oil company.

**[0003]** The emulsified water can also contain various amounts of salts. These salts are detrimental to crude oil refining processes due to potential corrosion in the refinery. In crude oil refining, desalting techniques comprise the deliberate mixing of the incoming crude oil with a fresh "wash water" to extract the water soluble salts and hydrophilic solids from the crude oil. Primary dehydration of the crude oil occurs in oil field water oil separation systems such as "free water knock out" and "phase separators." Quite often, these systems are not adequate for efficient separation due to factors such as over production, unexpected production changes, and system underdesigns. In these cases, emulsion-breaking chemicals are added to the production processes to assist and promote rapid water oil separations.

**[0004]** Commonly used emulsion-breaking chemicals or demulsifiers include alkylphenol formaldehyde resin alkoxylates (AFRA), polyalkylene glycols (PAG), organic sulfonates, and the like. These compounds, however, may not provide satisfactory performance in all instances. In particular, in extremely cold weather (e.g., -40°C and below) various problems are known. These active ingredients are typically viscous and require a suitable solvent to reduce the viscosity of the demulsifier blend. Accordingly, there is an ongoing need for new, economical and effective chemicals and processes for resolving emulsions into the component parts of water and oil or brine, including processes and compositions that are suitable for cold climates.

**[0005]** Organic acids are commonly used in demulsifier formulations to enhance performance. Organic acids (and occasionally inorganic acids) are also sometimes used as separate or supplementary treatments to conventional demulsifier formulations. Such acids or formulations containing acids require solvents to stabilize the blend, especially in cold climate conditions where freezing is an issue and pour points of less than -40°C are required. Inactive solvents comprise large proportions of the total volume of a demulsifier blend, especially when the blend is used in cold climates. The purpose of such solvent is primarily viscosity reduction to allow handling and prevent freezing. The problem is that such blends contain significant amounts of solvent.

**[0006]** A main challenge in oilfield production is the resolution of crude oil emulsions. The emulsions may be water-in-oil, oil-in-water, or complex or multiple emulsions (e.g., water-in-oil-in-water). A reverse emulsion breaker is typically used to treat water external emulsions and a standard emulsion breaker is normally used to treat oil external emulsions. Many reverse emulsion breakers also have a small window of treatment dosages, which makes it challenging and difficult to properly control resolution. Complex or multiple emulsions typically require both a reverse and a standard emulsion breaker to aid in its resolution into clean water and dry oil. These two products traditionally are incompatible, so each must by injected separately. Chemicals that resolve oil-in-water emulsions generally stabilize water-in-oil emulsion and vice-versa. Furthermore, complex emulsions are often produced in oilfields that use steam as a means of enhancing production, particularly in the steam-assisted gravity drainage process.

**[0007]** WO96/00766 discloses a combination (mixture and/or reaction product) of an epoxy based demulsifier and a heterocyclic compound, e.g. dimercaptothiadiazole, which been found to exhibit synergistic activity in marine oil formulations especially Trunk Piston Oils. The combination produces Trunk Piston Oils with improved water-shedding properties. US1596589 discloses a process for recovering the oil of a petroleum emulsion, characterized by subjecting the emulsion to the action of a non-saponaceous non-saponifiable, fatty derivative which bears a simple genetic relationship to its parent material. US4098692 discloses a method of demulsifying a water in oil emulsion by contacting the emulsion

with an alkyd resin in which one component of the resin is the residue of a polyalkylene glycol. US2003/0182848 discloses a diesel fuel composition which improves the performance of diesel engine particulate exhaust traps comprising a diesel fuel containing a combination of 1-25 ppm of metal in the form of a metal salt additive and 100 to 500 ppm of an oil soluble nitrogen containing ashless detergent additive. US1659996 discloses a process for breaking or separating petroleum emulsions by subjecting the emulsion to the action of a treating agent consisting of a mixture comprising a condensation product containing a sulpho-aromatic, soap-forming group and other complex organic bodies, produced by the reaction between an aromatic sulphonic acid and an organic soap-forming group which is susceptible to chemical reaction with sulphuric acid. US4689177 discloses the use of nitrogen-containing tridithiocarbamic acid compositions as reverse demulsifiers.

**[0008]** For this reason it is desired to have a demulsifier that is able to resolve complex or multiple emulsions in a single product application without the need for a two product resolution process. It is also desired to have a demulsifier composition capable of resolving water external and complex emulsions while having a broad dosage range.

## SUMMARY

**[0009]** The present invention includes the use of anhydride compositions, including, for example, alkyl and aryl anhydrides, for use as a demulsifier in resolving a water external emulsion of water and oil or a complex emulsion of water and oil. In particular, the anhydride composition can be used alone or in a blend with other demulsifiers. Specific anhydrides suitable for use in the present invention include acetic and propionic, with the preferred anhydride being acetic anhydride. The anhydride composition can be added directly to crude oil or other compositions to be resolved. As such, the demulsifier composition includes one or more anhydrides or in combination with other demulsifiers. The anhydride(s) may be used in an amount ranging between trace (which is around 0.5% or less by weight) and 100% by weight of the demulsifier composition.

**[0010]** This invention further relates to the use of a demulsifier composition formed from a blend of demulsifier and the anhydride. The demulsifier includes ionic and non-ionic surfactants. Specific demulsifiers for use in the composition include alkylphenol resin, alkoxylates and derivatives, polyglycol ethers and derivatives, amine alkoxylates and derivatives, polyamine alkoxylates and derivates, and combinations thereof. The demulsifier composition includes acetic anhydride in an amount ranging between 1% and 99% by weight of the composition. More preferably, the acetic anhydride is added in an amount ranging between 20% and 80% by weight of the demulsifier composition. Even more preferably, the acetic anhydride is added in an amount ranging between 30% and 60% by weight of the demulsifier composition. As such, the anhydride can be used alone, so that the ultimate demulsifier composition contains an amount of the anhydride equal to between a trace amount and up to 100% by weight of the demulsifier composition.

**[0011]** Disclosed is a use of one or more anhydrides as a solvent. Also disclosed is the use of the anhydride(s) blended alone or with a demulsifier to form a demulsifier composition in which the anhydride functions as a solvent. As such, any amount of anhydride can be used as a solvent.

**[0012]** Disclosed is a method for dehydrating crude oil, whereby an amount of the demulsifier composition is added to the crude oil. The demulsifier composition includes an anhydride, such as acetic anhydride, and potentially other constituents. The resultant demulsifier composition remains fluid at sub-zero temperatures including down to 40°C below zero and lower.

**[0013]** The anhydride may be used alone, where the demulsifier composition includes an amount of anhydride from trace to 100 wt%. An aspect of the invention includes a method for resolving water external (including multiple) emulsions of water and oil whereby an effective amount of a demulsifier composition is added to the emulsion. In another aspect, the invention also includes a method of resolving multiple emulsions in a single step demulsification process.

**[0014]** In an embodiment, the demulsifier composition is a reverse emulsion breaker. In another embodiment, the demulsifier composition is a combination reverse emulsion breaker and standard emulsion breaker.

**[0015]** An advantage of the invention is to provide an emulsion breaker capable of resolving complex or multiple emulsions with a single product.

**[0016]** Another advantage of the invention is to provide an emulsion breaker composition that is winterized for use in extreme cold conditions.

**[0017]** A further advantage of the invention is to provide an emulsion breaker that does not demonstrate reduced resolving activity with overtreatment.

**[0018]** Additional features and advantages are described herein, and will be apparent from, the following Detailed Description and Examples.

## DETAILED DESCRIPTION

**[0019]** The term "demulsifier" as used herein refers to a class of chemicals used to aid the separation of emulsions (including water in oil, oil in water, and multiple emulsions). They are commonly used in the processing of crude oil,

which is typically produced along with significant quantities of saline water. This water (and salt) must be removed from the crude oil prior to refining, otherwise significant corrosion problems can occur in the refining process. Demulsifiers are typically based on the following chemistry: acid catalysed phenol-formaldehyde resins, base catalysed phenol-formaldehyde resins, polyamines, di-epoxides, polyols. The above are usually ethoxylated (and/or propoxylated) to provide the desired degree of water/oil solubility. The addition of ethylene oxide increases water solubility, whereas propylene oxide decreases it. Commercially available demulsifier formulations are typically a mixture of two to four different chemistries in a carrier solvent(s), such as xylene, HAN, IPA, MeOH.

**[0020]** The term "acetic anhydride" as used herein refers to acetyl oxide or acetic oxide of the formula $(CH_3CO)_2O$. The acetic anhydride is a colorless, mobile, strongly refractive liquid. It is miscible with alcohol, ether, and acetic acid; and decomposes in water to form acetic acid.

**[0021]** The present invention relates to the use of a demulsifier composition that includes anhydride and can include an amount of a known demulsifier. Suitable anhydrides include alkyl and aryl anhydrides, acetic anhydride being preferred. The resultant composition not only functions as a demulsifier, but is also a stable fluid at low temperatures. Specifically, the demulsifier composition functions in cold weather environments of -40°C and below and reduces the need for inactive solvents. As such, the anhydride demulsifier composition used in the present invention is effective for resolving a broad range of hydrocarbon emulsions encountered in crude oil production, refining, and chemical processing. Typical hydrocarbons include crude oil, refined oil, bitumen, condensate, slop oil, distillates, fuels, brines, and mixtures thereof. The demulsifiers are also useful for resolving emulsions in butadiene, styrene, acrylic acid, and other hydrocarbon monomer process streams.

**[0022]** The anhydride offers demulsification performance similar to acids (organic or inorganic) but has an appreciable solubility for conventional demulsifier active ingredients. For example, acetic anhydride has a freezing point of -73°C, making it versatile not only as an active ingredient but also as a winterizing solvent. The acetic anhydride demulsifiers can be used to demulsify water-in-oil emulsions in various production and refinery processes. In a refinery desalting process, the incoming crude is deliberately mixed with wash water to remove dissolved salts and other contaminants. To extract water from the resulting water-in-crude oil emulsion, the emulsion is admixed with an effective amount of the acetic anhydride demulsifiers. In the process of resolving crude petroleum oil emulsions of the water-in-oil type, the demulsifier compositions are brought into contact with or caused to act upon the emulsion to be treated in any of the various methods now generally used in the petroleum industry to resolve or break crude petroleum oil emulsions with a chemical agent.

**[0023]** According to an embodiment, the demulsifier composition used comprises at least an anhydride and can also be a blend of at least a "demulsifying amount" of a demulsifier and anhydride, generally acetic anhydride. Demulsifiers, such as ionic or non-ionic surfactants, may be used alone or in combination with any of a number of demulsifiers known in the art including fatty acids, fatty amines, glycols, and alkylphenol formaldehyde condensation products. Typical demulsifiers for breaking crude oil emulsions that may have utility in the use of the compositions herein are described in U.S. Pat. Nos. 2,499,370; 2,557,081; 2,602,053; 3,640,894; 3,699,894; 3,684,735; 4,537,701; and U.K. Patent No. 2,118,937A.

**[0024]** Suitable "surfactants" are defined herein to include, but are not necessarily limited to alkylphenol resin such as, oxyalkylated alkyl phenol resins, oxyalkylated amines, glycol resin esters, polyglycol ethers and derivatives, such as bisphenol glycol ethers, bisphenol glycol esters, salts of alkylaryl sulfonic acid, decarbamates, oxyalkylated polyols reacted with compounds selected from the group consisting of diepoxides and polycarboxylic acids, unreacted oxyalkylated polyols, unreacted oxyalkylated phenolic resins, alkoxylates and derivatives, amine alkoxylates and derivatives, polyamine alkoxylates and derivatives, and combinations thereof. The derivatives include post-reacted materials such as polyglycol ether which is often reacted with another polyglycol ether using a linking chemical. Conversely, the polyglycol ether may be reacted with a resin, or any of these compositions may be slightly reacted with, for example, a fatty acid.

**[0025]** In alternative embodiments, the particular demulsifier or solubilizing surfactant used, as well as whether a single demulsfier or a combination of demulsifiers is used, will depend upon the emulsion properties of the produced fluids. The demulsifiers can be added in a variety of amounts including between broadly trace to 100% or 1% to 99% by weight of the composition or between 10% and 90% by weight of the composition. More specifically, the demulsifier can be added in an amount equal to between 20% and 80% by weight of the composition or, 40% and 70% by weight of the demulsifier composition. More preferably, the demulsifier is added in an amount equal to between 25% and 50% by weight of the demulsifier composition.

**[0026]** More specifically, the anhydride demulsifier composition ("demulsifier composition") is formed from an amount of anhydride and optionally a known demulsifier, such as the ones mentioned above. The anhydrides include alkyl and aryl anhydrides, specifically propionic and acetic anhydrides, with acetic anhydride being preferred. The anhydride blended with the demulsifier is typically neat, or nearly 100% pure. It can be added in any amount sufficient to produce a demulsification and winterizing solvent. The amount of anhydride mixed with the demulsifier can vary according to a particular use; however, it is generally added in an amount sufficient to prevent freezing of the demulsifier and allow for use in cold climates.

**[0027]** The anhydride, and especially the acetic anhydride, can be added in an amount equal to between trace and up to 100% by weight of the demulsifier composition. If the acetic anhydride is to be used as a principle solvent then it will preferably be added in an amount equal to between 20% and 80% by total weight of the demulsifier composition. More preferably the acetic anhydride is added in an amount equal to between 30% and 60% by weight of the demulsifier composition. The acetic anhydride can also be added in an amount equal to between 50% and 75% by weight of the demulsifier. In an alternative, other solvents may be included with the anhydride whereby it can be added in an amount ranging between 1% and 10% by total weight of the demulsifier composition. Again, broadly, the demulsifier composition can include an amount of anhydride, including acetic anhydride, ranging between trace or 1% and up to 99% or 100% by weight of the demulsifier composition.

**[0028]** The demulsifier composition may also include corrosion inhibitors, viscosity reducers and other chemical treatments used in crude oil production, refining and chemical processing. Additional optional solvents could be added such as: xylene, toluene, light or heavy aromatic naphtha, and the like. Each component contributes to different treating characteristics when added to the crude oil emulsion due to their unique chemical properties.

**[0029]** In a typical application, the acetic anhydride alone or with a demulsifier is blended together to form a chemical treatment suitable for application to the emulsion. The amount of the demulsifier composition used depends on the particular crude oil emulsion being treated. Although the amount added is typically at least 10 ppm. In general, the effective amount of demulsifier composition ranges from between 10 ppm to 1,000 ppm based on the volume of oil. For example, the demulsifier composition can be introduced into the crude oil emulsion by injecting beneath the surface into the oil well itself by injecting into the crude oil at the well-head or by injecting into the crude oil process stream at a point between and including the well-head and the final oil storage tank. The demulsifier composition may be injected continuously or in batch fashion. The injection step is preferably accomplished using electric or gas pumps.

**[0030]** The treated crude oil emulsion is then allowed to separate into distinct layers of water and oil. Once separation into distinct layers of water and oil has been effected, various means known in the art can be utilized for withdrawing the free water and separating crude oil.

**[0031]** In a typical process for demulsification of crude oil, a reservoir is provided to hold the composition of the invention in either diluted or undiluted form adjacent to the point where the effluent crude petroleum oil leaves the well. For convenience, the reservoir is connected to a proportioning pump capable of dropwise injecting the demulsifier of the invention into the fluids leaving the well, which then pass through a flow line into a settling tank. Generally, the well fluids pass into the settling tank at the bottom of the tank so that incoming fluids do not disturb stratification of the layers of crude petroleum water and oil that takes place during the course of demulsification.

**[0032]** The role of the demulsifier is usually to generate dry oil for use in downstream applications. In the case of steam-assisted gravity drainage ("SAGD") process, however, the demulsifier is used to generate clean water. It should be appreciated that the invention has equal application in such SAGD processes, further explained in the examples below.

**[0033]** The foregoing may be better understood by reference to the following examples, which are intended for illustrative purposes and are not intended to limit the scope of the invention.

Example 1 (not according to the invention)

**[0034]** Listed in Table 1 below are a variety of compositions that were tested as demulsifiers. The testing was performed as a typical bottle test where 100 ml of warmed oil emulsion was contacted for a period of time with a demulsifier. The oil contained water in an amount equal to 15% by volume of the total mixture. The emulsions were heated to 80°C. The demulsifiers were added as listed below in an amount ranging between 300 ppm to 2,400 ppm. The emulsion and demulsifier mix was shaken.

Table 1

| Chemical | Dose/ppm | Water drop/ml (monitored over time) | | | | Residual water in oil / % |
|---|---|---|---|---|---|---|
| | | 15’ | 25’ | 1h | 2h | |
| D-88 + D-87 | 300+300 | 0 | 0 | 1 | 3 | 11.5 |
| | 600+600 | 0 | 1 | 8 | 14 | 2.4 |
| | 900+900 | 0 | 1 | 10 | 14 | 2.1 |
| | 1200+1200 | 2 | 4 | 13 | 15 | 1.3 |
| 215.1 | 300 | 2 | 4 | 13 | 15 | 1.2 |
| | 600 | 5 | 9 | 12 | 15 | 1.2 |

(continued)

| Chemical | Dose/ppm | Water drop/ml (monitored over time) | | | | Residual water in oil / % |
|---|---|---|---|---|---|---|
| | | 15' | 25' | 1h | 2h | |
| | 900 | 6 | 10 | 13 | 15 | 1.1 |
| | 1200 | 8 | 11 | 13 | 13 | 0.8 |

**[0035]** Performance of the chemical treatment was evaluated by means of monitoring the volume of water that phase separated in the bottle over time (15 minutes, 25 minutes, 1 hour, and 2 hours) and also by determining the amount of residual water (percentage by volume) that remained in the oil at the end of the 2 hour period (far right column).

**[0036]** The two formulations D-87 and D-88 were designed to treat a a particular oilfield emulsion. The demulsifier and acid blends were both required to dehydrate the crude oil. Neither is capable of treatment on its own and treatment rates of both are high. D-88 is a conventional demulsifier blend comprising 40% active ingredients (polymeric alkoxylates and derivatives) and 60% inactive solvent (alcohol and aromatic hydrocarbon). D-87 is a 50% active solution of acetic acid in xylene and isopropyl alcohol. These solvents are required to prevent the acetic acid from freezing (it has a melting point of 16°C).

**[0037]** Blend 215.1 is a novel blend comprising demulsifier active ingredients from D-88 (25%) and acetic anhydride (75%). The laboratory test data shows that at 300 ppm this single blend performs equivalently to 1200 ppm D-88 plus 1200 ppm D-87. Moreover, blend 215.1 remains fluid and stable at temperatures of less than 40°C below zero, eliminating the need for inert solvents.

Example 2

**[0038]** A multiple (i.e., complex) emulsion taken from a SAGD facility was treated with acetic anhydride in a typical laboratory bottle test. The acetic anhydride liberated the water external phase as clean water at treat rates of 700 ppm (by volume) and above with little indication of overtreatment when used in excess (Table 2A). The dosages in Table 2A are higher than typically used in a production facility and are used to demonstrate resistance to overtreatment. In contrast, a traditional emulsion breaker (labeled REB in Table 2B) showed significantly reduced resolving ability above 200 ppm.

Table 2A

| | 650 ppm | 700 ppm | 1,000 ppm | 1,250 ppm | 1,500 ppm | 2,000 ppm |
|---|---|---|---|---|---|---|
| Acetic anhydride | no break | break | break | break | break | break |
| Water quality | poor | very good | very good | very good | very good | very good |

Table 2B

| | 120 ppm | 140 ppm | 160 ppm | 200 ppm | 240 ppm | 280 ppm |
|---|---|---|---|---|---|---|
| REB | no break | no break | break | break | sl. break | no break |
| Water quality | poor | poor | good | good | poor | poor |

Example 3

**[0039]** A multiple water-in-oil-in-water (w/o/w) emulsion taken from a SAGD facility was treated with a dilute solution (10% v/v) of demulsifier actives in acetic anhydride. The blend included a mixture of demulsifier ingredients in a solution of acetic anhydride. These ingredients were known to be effective in the dehydration of such types of crude oil and were fully soluble in the acetic anhydride solution. They comprised polymeric alkoxylates and derivatives including alklyphenol formaldehyde resins.

**[0040]** The resultant solution was stable and fluid to temperatures of less than 40°C below zero. This single-product treatment yielded clean water and dehydrated oil in a typical laboratory bottle test. Traditionally, this process would have required two different chemicals: (i) a reverse emulsion breaker to yield a water-in-oil emulsion and a water phase (w/o/w $\rightarrow$ w/o + w) and (ii) a standard demulsifier added to the water-in-oil emulsion to complete the phase separation into clean water and dry oil (w/o $\rightarrow$ w + o).

Example 4 (not according to the invention)

**[0041]** Acetic anhydride is used as a demulsifier. Tests are performed whereby a typical bottle test of 100 ml of warmed oil emulsion is contacted for a period of time with the acetic anhydride demulsifier. The oil contains water in an amount equal to 15% by volume of the total mixture. The emulsions are heated to 80°C. The acetic anhydride is then added in an amount ranging between 300 ppm and 2400 ppm. The emulsion and demulsifier mix is shaken.

**[0042]** Performance of the chemical treatment is evaluated by means of monitoring the volume of water that phase separates in the bottle over time (15 minutes, 25 minutes, 1 hour, and 2 hours) and also by determining the amount of residual water (percentage by volume) that remains in the oil at the end of the 2 hour period. The results will show that water is separated, and the residual water is less than 1.2%.

**[0043]** While the invention has been explained in relation to exemplary embodiments and examples not according to the invention, it is to be understood that various modifications thereof will become apparent to those skilled in the art upon reading the description. Therefore, it is to be understood that the invention disclosed herein is intended to cover such modifications as fall within the scope of the appended claims.

## Claims

1. Use of a demulsifier composition comprising one or more anhydrides for resolving a water external emulsion of water and oil or a complex emulsion of water and oil.

2. The use according to claim 1, wherein the water external emulsion of water and oil or the complex emulsion of water and oil is derived from a steam-assisted gravity drainage process.

3. The use according to claim 1, wherein the oil is selected from the group consisting of crude oil, refined oil, bitumen, condensate, slop oil, distillates, fuels, brines or mixtures thereof.

4. A method for resolving a water external emulsion of water and oil or a complex emulsion of water and oil, the method comprising adding an effective amount of a demulsifier composition comprising one or more anhydrides to the emulsion.

5. The method according to claim 4, wherein when the method is for resolving a complex emulsion of water and oil, the method further comprises separating the oil from the water.

6. The method according to claim 5, wherein the oil is selected from the group consisting of crude oil, refined oil, bitumen, condensate, slop oil, distillates, fuels, brines or mixtures thereof.

7. The use according to claim 1, or the method according to claim 4, wherein the demulsifier composition further comprises an effective amount of a demulsifier selected from the group consisting of: alkylphenol resins; alkoxylates and derivatives; polyglycol ethers and derivatives; amine alkoxylates and derivatives; polyamine alkoxylates and derivates; oxyalkylated amines; glycol resin esters; salts of alkylaryl sulfonic acid; dicarbamates; oxyalkylated polyols reacted with diepoxides and polycarboxylic acids; unreacted oxyalkylated polyols; unreacted oxyalkylated phenolic resins; alkoxylates and derivatives; amine alkoxylates and derivatives; and combinations thereof.

8. The use according to claim 1, or the method according to claim 4, wherein the one or more anhydrides are present in an amount ranging between 0.5% or less by weight and 100% by weight of the demulsifier composition.

9. The use according to claim 1, or the method according to claim 4, wherein the one or more anhydrides are present in an amount ranging between 1% and 99% by weight of the demulsifier composition.

10. The use according to claim 1, or the method according to claim 4, wherein the one or more anhydrides are present in an amount ranging between 20% and 80% by weight of the demulsifier composition.

11. The use according to claim 1, or the method according to claim 4, wherein the one or more anhydrides are present in an amount ranging between 30% and 60% by weight of the demulsifier composition.

12. The use according to claim 1, or the method according to claim 4, wherein the one or more anhydrides are present in an amount ranging between 50% and 75% by weight of the demulsifier composition.

13. The use according to claim 1, or the method according to claim 4, wherein the demulsifier composition further comprises additional solvents.

14. The use according to claim 1, or the method according to claim 4, wherein the one or more anhydrides is selected from the group consisting of: alkyl anhydrides and aryl anhydrides.

15. The use according to claim 1, or the method according to claim 4, wherein the one or more anhydrides is selected from the group consisting of: propionic anhydride and acetic anhydride.

**Patentansprüche**

1. Verwendung einer Demulgatorzusammensetzung umfassend ein oder mehrere Anhydride zum Trennen einer O/W-Emulsion aus Wasser und Öl oder einer komplexen Emulsion aus Wasser und Öl.

2. Verwendung nach Anspruch 1, wobei die O/W-Emulsion aus Wasser und Öl oder die komplexe Emulsion aus Wasser und Öl aus einem dampfgestützten Schwerkraftentwässerungsverfahren stammt.

3. Verfahren nach Anspruch 1, wobei das Öl ausgewählt ist aus der Gruppe bestehend aus Rohöl, raffiniertem Öl, Bitumen, Kondensat, Slop-Öl, Destillaten, Kraftstoffen, Laugen oder Mischungen davon.

4. Verfahren zum Trennen einer O/W-Emulsion aus Wasser und Öl oder eine komplexe Emulsion aus Wasser und Öl, wobei das Verfahren ein Zugeben einer wirksamen Menge einer Demulgatorzusammensetzung umfassend ein oder mehrere Anhydride zu der Emulsion umfasst.

5. Verfahren nach Anspruch 4, wobei wenn das Verfahren zum Trennen einer komplexen Emulsion aus Wasser und Öl dient, das Verfahren ferner ein Abtrennen des Öls von dem Wasser umfasst.

6. Verfahren nach Anspruch 5, wobei das Öl ausgewählt ist aus der Gruppe bestehend aus Rohöl, raffiniertem Öl, Bitumen, Kondensat, Slop-Öl, Destillaten, Kraftstoffen, Laugen oder Mischungen davon.

7. Verfahren nach Anspruch 1 oder Verfahren nach Anspruch 4, wobei die Demulgatorzusammensetzung ferner eine wirksame Menge eines Demulgators umfasst, welcher ausgewählt ist aus der Gruppe bestehend aus:

   Alkylphenolharzen; Alkoxylaten und Derivaten; Polyglykolethern und Derivaten; Aminalkoxylaten und Derivaten; Polyaminalkoxylaten und Derivaten; oxyalkylierten Aminen; Glykolharzestern; Salzen von Alkylarylsulfonsäure; Dicarbamaten; oxyalkylierten Polyolen, die mit Diepoxiden und Polycarbonsäuren umgesetzt sind; nicht umgesetzten oxyalkylierten Polyolen; nicht umgesetzten oxyalkylierten Phenolharzen; Alkoxylaten und Derivaten; Aminalkoxylaten und Derivaten; und Kombinationen davon.

8. Verwendung nach Anspruch 1 oder Verfahren nach Anspruch 4, wobei die ein oder mehreren Anhydride in einer Menge im Bereich zwischen 0,5 Gew.-% oder weniger und 100 Gew.-% der Demulgatorzusammensetzung vorliegen.

9. Verfahren nach Anspruch 1 oder Verfahren nach Anspruch 4, wobei die ein oder mehreren Anhydride in einer Menge im Bereich zwischen 1 Gew.-% und 99 Gew.-% der Demulgatorzusammensetzung vorliegen.

10. Verfahren nach Anspruch 1 oder Verfahren nach Anspruch 4, wobei die ein oder mehreren Anhydride in einer Menge im Bereich zwischen 20 Gew.-% und 80 Gew.-% der Demulgatorzusammensetzung vorliegen.

11. Verfahren nach Anspruch 1 oder Verfahren nach Anspruch 4, wobei die ein oder mehreren Anhydride in einer Menge im Bereich zwischen 30 Gew.-% und 60 Gew.-% der Demulgatorzusammensetzung vorliegen.

12. Verfahren nach Anspruch 1 oder Verfahren nach Anspruch 4, wobei die ein oder mehreren Anhydride in einer Menge im Bereich zwischen 50 Gew.-% und 75 Gew.-% der Demulgatorzusammensetzung vorliegen.

13. Verfahren nach Anspruch 1 oder Verfahren nach Anspruch 4, wobei die Demulgatorzusammensetzung ferner weitere Lösungsmittel umfasst.

14. Verfahren nach Anspruch 1 oder Verfahren nach Anspruch 4, wobei die ein oder mehreren Anhydride ausgewählt sind aus der Gruppe bestehend aus:

    Alkylanhydriden und Arylanhydriden.

15. Verfahren nach Anspruch 1 oder Verfahren nach Anspruch 4, wobei die ein oder mehreren Anhydride ausgewählt sind aus der Gruppe bestehend aus:

    Propionsäureanhydrid und Essigsäureanhydrid.

**Revendications**

1. Utilisation d'une composition de désémulsionnant comprenant un ou plusieurs anhydrides pour résoudre une émulsion d'huile dans l'eau ou une émulsion complexe d'eau et d'huile.

2. Utilisation selon la revendication 1, dans laquelle l'émulsion d'huile dans l'eau ou l'émulsion complexe d'eau et d'huile est tirée d'un processus de drainage par gravité assisté par de la vapeur d'eau.

3. Utilisation selon la revendication 1, dans laquelle l'huile est choisie dans le groupe constitué de pétrole brut, de pétrole raffiné, de bitume, d'un condensat, d'un rejet de fabrication, de distillats, de carburants, de saumures ou de leurs mélanges.

4. Procédé de résolution d'une émulsion d'huile dans l'eau ou d'une émulsion complexe d'eau et d'huile, le procédé comprenant l'addition d'une quantité efficace d'une composition de désémulsionnant comprenant un ou plusieurs anhydrides à l'émulsion.

5. Procédé selon la revendication 4, dans lequel, lorsque le procédé est destiné à résoudre une émulsion complexe d'eau et d'huile, le procédé comprend en outre la séparation de l'huile de l'eau.

6. Procédé selon la revendication 5, dans lequel l'huile est choisie dans le groupe constitué de pétrole brut, de pétrole raffiné, de bitume, de condensat, de rejets de fabrication, de distillats, de carburants, de saumures ou de leurs mélanges.

7. Utilisation selon la revendication 1 ou procédé selon la revendication 4, dans laquelle ou lequel la composition de désémulsionnant comprend en outre une quantité efficace d'un désémulsionnant choisi dans le groupe constitué des résines d'alkylphénols ; des alcoxylates et de leurs dérivés ; des éthers de polyglycols et de leurs dérivés ; des alcoxylates d'amines et de leurs dérivés ; des alcoxylates de polyamines et de leurs dérivés ; des amines oxyalkylées ; des esters de résines de glycol ; des sels de l'acide alkylarylsulfonique ; des dicarbamates ; des polyols oxyalkylés soumis à une réaction avec des diépoxydes et des acides polycarboxyliques ; des polyols oxyalkylés non soumis à une réaction ; des résines phénoliques oxyalkylées non soumises à une réaction ; des alcoxylates et de leurs dérivés ; des alcoxylates d'amines et de leurs dérivés ; et de leurs combinaisons.

8. Utilisation selon la revendication 1 ou procédé selon la revendication 4, dans laquelle ou lequel les un ou plusieurs anhydrides sont présents en quantité comprise entre 0,5 % ou moins en poids et 100 % en poids de la composition de désémulsionnant.

9. Utilisation selon la revendication 1 ou procédé selon la revendication 4, dans laquelle ou lequel les un ou plusieurs anhydrides sont présents en quantité comprise entre 1 % et 99 % en poids de la composition de désémulsionnant.

10. Utilisation selon la revendication 1 ou procédé selon la revendication 4, dans laquelle ou lequel les un ou plusieurs anhydrides sont présents en quantité comprise entre 20 % et 80 % en poids de la composition de désémulsionnant.

11. Utilisation selon la revendication 1 ou procédé selon la revendication 4, dans laquelle ou lequel les un ou plusieurs anhydrides sont présents en quantité comprise entre 30 % et 60 % en poids de la composition de désémulsionnant.

12. Utilisation selon la revendication 1 ou procédé selon la revendication 4, dans laquelle ou lequel les un ou plusieurs anhydrides sont présents en quantité comprise entre 50 % et 75 % en poids de la composition de désémulsionnant.

**13.** Utilisation selon la revendication 1 ou procédé selon la revendication 4, dans laquelle ou lequel la composition de désémulsionnant comprend en outre des solvants supplémentaires.

**14.** Utilisation selon la revendication 1 ou procédé selon la revendication 4, dans laquelle ou lequel les un ou plusieurs anhydrides sont choisis dans le groupe constitué des anhydrides alkyle et des anhydrides d'aryle.

**15.** Utilisation selon la revendication 1 ou procédé selon la revendication 4, dans laquelle ou lequel les un ou plusieurs anhydrides sont choisis dans le groupe constitué de l'anhydride propionique et de l'anhydride acétique.

## REFERENCES CITED IN THE DESCRIPTION

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