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(54) **Microemulsions**

Mikroemulsionen

Microémulsions

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Description

[0001] This invention relates to water-in-oil microemulsions, for example, for use as industrial lubricants e.g. hydraulic or machine tool cutting oils.

[0002] US-A-4832868 discloses surfactant mixtures, which may contain fatty amine ethoxylates and certain alcohol ethoxylates, useful in the preparation of oil-in-water microemulsions.

[0003] The use of cutting oil and macroemulsions of these oils in metalworking is well known. Neat oils are used when a good surface finish is required on the metal being worked. However, due to the poor coolant properties of the oils used rapid degeneration of the machine tool (which can reach temperatures in excess of 200°C) takes place.

[0004] To improve the life of the machine tool macroemulsions of the oil are made with water. The excellent coolant properties of the water does indeed improve the life of the tool. However, the incorporation of water coupled with the instability of macroemulsions gives rise to several other problems. These are that the lubricity of the oil is decreased with addition of water thereby affecting the surface finish of the metal. Also, as water is present the likelihood of corrosion becomes apparent. Consequently, the macroemulsion requires further addition of specialist additives to overcome the occurrence of corrosion. The presence of water droplets ($> 0.1 \mu\text{m}$) may also give rise to bacterial growth which not only can affect performance of the lubricant but also is unpleasant for the machine operator due to the oil becoming rancid and thus foul smelling.

[0005] The present invention seeks to overcome the above mentioned problems by providing a surfactant composition which allows the formulation of oil - water mixtures which are microemulsions of water in oil and behave as true solutions. The term "solution" herein describes any mixtures which are clear and homogenous. The term "behave as such" means that the mixture has substantially the same stability as a solution.

[0006] The present invention, in its various aspects, is as set out in the accompanying claims.

[0007] In one aspect, the present invention provides a water-in-oil microemulsion which behaves as a true solution comprising oil, water and a surfactant composition comprising

- i) a fatty acid amine ethoxylate
- ii) $\text{C}_6\text{-C}_{15}$ alcohol ethoxylate; and
- iii) tall oil fatty acid amine.

[0008] The components of the composition are combined together in quantities that allow the formation of microemulsions on addition to the appropriate oil and water mixture.

[0009] The composition may comprise additional components. These have been found to include sorbitan esters, mono and di - glycerides of fatty acids, polymeric emulsifiers containing fatty acid side groups, polyimides and substituted polyimides such as poly isobutenylsuccinimide. Other surfactant types will be apparent to those versed in the art.

[0010] Preferred components of the surfactant composition are all readily available commercially.

[0011] A preferred surfactant composition consists of the following components :

- i) 1 - 5 parts by volume of a fatty acid amine ethoxylate
- ii) 0.5 - 4 parts by volume of $\text{C}_6 - \text{C}_{15}$ alcohol ethoxylate, and
- iii) 1.5 - 5 parts by volume of tall oil fatty acid amine.

[0012] In one particularly preferred embodiment of the present invention, the surfactant composition consists of 3 parts of component (i), 2 parts of component (ii) and 2.75 parts of component (iii).

[0013] In another preferred embodiment of the present invention, the surfactant composition consists of 3 parts of component (i), part of component (ii) and 1.5 parts of component (iii).

[0014] In another preferred embodiment of the present invention, the surfactant composition consists of 2 parts of component (i), 1 part of component (ii) and 3 parts of component (iii).

[0015] The tall oil fatty acid amine imparts (further) stability to the surfactant composition.

[0016] The minimum quantity of the surfactant composition required is dependant upon the water content of the desired microemulsion and the base oil type being used. For example. 80 parts of a naphthenic base oil (Shell, solvent pale 60) was emulsified with 20 parts of water such that a microemulsion was obtained. This was achieved with the addition of 20 parts of the surfactant composition. Using a different base oil, based upon a paraffinic type. (Shell, 130 solvent neutral), with the same quantities of water and oil required 30 parts of the surfactant composition to form a microemulsion.

[0017] To determine the minimum quantity of the surfactant composition required the surfactant is added to the oil water mixture with gentle mixing until a clear homogenous microemulsion is obtained.

[0018] The present invention also provides a process comprising adding to a mixture of oil and water a surfactant composition as described hereinabove such that a clear homogenous water-in-oil microemulsion is formed.

[0019] In one embodiment of the present invention there is added, to a mixture of 20 parts of water and 80 parts of

paraffinic type base oil, 29 parts by volume relative to the oil water mixture of a surfactant composition consisting of 3 parts of a fatty acid amine ethoxylate, 2 parts of C₆-C₁₅ alcohol ethoxylate, and 2.75 parts of tall oil fatty acid amine.

[0020] In another embodiment of the present invention there is added, to a mixture of 30 parts of water and 70 parts of paraffinic type base oil, 40 parts by volume relative to the oil water mixture of a surfactant composition consisting of 3 parts of a fatty acid amine ethoxylate, 1 part of C₆-C₁₅ alcohol ethoxylate, and 1.5 parts of tall oil fatty acid amine.

[0021] In another embodiment of the present invention there is added, to a mixture of 10 parts of water and 90 parts of paraffinic type base oil, 14 parts by volume relative to the oil water mixture of a surfactant composition consisting of 2 parts of a fatty acid amine ethoxylate, 1 part of C₆-C₁₅ alcohol ethoxylate, and 3 parts of tall oil fatty acid amine.

[0022] These microemulsions will have many applications in the industrial lubricants market. It may be necessary for certain applications to incorporate other additives i.e. to give extreme pressure protection for higher temperature applications. These applications and additional additives will be apparent to those skilled in the art.

[0023] The invention shall now be described by way of example only.

Example 1

[0024] A surfactant composition suitable for combining 70 parts of a paraffinic type base oil (Shell 130 solvent neutral) with 30 parts of water was prepared from the following components in the quantities stated:

3 parts fatty acid amine ethoxylate
2.75 parts tall oil fatty acid amine
2 parts C₆-C₁₅ alcohol ethoxylate

[0025] The components were gently mixed to form a homogenous solution.

Example 2

[0026] 30 ml of water was added to 70 ml of Shell 130 solvent neutral in a clear glass container. The surfactant composition of Example 1 was introduced to the oil and water from a burette. After each addition of surfactant the resulting solution was mixed. This continued until a clear homogenous solution was observed. The resulting solution remains stable for more than one year.

Example 3

[0027] 20 ml of water was added to 80 ml of Shell solvent neutral in a clear glass container. The surfactant solution of Example 1 was introduced into the oil and water as in Example 2. The resulting solution remains stable for more than one year.

Example 4

[0028] The solution obtained in Example 2 was used to determine its corrosive properties on mild steel. This was done by placing a piece of mild steel in the solution and observing the formation of rust. No corrosion has been observed after 6 months.

Example 5

[0029] When using macroemulsions of oil and water problems of micro-organism growth can arise.

[0030] To determine whether the composition of the present invention is effective in preventing such growth an algae was introduced to the solution of Example 2. Any growth of this algae was to be monitored by any colour change of the solution as the algae produce a green growth in macroemulsions.

[0031] No micro-organism growth was observed after 6 months. It is believed that the compositions of the present invention prevents any micro-organism growth because the water droplets in the solution containing the surfactant composition are smaller than the micro-organisms and so there is insufficient oxygen for the algae to grow.

Example 6

[0032] A series of tests were conducted on an industrial lathe using solutions in Examples 2 and 3 and the neat base oil (Shell 130 solvent neutral). Initially the tool bits that were to be used were prepared by grinding to the same specification. These were then electron micrographed to confirm that the tool bits were to all intents and purposes identical. The bits

were then used to lathe 75 mm external diameter mild steel rod down to 20 mm external diameter over a 600 mm length at a rate of 2.5 mm per cut. The tool bits were then electron micrographed for a second time to determine which bits were wearing faster. The results, which are shown in Table 1, show that bits containing just neat oil or neat oil with an extreme pressure additive (Cereclor™ E45) wear considerably more quickly than those of Examples 2 and 3. The surface finish of the mild steel of all the samples was compared and found to be no different, thereby indicating no loss in the lubricity of the solutions containing water.

[0033] An added benefit was also observed during this test. When lathing the steel the observable amount of smoke was reduced using the solutions of Examples 2 and 3. In addition it is believed that the emissions given by the solutions of the present invention will be cleaner due to the higher oxygen content because of the presence of water. As seen in Table 1, the swarf generated by the cutting was collected and an experiment was carried out to determine the oil that had become associated with it. Again, the solutions from Examples 2 and 3 were shown to have an improvement over the neat oil as less oil was associated with these cuttings.

Example 7

[0034] Microemulsions have been prepared in the following base oil types :

- i) paraffinic
- ii) naphthenic
- iii) linear alpha olefins
- iv) ester type base fluids

Example 8

[0035] A microemulsion using linear alpha olefin was prepared as in Example 2 using 35 parts of the surfactant composition. This was then tested using the lubricant industry standard IP287 to determine the potential of the solution to promote corrosion. No corrosion has been observed using this or indeed any other prepared solution.

Example 9

[0036] The solution from Example 8 was doped with a heavily contaminated soluble oil. The resulting solution was then tested using an agar dipslide to monitor bacterial growth within the solution. No culture or bacterial growth was observed after 168 hours at 35°C. It is generally recognised that bacteria will be observed on the culture medium after 72 hours when held at 35°C.

Example 10

[0037] Solutions from Examples 2, 3 and 8 have been tested for wear prevention using a Reichert testing machine. This involves rotating a roller bearing over a known distance (100 m) within a specific length of time (60 s) with a load of 1.5 Kg. When comparing the solutions with their respective straight oils a reduction in weight loss of 22 % was observed on the solutions from Examples 2 and 3 whilst that of Example 8 showed a reduction in weight loss of 14 %.

Example 11

[0038] A hydraulic oil was prepared using the microemulsion from example 2 with an anti-wear additive based on sulphur. This was added at a rate of 5 % v/v. A further hydraulic oil was prepared using the same base oil and sulphur additive. Both oils were then tested for their anti-wear properties using the Reichert testing apparatus. The microemulsion showed a reduced weight loss compared to the standard oil of 10 %.

Example 12

[0039] A gear-oil has been prepared using a commercially available oil (Mobil Glygoyle™ HE460) and the composition of Example 1. The resulting oil has shown improved coolancy with no loss in lubricity using standard anti-wear tests i.e. four ball tests.

Example 13

[0040] A grinding oil was prepared using a linear alpha olefin base oil with the composition of Example 1. This was

tested against a standard grinding oil and was shown to be of superior cooling ability with no loss in lubricity.

TABLE 1:

Sample	Tool Number	Diameter /mm	Speed /RPM	Cut / mm	Length of cut / mm	Oil on Swarf g / Kg
Shell 130 solvent neutral	1	75-60	140	2.5	600	8.0
		60-45	190	2.5	600	
		45 - 25	260	2.5	600	
		25-20	350	2.5	600	
As above + 1 % Cereclor E45	2	75-60	140	2.5	600	8.3
		60-45	190	2.5	600	
		45-25	260	2.5	600	
		25-20	350	2.5	600	
Solution from Example 3	3	75-60	140	2.5	600	6.1
		60-45	190	2.5	600	
		45-25	260	2.5	600	
		25-20	350	2.5	600	
Solution from Example 2	4	75-60	140	2.5	600	5.5
		60-45	190	2.5	600	
		45-25	260	2.5	600	
		25-20	350	2.5	600	
As above + 1 % Cereclor E45	5	75 - 60	140	2.5	600	5.6
		60 - 45	190	2.5	600	
		45 - 25	260	2.5	600	
		25 -20	350	2.5	600	

Claims

1. A water-in-oil microemulsion which behaves as a true solution comprising oil, water and a surfactant composition comprising

- i). a fatty acid amine ethoxylate
- ii). C₆-C₁₅ alcohol ethoxylate; and
- iii). tall oil fatty acid amine.

2. A water-in-oil microemulsion as claimed in claim 1, wherein the surfactant composition consists of:

- i). 1 - 5 parts by volume of a fatty acid amine ethoxylate;
- ii). 0.5 - 4 parts by volume of a C₆-C₁₅ alcohol ethoxylate; and
- iii). 1.5 - 5 parts by volume of tall oil fatty acid amine.

3. A water-in-oil microemulsion as claimed in claim 1 or claim 2, wherein the surfactant composition consists of 3 parts by volume of component (i) and 2 parts by volume of component (ii) and 275 parts by volume of component (iii).

4. A water-in-oil microemulsion as claimed in claim 1 or claim 2, wherein the surfactant composition consists of 3 parts by volume of component (i) and 1 part by volume of component (ii) and 1.5 parts by volume of component (iii).

5. A water-in-oil microemulsion as claimed in claim 2, wherein the surfactant composition consists of 2 parts by volume of component (i) and 1 part by volume of component (ii) and 3 parts by volume of component (iii).

6. A process for forming a water-in-oil microemulsion which behaves as a true solution, which process comprises adding to a mixture of oil and water a surfactant composition comprising

- i). a fatty acid amine ethoxylate
- ii). C₆-C₁₅ alcohol ethoxylate; and
- iii). tall oil fatty acid amine

such that clear homogenous water-in-oil microemulsion is formed.

7. A process according to claim 6 wherein the surfactant composition consists of:

- i). 1 - 5 parts by volume of a fatty acid amine ethoxylate;
- ii). 0.5 - 4 parts by volume of a C₆-C₁₅ alcohol ethoxylate; and
- iii). 1.5 - 5 parts by volume of tall oil fatty acid amine.

8. A process according to claim 6 or claim 7 wherein the surfactant composition consists of 3 parts by volume of component (i) and 2 parts by volume of component (ii) and 2.75 parts by volume of component (iii).

9. A process according to claim 6 or claim 7 wherein the surfactant composition consists of 3 part by volume of component (i) and 1 put by volume of component (ii) and 1.5 parts by volume of component (iii).

10. A process according to claim 6 or claim 7 wherein the surfactant composition consists of 2 parts by volume of component (i), 1 part by volume of component (ii) and 3 parts by volume of component (iii).

11. A process according to claim 6 wherein the surfactant composition is added to a mixture of 30 parts by volume of water and 70 parts by volume of paraffinic type base oil in an amount of 40 parts by volume relative to the oil water mixture; the surfactant composition consisting of 3 parts by volume of component (i), 1 part by volume of component (ii) and 1.5 parts by volume of component (iii).

12. A process according to claim 6 wherein the surfactant composition is added to a mixture of 20 parts by volume of water and 80 parts by volume of paraffinic type base oil in an amount of 29 parts by volume relative to the oil water mixture; the surfactant composition consisting of 3 parts by volume of component (i), 2 parts by volume of component (ii) and 2.75 parts by volume of component (iii).

13. A process according to claim 6 wherein the surfactant composition is added to a mixture of 10 parts by volume of water and 90 parts by volume of paraffinic base oil in an amount of 14 parts by volume relative to the oil water mixture; the surfactant composition consisting of 2 parts by volume of component (i), 1 part by volume of component (ii) and 3 parts by volume of component (iii).

14. The use of a water-in-oil microemulsion which behaves as a true solution according to any of claims 1 to 5 or obtainable according to any one of claims 6-13 as an industrial lubricant.

15. The use of a surfactant composition as defined in any of claims 1 to 5 to form a water in-oil microemulsion which behaves as a true solution.

16. The use of a surfactant composition as defined in any of claims 1 to 5 to prevent growth of micro-organisms in an oil and water mixture by adding the composition to an oil and water mixture to form a water-in-oil microemulsion which behaves as a true solution.

Patentansprüche

1. Eine Wasser-in-Öl Mikroemulsion, die sich wie eine echte Lösung verhält und die Öl, Wasser und eine oberflächen-aktive Zusammensetzung umfasst, die Folgendes umfasst:

- (i) ein Fettsäureaminethoxylat;
- (ii) C₆-C₁₅ Alkoholethoxylat; und
- (iii) Tallölfettsäureamin.

2. Eine Wasser-in-Öl Mikroemulsion wie in Anspruch 1 beansprucht, wobei die oberflächenaktive Zusammensetzung aus Folgendem besteht:

- (i) 1 - 5 Volumenanteile eines Fettsäureaminethoxylats;
- (ii) 0,5 - 4 Volumenanteile eines C₆-C₁₅ Alkoholethoxylats; und
- (iii) 1,5 - 5 Volumenanteile von Tallölfettsäureamin.

3. Eine Wasser-in-Öl Mikroemulsion wie in Anspruch 1 oder Anspruch 2 beansprucht, wobei die oberflächenaktive Zusammensetzung aus 3 Volumenanteilen von Komponente (i) und 2 Volumenanteilen von Komponente (ii) und 2,75 Volumenanteilen von Komponente (iii) besteht.

4. Eine Wasser-in-Öl Mikroemulsion wie in Anspruch 1 oder Anspruch 2 beansprucht, wobei die oberflächenaktive Zusammensetzung aus 3 Volumenanteilen von Komponente (i) und 1 Volumenanteil von Komponente (ii) und 1,5 Volumenanteilen von Komponente (iii) besteht.

5. Eine Wasser-in-Öl Mikroemulsion wie in Anspruch 1 oder Anspruch 2 beansprucht, wobei die oberflächenaktive Zusammensetzung aus 2 Volumenanteilen von Komponente (i) und 1 Volumenanteil von Komponente (ii) und 3 Volumenanteilen von Komponente (iii) besteht.

6. Ein Verfahren für das Bilden einer Wasser-in-Öl Mikroemulsion, die sich wie eine echte Lösung verhält, wobei dieses Verfahren das Hinzufügen einer oberflächenaktiven Zusammensetzung zu einer Mischung aus Öl und Wasser umfasst, wobei die oberflächenaktive Zusammensetzung Folgendes umfasst:

- (i) ein Fettsäureaminethoxylat;
- (ii) C₆-C₁₅ Alkoholethoxylat; und
- (iii) Tallölfettsäureamin,

so dass eine klare, homogene Wasser-in-Öl Mikroemulsion gebildet wird.

7. Ein Verfahren gemäß Anspruch 6, wobei die oberflächenaktive Zusammensetzung aus Folgendem besteht:

- (i) 1 - 5 Volumenanteile eines Fettsäureaminethoxylats;
- (ii) 0,5 - 4 Volumenanteile eines C₆-C₁₅ Alkoholethoxylats; und
- (iii) 1,5 - 5 Volumenanteile von Tallölfettsäureamin.

8. Ein Verfahren gemäß Anspruch 6 oder Anspruch 7, wobei die oberflächenaktive Zusammensetzung aus 3 Volumenanteilen von Komponente (i) und 2 Volumenanteilen von Komponente (ii) und 2,75 Volumenanteilen von Komponente (iii) besteht.

9. Ein Verfahren gemäß Anspruch 6 oder Anspruch 7, wobei die oberflächenaktive Zusammensetzung aus 3 Volumenanteilen von Komponente (i) und 1 Volumenanteil von Komponente (ii) und 1,5 Volumenanteilen von Komponente (iii) besteht.

10. Ein Verfahren gemäß Anspruch 6 oder Anspruch 7, wobei die oberflächenaktive Zusammensetzung aus 2 Volumenanteilen von Komponente (i), 1 Volumenanteil von Komponente (ii) und 3 Volumenanteilen von Komponente (iii) besteht.

11. Ein Verfahren gemäß Anspruch 6, wobei die oberflächenaktive Zusammensetzung zu einer Mischung aus 30 Volumenanteilen von Wasser und 70 Volumenanteilen von Grundöl vom paraffinischen Typ in einer Menge von 40 Volumenanteilen mit Bezug auf die Öl-Wasser-Mischung hinzugefügt wird; wobei die oberflächenaktive Zusammensetzung aus 3 Volumenanteilen von Komponente (i), 1 Volumenanteil von Komponente (ii) und 1,5 Volumenanteilen von Komponente (iii) besteht.

12. Ein Verfahren gemäß Anspruch 6, wobei die oberflächenaktive Zusammensetzung zu einer Mischung aus 20 Volumenanteilen von Wasser und 80 Volumenanteilen von Grundöl vom paraffinischen Typ in einer Menge von 29 Volumenanteilen bezüglich der Öl-Wasser-Mischung hinzugefügt wird; wobei die oberflächenaktive Zusammensetzung aus 3 Volumenanteilen von Komponente (i), 2 Volumenanteilen von Komponente (ii) und 2,75 Volumenanteilen von Komponente (iii) besteht.

- 5 **13.** Ein Verfahren gemäß Anspruch 6, wobei die oberflächenaktive Zusammensetzung zu einer Mischung aus 10 Volumenanteilen von Wasser und 90 Volumenanteilen von Grundöl vom paraffinischen Typ in einer Menge von 14 Volumenanteilen mit Bezug auf die Öl-Wasser-Mischung hinzugefügt wird; wobei die oberflächenaktive Zusammensetzung aus 2 Volumenanteilen von Komponente (i), 1 Volumenanteil von Komponente (ii) und 3 Volumenanteilen von Komponente (iii) besteht.
- 10 **14.** Die Verwendung einer Wasser-in-Öl Mikroemulsion, die sich wie eine echte Lösung verhält, die gemäß einem der Ansprüche 1 bis 5 oder gemäß einem der Ansprüche 6 bis 13 als ein Industrieschmierstoff erhältlich ist.
- 15 **15.** Die Verwendung einer oberflächenaktiven Zusammensetzung wie in einem der Ansprüche 1 bis 5 definiert für das Bilden einer Wasser-in-Öl Mikroemulsion, die sich wie eine echte Lösung verhält.
- 15 **16.** Die Verwendung einer oberflächenaktiven Zusammensetzung wie in einem der Ansprüche 1 bis 5 definiert für das Verhindern des Wachstums von Mikroorganismen in einer Mischung aus Öl und Wasser durch Hinzufügen der Zusammensetzung zu einer Mischung aus Öl und Wasser, um eine Wasser-in-Öl Mikroemulsion, die sich wie eine echte Lösung verhält, zu bilden.

Revendications

- 20 **1.** Microémulsion d'eau dans l'huile se comportant comme une solution authentique, comprenant de l'huile, de l'eau et une composition de surfactant comprenant :
- 25 i. un éthoxylate amine d'acide gras
 ii. un éthoxylate d'alcool C₆-C₁₅ ; et
 iii. une amine d'acide gras tallol
- 30 **2.** Microémulsion d'eau dans l'huile, comme revendiquée dans la revendication 1, dans laquelle la composition du surfactant est la suivante :
- 35 i. 1 à 5 parties par volume d'éthoxylate amine d'acide gras ;
 ii. 0,5 à 4 parties par volume d'éthoxylate d'alcool C₆-C₁₅ ; et
 iii. 1,5 à 5 parties par volume d'amine d'acide gras tallol.
- 40 **3.** Microémulsion d'eau dans l'huile, comme revendiquée dans la revendication 1 ou 2, dans laquelle le surfactant est composé de 3 parties par volume de composant (i), de 2 parties par volume de composant (ii) et de 2,75 parties par volume de composant (iii).
- 45 **4.** Microémulsion d'eau dans l'huile comme revendiquée dans la revendication 1 ou dans la revendication 2, dans laquelle le surfactant est composé de 3 parties par volume de composant (i) et 1 partie par volume de composant (ii) et, 1,5 partie par volume de composant (iii).
- 50 **5.** Microémulsion d'eau dans l'huile, comme revendiquée dans la revendication 1 ou dans la revendication 2, dans laquelle le surfactant est composé de 2 parties par volume de composant (i), de 1 partie par volume de composant (ii) et de 3 parties par volume de composant (iii).
- 55 **6.** Procédé pour former une microémulsion d'eau dans l'huile agissant comme une solution authentique, ledit processus comprenant l'ajout à un mélange d'huile et d'eau d'un surfactant dont la composition est la suivante :
- i. un éthoxylate amine d'acide gras
 ii. un éthoxylate d'alcool C₆-C₁₅ ; et
 iii. une amine d'acide gras tallol
- de façon à former une microémulsion d'eau dans l'huile homogène et claire.
- 7.** Procédé selon la revendication 6, dans lequel la composition du surfactant est la suivante :
- i. 1 à 5 parties par volume d'éthoxylate amine d'acide gras ;

ii. 0,5 à 4 parties par volume d'éthoxylate d'alcool C₆-C₁₅ ; et

iii. 1,5 à 5 parties par volume d'amine d'acide gras tallol.

- 5 **8.** Procédé selon la revendication 6 ou 7, dans lequel la composition du surfactant consiste en 3 parties par volume de composant (i), 2 parties par volume de composant (ii), et 2,75 parties par volume de composant (iii).
- 9.** Procédé selon la revendication 6 ou 7, dans lequel la composition du surfactant consiste en 3 parties par volume de composant (i), 1 partie par volume de composant (ii), et 1,5 partie par volume de composant (iii).
- 10 **10.** Procédé selon la revendication 6 ou 7, dans lequel la composition du surfactant consiste en 2 parties par volume de composant (i), 1 partie par volume de composant (ii) et 3 parties par volume de composant (iii).
- 11.** Procédé selon la revendication 6, dans lequel la composition est ajoutée à un mélange de 30 parties par volume d'eau et de 70 parties par volume d'une huile de base de type paraffine, dans une quantité de 40 parties par volume par rapport au mélange huile-eau ; la composition du surfactant, qui consiste en 3 parties par volume de composant (i), 1 partie par volume de composant (ii) et 1,5 partie par volume de composant (iii).
- 15 **12.** Procédé selon la revendication 6, dans lequel la composition est ajoutée à un mélange de 20 parties par volume d'eau et de 80 parties par volume d'une huile de base de type paraffine, dans une quantité de 29 parties par volume par rapport au mélange huile-eau ; la composition du surfactant, qui consiste en 3 parties par volume de composant (i), 2 parties par volume de composant (ii) et 2,75 parties par volume de composant (iii).
- 20 **13.** Procédé selon la revendication 6, dans lequel la composition est ajoutée à un mélange de 10 parties par volume d'eau et de 90 parties par volume d'une huile de base de type paraffine, dans une quantité de 14 parties par volume par rapport au mélange huile-eau ; la composition du surfactant, qui consiste en 2 parties par volume de composant (i), 1 partie par volume de composant (ii) et 3 parties par volume de composant (iii).
- 25 **14.** Utilisation d'une microémulsion d'eau dans l'huile, se comportant comme une solution authentique, selon l'une quelconque des revendications 1 à 5 ou réalisable selon l'une quelconque des revendications 6 à 13, comme lubrifiant industriel.
- 30 **15.** Utilisation d'une composition de surfactant, comme définie dans l'une quelconque des revendications 1 à 5, pour former une microémulsion d'eau dans l'huile, se comportant comme une solution authentique.
- 16.** Utilisation d'une composition de surfactant, comme définie dans l'une quelconque des revendications 1 à 5, pour empêcher le développement de micro-organismes dans un mélange huile-eau, en ajoutant la composition à un mélange huile-eau, pour former une microémulsion d'eau dans l'huile se comportant comme une solution authentique.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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