

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference OIL4-61833-WO	FOR FURTHER ACTION	See item 4 below
International application No. PCT/US2017/050944	International filing date (<i>day/month/year</i>) 11 September 2017 (11.09.2017)	Priority date (<i>day/month/year</i>) 14 September 2016 (14.09.2016)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant BAKER HUGHES, A GE COMPANY, LLC		

1.	This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 bis.1(a).																								
2.	This REPORT consists of a total of 7 sheets, including this cover sheet.																								
In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.																									
3.	This report contains indications relating to the following items: <table style="width: 100%;"> <tr> <td style="width: 5%; text-align: center;">☒</td> <td style="width: 25%;">Box No. I</td> <td style="width: 70%;">Basis of the report</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. II</td> <td>Priority</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td style="text-align: center;">☒</td> <td>Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td style="text-align: center;">☒</td> <td>Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table>	☒	Box No. I	Basis of the report	☐	Box No. II	Priority	☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	☐	Box No. IV	Lack of unity of invention	☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	☐	Box No. VI	Certain documents cited	☐	Box No. VII	Certain defects in the international application	☒	Box No. VIII	Certain observations on the international application
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4.	The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).																								

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Date of issuance of this report 19 March 2019 (19.03.2019)
Facsimile No. +41 22 338 82 70	Authorized officer Agnès Wittmann-Regis e-mail: pct.team6@wipo.int

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To:
CHANDLER, KIMBERLY L.

BAKER HUGHES, A GE COMPANY, LLC
INTELLECTUAL PROPERTY COUNSEL 17021 ALDINE
WESTFIELD HOUSTON TX 77073 USA

Date of mailing
(day/month/year) **26 December 2017 (26.12.2017)**

Applicant's or agent's file reference OIL4-61833-WO		FOR FURTHER ACTION See paragraph 2 below	
International application No. PCT/US2017/050944	International filing date (day/month/year) 11 September 2017 (11.09.2017)	Priority date(day/month/year) 14 September 2016 (14.09.2016)	
International Patent Classification (IPC) or both national classification and IPC C09K 8/524(2006.01)i			
Applicant BAKER HUGHES, A GE COMPANY, LLC			

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis. I(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.
For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/KR International Application Division Korean Intellectual Property Office 189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea Facsimile No. +82-42-481-8578	Date of completion of this opinion 26 December 2017 (26.12.2017)	Authorized officer KIM, Sun Hee Telephone No. +82-42-481-5405
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**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2017/050944

Box No. 1 Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of :

- ☒ the international application in the language in which it was filed
- ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*. I(a))

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

- a. ☐ forming part of the international application as filed:
☐ in the form of an Annex C/ST.25 text file.
☐ on paper or in the form of an image file.
- b. ☐ furnished together with the international application under PCT Rule 13*ter*. I(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.
- c. ☐ furnished subsequent to the international filing date for the purposes of international search only:
☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*. I(a)).
☐ on paper or in the form of an image file (Rule 13*ter*. I(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2017/050944

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	3-12	YES
	Claims	1-2	NO
Inventive step (IS)	Claims	NONE	YES
	Claims	1-12	NO
Industrial applicability (IA)	Claims	1-12	YES
	Claims	NONE	NO

2. Citations and explanations :

Reference is made to the following document:

D1: US 2010-0130384 A1 (LIGHTFORD, STEPHEN CHARLES et al.) 27 May 2010

1. Novelty and Inventive Step

1.1 Independent Claim 1

D1, which is considered to represent the most relevant state of claim 1, discloses a method for removing an organic material from a portion of a wellbore, the method comprising the steps of: forming a composition comprising an organic solvent blend of a non-polar organic solvent and a polar organic solvent, and an surfactant; introducing the composition to the portion from which the organic material is to be removed; and placing the composition in the portion of the well to be treated for a sufficient contact time for the organic solvent blend to dissolve a substantial amount of the organic material, wherein the composition is a dispersion (see paragraphs [0026], [0029]; and claim 15).

As all the features of claim 1 are disclosed in D1, this claim is anticipated by D1. Therefore, claim 1 lacks novelty under PCT Article 33(2).

1.2 Dependent Claims 2-12

Concerning the additional feature of claim 2, D1 discloses the organic material such as asphaltene and paraffin deposition (see paragraph [0011]).

Continued on Supplemental Box

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2017/050944

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

1. The expression "at least partially" causes problems in exactly defining the subject matter of claims 1 and 8 because it provides multiple choices as to the scope of the features related to this expression. Thus, claims 1 and 8 do not meet the requirement of PCT Article 6.

2. The expression "and/or" causes problems in exactly defining the subject matter of claim 10 because it provides multiple choices as to the scope of the features related to this expression. Thus, claim 10 does not meet the requirement of PCT Article 6.

(Note: The international search report and the written opinion have been established on the assumption that the phrase 'and/or' in claim 10 is 'or'.)

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of : Box No. V

As all the feature of claim 2 is disclosed in D1, this claim is anticipated by D1. Therefore, claim 2 lacks novelty under PCT Article 33(2).

Concerning the additional feature of claim 3, D1 discloses that the non-polar organic solvent is aromatic solvents, and the polar organic solvent is N-methyl pyrrolidone (see paragraphs [0022], [0024]). And a kind of a surfactant of claim 3 can be appropriately selected by a person skilled in the art without exercising any ingenuity, considering the feature of D1 in that the surfactant can be selected from the group consisting of: ethoxylated alcohols, ethoxylated nonylphenol, and any combination thereof (see paragraph [0025]).

The additional features of claims 4-5 can be optimized by repeated experiments practiced by a person skilled in the art without exercising any ingenuity, considering the feature of D1 in that the organic solvent blend comprises the non-polar organic solvent and the polar organic solvent in the ratio of: (a) from about 99% to about 95% by volume of the non-polar organic solvent; and (b) from about 1% to about 5% by volume of the polar organic solvent (see paragraph [0020]). And no unexpected benefit has been shown in relation to the feature.

The additional features of claims 6-7 can be optimized by repeated experiments practiced by a person skilled in the art without exercising any ingenuity, considering the feature of D1 in placing the composition in the portion of the well to be treated for a sufficient contact time for the organic solvent blend to dissolve a substantial amount of the organic material (see paragraph [0029]).

Concerning the additional feature of claim 8, D1 discloses the step of placing the composition in the portion of the well to be treated for a sufficient contact time for the organic solvent blend to dissolve a substantial amount of asphaltene deposits and scale deposits (see paragraphs [0011], [0029]). And a single phase fluid further comprising at least one scale dissolver of claim 8 can be appropriately selected by a person skilled in the art without exercising any ingenuity.

The additional feature of claim 9 can be appropriately selected by a person skilled in the art without exercising any ingenuity, considering the feature of D1 in scale deposits (see paragraph [0011]).

Continued on The Next Page

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of : Previous Page

Although the additional feature of claim 10 is not disclosed in D1, such a feature can be appropriately selected by a person skilled in the art without exercising any ingenuity.

Although the additional features of claims 11-12 are not disclosed in D1, such features can be optimized by repeated experiments practiced by a person skilled in the art without exercising any ingenuity. And no unexpected benefit has been shown in relation to the feature.

Accordingly, claims 3-12 would have been obvious over D1. Therefore, claims 3-12 lack an inventive step under PCT Article 33(3).

2. Industrial Applicability

Claims 1-12 are industrially applicable under PCT Article 33(4).

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As all the features of claim 1 are disclosed in D1, this claim is anticipated by D1. Therefore, claim 1 lacks novelty under PCT Article 33(2).

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2. The expression "and/or" causes problems in exactly defining the subject matter of claim 10 because it provides multiple choices as to the scope of the features related to this expression. Thus, claim 10 does not meet the requirement of PCT Article 6.

(Note: The international search report and the written opinion have been established on the assumption that the phrase 'and/or' in claim 10 is 'or'.)

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Although the additional features of claims 11-12 are not disclosed in D1, such features can be optimized by repeated experiments practiced by a person skilled in the art without exercising any ingenuity. And no unexpected benefit has been shown in relation to the feature.

Accordingly, claims 3-12 would have been obvious over D1. Therefore, claims 3-12 lack an inventive step under PCT Article 33(3).

2. Industrial Applicability

Claims 1-12 are industrially applicable under PCT Article 33(4).

(51) International Patent Classification:
C09K 8/524 (2006.01)(21) International Application Number:
PCT/US2017/050944(22) International Filing Date:
11 September 2017 (11.09.2017)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
62/394,325 14 September 2016 (14.09.2016) US
15/699,744 08 September 2017 (08.09.2017) US(71) Applicant: BAKER HUGHES, A GE COMPANY, LLC
[US/US]; 17021 Aldine Westfield, Houston, Texas 77073 (US).

(72) Inventors: QUINTERO, Lirio; 128 Gessner Road, Houston, Texas 77024 (US). FELIPE, Mary Jane; 15000 W. Airport Blvd., No. 532, Sugar Land, Texas 77498 (US).

(74) Agent: CHANDLER, Kimberly L.; Baker Hughes, a GE Company, LLC, 17021 Aldine Westfield, Houston, Texas 77073 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,

(54) Title: METHOD FOR REMOVING ORGANIC AND INORGANIC DEPOSITS IN ONE STEP

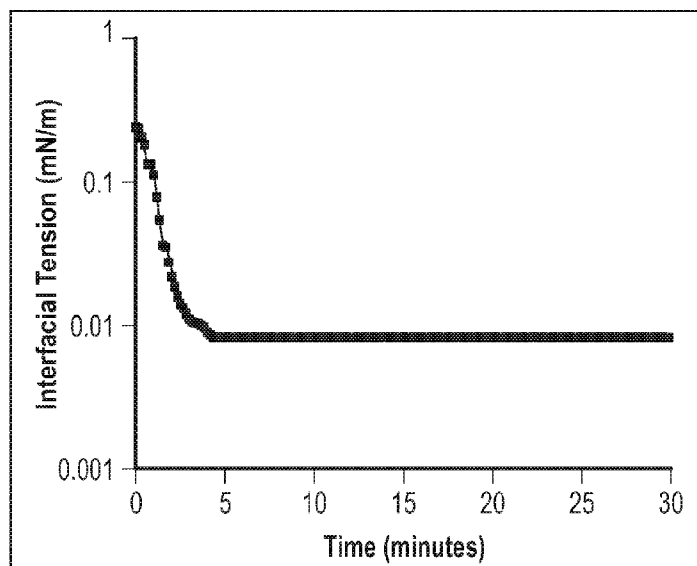


FIG. 3

(57) **Abstract:** Both organic deposits and inorganic deposits in a wellbore are simultaneously removed from a wellbore by contacting the deposits with a single phase fluid for an amount of time effective to simultaneously disperse the organic deposits and dissolve the inorganic deposits, where the single phase fluid includes least one solvent, at least one surfactant, at least one co-solvent, and at least one scale dissolver. The method further involves at least partially removing the organic deposits and inorganic deposits from the wellbore. In an embodiment where it is not necessary to remove inorganic deposits, the scale dissolver may be omitted.



MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

METHOD FOR REMOVING ORGANIC AND INORGANIC DEPOSITS IN ONE STEP

TECHNICAL FIELD

[0001] The present invention relates to methods for removing organic and inorganic deposits; and more particularly relates, in one non-limiting embodiment, to methods for simultaneously removing organic and inorganic deposits during any well intervention after an oil and gas well is completed in one step.

TECHNICAL BACKGROUND

[0002] Crude oils and other heavier petroleum fractions often contain organic materials such as asphaltenes and paraffins. The major constituents of the paraffinic waxes contain long-chain normal alkyl regions. These waxy compounds readily crystallize out upon cooling of the oil fraction containing them. This cooling may result in deposits which obstruct the flow of hydrocarbon production fluids if the cooling occurs in a wellbore or a flowline such as a pipe or other conduit. These deposits must be removed from the wellbore to achieve continued and/or efficient production of petroleum. These deposits may also occur in the near-wellbore region of the formation, and these deposits are often a combination of paraffins, asphaltenes, emulsion, and/or inorganic scale.

[0003] Asphaltene deposits in the wellbore also cause problems and must be removed. Asphaltenes are organic materials consisting of aromatic and naphthenic ring compounds containing nitrogen, sulfur and oxygen molecules. The asphaltene fraction of crude may be defined as the organic part of the oil that is not soluble in straight-chain solvents such as pentane or heptane. Asphaltenes may exist as a colloidal suspension stabilized by resin molecules (e.g. aromatic ring systems) in the oil. The asphaltenes may precipitate as a result of a number of effects or factors including, but not necessarily limited to, pressure drop, shear forces (turbulent flow), acids, solution carbon dioxide (CO₂), mixing of incompatible crude oils, injected condensate, or other conditions or materials that break or disturb the stability of the asphaltic dispersion. Asphaltene deposits may occur in the near-wellbore region of a subterranean

formation, well production tubing, valves and chokes, flowlines, risers, surface treating vessels, and storage tanks.

[0004] Besides these organic deposits, inorganic deposits may also cause concerns. Inorganic deposits are mainly salts that precipitate due to an incompatible mix of salt-containing water and other chemicals including, but not necessarily limited to sulfate salts, carbonate salts, halide salts, and combinations of these which can cause problematic scales which can also obstruct hydrocarbon flow in the wellbore and the near-wellbore region of the formation.

[0005] Various methods for removing paraffin wax have been utilized in the past. Sulfur trioxide has been used to contact the paraffin and form a dispersible material that is removed with an aqueous liquid and a surfactant. Other solvents and dispersants such as a copolymer of a primary alcohol and ethylene oxide with sodium silicate and N-substituted succinimide ethers have been tried. U.S. Pat. No. 4,813,482 teaches injecting a mixture of an alkyl or aralkyl polyoxyalkylene phosphate ester surfactant in free acid form or as a salt with a mutual solvent and water to remove paraffin deposits. This mixture must be at a temperature greater than the melting point of the wax to be effective. These processes do not melt the wax; they can only slowly eat away at its surface. This is typically not fast enough for economic deposit removal at most realistic surface-to-volume ratios. Furthermore, they create dispersions in water which must be disposed of or otherwise expensively dealt with.

[0006] U.S. Pat. No. 4,755,230 teaches the use of inorganic nitrate/nitrite compounds in redox reactions which result in an exotherm which melts the paraffin deposit and generates nitrogen gas. This technique does melt the wax, but requires the use of water to deliver the reactants, so that if the wax disperses at all, which it may well not, it does so into water which then must be expensively dealt with. Furthermore, gas generating redox reactions tend to be self-accelerating, rendering them at best kinetically unpredictable, and at worst explosive.

[0007] Methods for removing paraffin wax deposits from the surfaces of hydrocarbon (oil and/or gas) production equipment during oil production by

melting and subsequently dispersing the deposits are also described in U.S. Pat. No. 5,484,488. These methods utilize an acid compound and a neutralizer compound which react exothermally to melt the deposit and form a dispersant to remove the melted fragments of the deposit. Examples of acids used in this method include H_3PO_4 , H_2SO_4 , and HCl , whereas examples of neutralizers used include NaOH , KOH , MgO , MgCO_3 and NaHCO_3 .

[0008] It would thus be desirable to discover a new method and/or composition to remove organic deposits such as paraffins, asphaltenes and other types of undesired deposits and impediments from wellbore and the near-wellbore region of a subterranean formation, for instance inorganic deposits and the like that may be easily implemented. Because each wellbore procedure is costly and time consuming, it would be desirable to simultaneously remove both organic deposits and inorganic deposits in one step instead of in two or more separate steps.

SUMMARY

[0009] In one non-limiting embodiment there may be provided a method for removing organic deposits from a wellbore that involves contacting the organic deposits in the wellbore with a single phase fluid for an amount of time effective to disperse the organic deposits. The single phase fluid includes, but is not necessarily limited to, at least one solvent, at least one surfactant, and at least one co-solvent. The method additionally includes at least partially removing the organic deposits from the wellbore.

[0010] There is provided in one non-restrictive version, a method for simultaneously removing organic deposits and inorganic deposits from a wellbore, which method includes contacting the organic deposits and inorganic deposits in the wellbore with a single phase fluid for an amount of time effective to simultaneously disperse the organic deposits and dissolve the inorganic deposits. The single phase fluid includes, but is not necessarily limited to, at least one solvent, at least one surfactant, at least one co-solvent, and at least one scale dissolver. The method additionally involves

simultaneously at least partially removing the organic deposits and inorganic deposits from the wellbore.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1 is a series of three photographs where:

[0012] FIG. 1(a) is a photograph of a water drop on a surface coated with a paraffin deposit showing a contact angle of 100.5°;

[0013] FIG. 1(b) is a photograph of a water drop on a surface initially coated with a paraffin deposit and subsequently cleaned with a stand-alone solvent for paraffin cleanup, showing a contact angle of 82.2°;

[0014] FIG. 1(c) is a photograph of a water drop on a surface initially coated with a paraffin deposit and subsequently cleaned with Formulation 2 described herein, showing a contact angle of 8.0°;

[0015] FIG. 2 is a series of four photographs where:

[0016] FIG. 2(a) is a photograph of a paraffin deposit;

[0017] FIG. 2(b) is a photograph of granular calcium carbonate representing scale;

[0018] FIG. 2(c) is a photograph of single phase Formulation 2;

[0019] FIG. 2(d) is a photograph of the single phase Formulation 2 of FIG. 2(c) showing that the organic deposit (paraffins) and inorganic solids (calcium carbonate) were completely dissolved;

[0020] FIG. 3 is a plot of interfacial tension profile of Formulation 1 in contact with a crude oil as a function of time;

[0021] FIG. 4 (a) is a photograph of a single phase Formulation 3 in contact with an organic solid deposit sample at an initial condition; and

[0022] FIG. 4 (b) is a photograph showing the complete dissolution of the solid organic deposit after 3 hours of contact with Formulation 3 at 150°F (65.5°C).

DETAILED DESCRIPTION

[0023] A method has been discovered for simultaneously removing undesirable deposits, such as organic deposits and inorganic deposits, from wellbores and the near wellbore region of subterranean formations. Organic deposits that may be removed by the methods herein include, but are not necessarily limited to, paraffins, asphaltenes, tar, sludge, schmoo, and combinations of these. "Tar" includes, but is not necessarily limited to tar mats and tar mat materials that are present in some reservoirs and near-wellbore regions of wells which can impair production. These deposits may also occur in combinations with emulsions, inorganic scale, corrosion products, and bacteria. Schmoo is an informal "catch-all" phrase for slimy, oily substances or deposits that adhere to almost any surface it contacts, and which is difficultly removed. As noted, inorganic deposits are typically salts that precipitate due to an incompatible mixing of salt-containing water and other chemicals including, but not necessarily limited to sulfate salts, carbonate salts, halide salts, and combinations of these which can cause problematic scales which can also obstruct hydrocarbon flow in the wellbore and the near-wellbore region of the formation.

[0024] Because the fluid is a single phase it is stable and thus does not separate upon storage, handling or use. Further, because the fluid is a single phase fluid it can be injected, pumped or otherwise introduced into the wellbore and near-wellbore regions of the subterranean formation in one step without having to use two or more fluids which are immiscible with each other and which would not form a single phase fluid and thus be unsuitable for and impossible to use in a one-step process.

[0025] Generally, suitable solvents include, but are not necessarily limited to, organic solvents, aromatic solvents, aliphatic solvents, naphthenic solvents, and mixtures of these solvents which are good for dispersing paraffins and asphaltenes, and forming dispersions of paraffins and asphaltenes. The solvents may be naturally occurring or synthetic. More specific, non-limiting examples of suitable dispersions include, but are not limited to: light aliphatic solvents with carbon numbers between C₆ and C₁₅; light aromatic solvents com-

posed of isomers of C_9H_{12} ; heavy aromatic solvent primarily composed of C_{10} aromatic (CAS number 64742-94-5); and combinations thereof, and the like. Other solvents include, but are not limited to, terpenes, ionic liquids, synthetic solvents such as methyl ester solvents and solvents produced by metathesis catalyst technology.

[0026] Suitable surfactants for the single phase additive fluid include, but are not necessarily limited to, nonionic surfactants having an HLB between about 9 and about 14, for instance alkoxylated surfactants, such as alkoxylated alcohols, where the alkoxy groups are ethoxy groups, propoxy groups or mixtures thereof. Other nonionic surfactants include polymeric alkoxylates, polyglucosides, sorbitan esters, amine oxide, and alkanolamides. Other suitable surfactants include, but are not necessarily limited to anionic surfactants which may include but are not necessarily limited to oxyalkylated ether sulfates, alkyl aryl sulfates, disulfonates, sulfosuccinates, sulfonates (e.g. sulfonated amines and salts thereof), and carboxylates, cationic surfactants, and mixtures thereof, again where the alkoxy groups are ethoxy groups, propoxy groups or mixtures thereof. Other suitable surfactants include, but are not limited to gemini surfactants, betaines, amino-acids such as (including, but not limited to cocoyl glutamate), cationic surfactants, such as quaternary ammonium compounds (e.g. polyglycol ether ammonium methyl chloride).

[0027] Suitable co-solvents for the single phase additive fluid include, but are not necessarily limited to, glycol ethers, which can include, but are not necessarily limited to, ethylene glycol mono-butyl ether, dipropylene glycol mono-methyl ether, propylene glycol ethers, methyl 2-pyrrolidone, as well as other co-solvents such as methanol, isopropyl alcohol, butanol, pentanol, hexanol, isooctyl alcohol and their isomers, C1-C8 alcohol blends, and the like, and mixtures thereof.

[0028] Suitable scale dissolvers for the single phase additive fluid include, but are not necessarily limited to, in-situ acids and already-formed acids, in particular hydrochloric acid, acetic acid, phosphoric acid, formic acid, hydrofluoric acid, citric acid, uric acid, synthetic acid (obtained by a

combination of urea and hydrogen chloride) and the like, and blends of these acids. In-situ acids are defined herein as acids generated in-situ in the wellbore.

[0029] Generally, the solvents for the organic deposits are hydrophobic and the scale dissolvers are hydrophilic. By using appropriate surfactants (which are very hydrophilic) and co-solvents (which are mainly hydrophilic), and appropriate amounts of these surfactant and co-solvents, the solvents and the scale dissolvers may be all combined together into a stable, single phase fluid. By “stable” is meant that the single phase fluid does not separate into different phases over time upon standing, handling, and/or use. If once the single phase fluid is introduced into the wellbore and contacts the organic deposits and inorganic deposits, then it is acceptable, although not necessary, for the components of the fluid to phase separate prior to being removed from the wellbore along with the dispersed organic deposits and dissolved inorganic deposits.

[0030] In an embodiment where there are no inorganic deposits or the inorganic deposits need not be removed, the scale dissolver may be omitted from or absent from the single phase fluid.

[0031] In one non-limiting embodiment, the components of the single phase fluid have the following proportions: between about 5 independently to about 40 wt% at least one solvent, between about 5 independently to about 25 wt% at least one surfactant, between about 5 independently to about 30 wt% co-solvent, and between about 0.1 independently to about 35 wt% scale dissolver. Alternatively the components of the single phase fluid have the following proportions: between about 10 independently to about 20 wt% at least one solvent, between about 7 independently to about 15 wt% at least one surfactant, between about 10 independently to about 20 wt% co-solvent, and between about 5 independently to about 15 wt% scale dissolver. The term “independently” as used herein with respect to a range means that any lower threshold may be combined with any upper threshold to provide a suitable alternative range.

[0032] The contact time between the single phase fluid and the organic deposits and inorganic deposits may suitable range from about 5 minutes independently to about 72 hours, alternatively from about 30 minutes independently to about 24 hours; in another non-limiting embodiment from about 1 hour independently to about 15 hours; and in another non-restrictive version from 2 hours to 48 hours. It will be appreciated that the goal is to fully contact the single phase fluid with the organic deposits and inorganic deposits as much as possible. This contact disperses the organic deposits into the fluid and dissolves the inorganic deposits simultaneously. Then the organic deposits and inorganic deposits are at least partially removed from the wellbore along with the fluid, which may or may not remain single phase. While complete removal of the organic deposits and inorganic deposits is desired, it will be appreciated that as a practical matter only partial removal may be possible. For instance, given that contacting the deposits occurs within a wellbore, it can be difficult at such a distance to fully contact all of the deposits with the single phase fluid as a practical matter.

[0033] Other components that may be included in the single phase fluid besides those already discussed include, but are not necessarily limited to, brine (including, but not necessarily limited to KCl brines, NaCl brines, CaCl_2 brines, ZnCl_2 brines, bromide brines, formate brines and the like), dispersants, wax inhibitors, asphaltene inhibitors, defoamers, corrosion inhibitors, hydrate inhibitors, and combinations thereof.

[0034] The invention will now be described with respect to certain Examples which are provided to further illustrate the invention, but not necessarily limit it in any way

EXAMPLES

[0035] The selection of a solvent that is efficient to dissolve paraffins and asphaltenes is important in order for the formulation to be able to achieve good cleaning of paraffins and asphaltenes deposits. When these solvents are used as stand-alone fluids, they produce good cleaning of paraffins and asphaltenes

deposits; however, the wettability alteration damage mechanism caused by paraffins and/or asphaltenes is not treated or addressed by these stand-alone solvents.

[0036] The role of the surfactant and co-solvents in the single phase fluids described herein is to get the immiscible components (*i.e.* solvent and scale dissolver diluted in water) into a single-phase fluid. The presence of very hydrophilic surfactants in the single-phase fluid, turn the surface from oil-wet to water-wet at the same time that paraffins and asphaltenes are removed. Thus it eliminates the wettability alteration damage. This is demonstrated by the measurement of contact angle.

[0037] Contact angle is one of the common ways to measure the wettability of a surface. Wetting refers to the study of how a liquid deposited on a solid substrate spreads out or the ability of liquids to form boundary surfaces with solid states. The wetting is determined by measuring the contact angle formed between the liquids and the solid. In hydrocarbon wells where oil and water are available, the water-wet tendency is high with a small contact angle between the solid surface and water, while large contact angles (about 80° or more) correspond to oil-wet surfaces.

[0038] Examples are presented in FIG. 1 where:

- (a) Figure 1(a) shows the contact angle between a water drop and a surface coated with a paraffin deposit. The measured contact angle was 100.5°, which corresponds to surfaces that are completely oil-wet.
- (b) Figure 1(b) shows the contact angle between a water drop and a surface that was covered with paraffin deposit and then cleaned with the stand-alone solvent for paraffins cleanup. The contact angle was 82.2°. The results demonstrated that, even if the surface was free of paraffin deposit, the surface remained oil-wet after the cleaning process with the solvent.
- (c) Figure 1(c) shows the contact angle between a water drop and a surface that was covered with paraffin deposit and then cleaned with

Formulation 2 (described below). The measured contact angle was 8.0° and the water droplet was spread over a larger area of the surface, which corresponds to the case where the surface is very water-wet.

The contact angle measured after treatment with Formulation 2 shows very similar contact angles compared to contact angles achieved after treatment with Formulation 1 described in Table I.

[0039] Table I presents two examples of single phase fluids as described herein, Formulations 1 and 2. Table II presents two additional, different examples of single phase fluids as described herein, Formulations 3 and 4.

TABLE I
Single Phase Fluids – Formulations 1 and 2

Composition	Type	Formulation 1, %	Formulation 2, %
Glycol ether	co-solvent	13.1	13.2
Blend of polyoxyalkylene sulfate and alcohol ethoxylate	surfactant	17	17
Sulfonate amine salt	surfactant	0.7	0.7
Isooctyl alcohol	co-solvent	1.1	1.1
Aromatic solvent	solvent	18	18
Scale dissolver	acid	0.1	15
KCl brine	brine	50	35

TABLE II
Single Phase Fluids – Formulations 3 and 4

Composition	Type	Formulation 3, %	Formulation 4, %
Glycol ether	co-solvent	9	9
Blend of polyoxyalkylene	surfactant	16	16

sulfate and alcohol ethoxylate			
Sulfonate amine salt	surfactant	0.5	0.5
C1-C8 alcohol blend	co-solvent	14.5	14.5
Blend of aliphatic (C ₆ - C ₁₅) and aromatic (isomers of C ₉ H ₁₂) solvent	solvent	14.3	14.4
Scale dissolver	acid	0.1	10
KCl brine	brine	45.6	35.6

[0040] The scale dissolver (e.g., acid blends used to dissolve carbonate scales) are hydrophilic components that are much more efficient in dissolving the scales when these are free of organic materials. For that reason, the combination of good solvents for organic material removal with the scale dissolver and surfactants in a single-phase fluid should and does produce a faster dissolution of the scales. When the single-phase fluid contacts the scale, this will remove the organic material and turn the surface of the scales more water-wet or hydrophilic.

[0041] A blend of paraffin deposit (shown alone in FIG. 2(a)) and calcium carbonate (representing scale, shown in granular form in FIG. 2(b)) in a ratio of 50/50 was placed in the single-phase fluid Formulation 2 (shown alone in FIG. 2(c)) to determine the effectiveness to disperse the paraffin and dissolve the calcium carbonate with the acid at the same time (*i.e.*, in a single-step). A proportion by weight of 9/1 of Formulation 2/blend of paraffin and calcium carbonate was used.

[0042] FIG. 2(d) shows that the organic deposit (paraffins) and inorganic solids (calcium carbonate) were completely dispersed and dissolved after 3 hours at room temperature (about 72°F; about 22°C). Then, the sample shown in FIG. 2(d) was filtered using a filter paper to determine the percentage of residual solid.

[0043] The results showed that all the calcium carbonate was dissolved. Only 20% of the paraffin colloid particles were retained in the filter paper.

[0044] One additional property of the single-phase fluids described herein is their very low interfacial tension (IFT) when contacted with crude oil or organic materials. The IFT ranges between 10^{-2} and 10^{-3} mN/m, depending on the crude oil or organic material contacted, which is two orders of magnitude lower than the IFT of the stand-alone solvents with water or scale dissolver with crude oils. FIG. 3 shows the IFT profile of Formulation 1 in contact with a crude oil. The low IFT results in higher solubilization of organic material, which produces a fast dispersion of the organic deposits, as well the breaking of sludge and viscous damaging emulsions.

[0045] With respect to the effect of temperature on the methods and compositions described herein: the single phase fluid is able to disperse paraffin and asphaltenes deposits at ambient temperature (about 72°F; about 22°C), and the effectiveness increased when temperature increased. For example, a sample of paraffins/asphaltenes blend was completely dispersed after 3 hours at 72°F (22°C). The second sample of the same organic deposit blend was completely dispersed after 1 hour at 200°F (93°C).

[0046] In another example, FIG. 4(a) shows that an organic solid deposit in contact with Formulation 3 at the initial contact. FIG. 4(b) shows that the organic solid deposit of FIG. 4(a) were completely dispersed and dissolved after 3 hours at 150°F (about 65.5°C) temperature.

[0047] In the foregoing specification, the invention has been described with reference to specific embodiments thereof, and has been described as effective in removing organic deposits and inorganic deposits from remote locations, such as from wellbores drilled into subterranean reservoirs and from the subterranean formations themselves (particularly the near wellbore part of the formation), but also including from downhole equipment, tubing, chokes, valves, separators, tanks, pipelines, and the like to remove deposits therefrom. However, it will be evident that various modifications and changes can be

made thereto without departing from the broader scope of the invention as set forth in the appended claims. Accordingly, the specification is to be regarded in an illustrative rather than a restrictive sense. For example, specific combinations of solvents, surfactants, co-solvents, scale dissolvers, acids, dispersants, and other components falling within the claimed parameters, including contact methods and contact times, but not specifically identified or tried in a particular method or composition, are anticipated to be within the scope of this invention. Furthermore, deposits and reaction and contact conditions other than those specifically exemplified herein are expected to be useful for the methods and compositions described herein.

[0048] The present invention may suitably consist of or consist essentially of the elements disclosed and may be practiced in the absence of an element not disclosed. In one non-limiting embodiment here is provided a method for removing organic deposits from a wellbore consisting essentially of or consisting of contacting the organic deposits in the wellbore with a single phase fluid for an amount of time effective to simultaneously disperse the organic deposits, where the single phase fluid comprises, consists essentially of, or consists of at least one solvent, at least one surfactant, and at least one co-solvent, where the method additionally consists essentially of or consists of at least partially removing the organic deposits from the wellbore.

[0049] In another non-restrictive instance, in a non-limiting instance, the method for simultaneously removing organic deposits and inorganic deposits from a wellbore consists of or consists essentially of contacting the organic deposits and inorganic deposits in the wellbore with a single phase fluid for an amount of time effective to simultaneously disperse the organic deposits and dissolve the inorganic deposits, where the single phase fluid comprises, consists essentially of, or consists of at least one solvent, at least one surfactant, at least one co-solvent, and at least one scale dissolver; and where the method further consists of or consists essentially of simultaneously at least partially removing the organic deposits and inorganic deposits from the wellbore.

[0050] As used herein, the terms “comprising,” “including,” “containing,” “characterized by,” and grammatical equivalents thereof are inclusive or open-ended terms that do not exclude additional, unrecited elements or method acts, but also include the more restrictive terms “consisting of” and “consisting essentially of” and grammatical equivalents thereof. As used herein, the term “may” with respect to a material, structure, feature or method act indicates that such is contemplated for use in implementation of an embodiment of the disclosure and such term is used in preference to the more restrictive term “is” so as to avoid any implication that other, compatible materials, structures, features and methods usable in combination therewith should or must be, excluded.

[0051] As used herein, the singular forms “a,” “an,” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise.

[0052] As used herein, the term “and/or” includes any and all combinations of one or more of the associated listed items.

[0053] As used herein, relational terms, such as “first,” “second,” “top,” “bottom,” “upper,” “lower,” “over,” “under,” etc., are used for clarity and convenience in understanding the disclosure and accompanying drawings and do not connote or depend on any specific preference, orientation, or order, except where the context clearly indicates otherwise.

[0054] As used herein, the term “substantially” in reference to a given parameter, property, or condition means and includes to a degree that one of ordinary skill in the art would understand that the given parameter, property, or condition is met with a degree of variance, such as within acceptable manufacturing tolerances. By way of example, depending on the particular parameter, property, or condition that is substantially met, the parameter, property, or condition may be at least 90.0% met, at least 95.0% met, at least 99.0% met, or even at least 99.9% met.

[0055] As used herein, the term “about” in reference to a given parameter is inclusive of the stated value and has the meaning dictated by the context (e.g., it includes the degree of error associated with measurement of the given parameter).

CLAIMS

What is claimed is:

1. A method for removing organic deposits from a wellbore comprising:
contacting the organic deposits in the wellbore with a single phase fluid
for an amount of time effective to disperse the organic deposits,
characterized in that the single phase fluid comprises:
at least one solvent;
at least one surfactant; and
at least one co-solvent; and
at least partially removing the organic deposits from the wellbore.
2. The method of claim 1 where the organic deposits comprise
asphaltenes, paraffins, and combinations thereof.
3. The method of claim 1 where:
the at least one solvent is selected from the group consisting of organic
solvents, aromatic solvents, aliphatic solvents, naphthenic
solvents, and combinations thereof;
the at least one surfactant is selected from the group consisting of:
nonionic surfactants having an HLB between 9 and 14,
anionic surfactants selected from the group consisting of
oxyalkylated ether sulfates, alkyl aryl sulfates,
disulfonates, sulfosuccinates, sulfonates and
carboxylates,
cationic surfactants,
gemini surfactants, betaines, amino-acids, and
combinations thereof; and
the at least one co-solvent is selected from the group consisting of glycol
ethers, methyl 2-pyrrolidone, methanol, isopropyl alcohol, butanol,

pentanol, hexanol, isooctyl alcohol and their isomers, blends of C1-C8 alcohols and combinations thereof.

4. The method of claim 1 where the single phase fluid comprises:
between 5 and 40 wt% of the at least one solvent;
between 5 and 25 wt% of the at least one surfactant; and
between 5 and 30 wt% of the at least one co-solvent;
based on the single phase fluid.
5. The method of claim 1 where the single phase fluid comprises:
between 10 and 20 wt% of the at least one solvent;
between 7 and 15 wt% of the at least one surfactant; and
between 10 and 20 wt% of the at least one co-solvent;
based on the single phase fluid.
6. The method of claim 1, 2, 3, 4, or 5 where the amount of time ranges between 5 minutes to 72 hours.
7. The method of claim 1, 2, 3, 4, or 5 where the amount of time ranges between 1 hour to 24 hours.
8. The method of claim 1, 2, 3, 4, or 5 where the single phase fluid further comprises at least one scale dissolver, and the method further comprises:
contacting the organic deposits and inorganic deposits in the wellbore
with the single phase fluid for an amount of time effective to
simultaneously disperse the organic deposits and dissolve the
inorganic deposits; and
simultaneously at least partially removing the organic deposits and
inorganic deposits from the wellbore.

9. The method of claim 8 where the inorganic deposits comprise scale precipitated from salts, where the salts comprise sulfate salts, carbonate salts, halide salts, and mixtures thereof.

10. The method of claim 8 where the at least one scale dissolver is an in-situ acid and/or an already-formed acid selected from the group consisting of hydrochloric acid, acetic acid, phosphoric acid, formic acid, hydrofluoric acid, citric acid, uric acid, synthetic acid (obtained by a combination of urea and hydrogen chloride), and blends of these acids.

11. The method of claim 8 where the single phase fluid comprises between 0.1 and 35 wt% of the at least one scale dissolver, based on the single phase fluid

12. The method of claim 8 where the single phase fluid comprises between 5 and 15 wt% of the at least one scale dissolver, based on the single phase fluid.

1/2

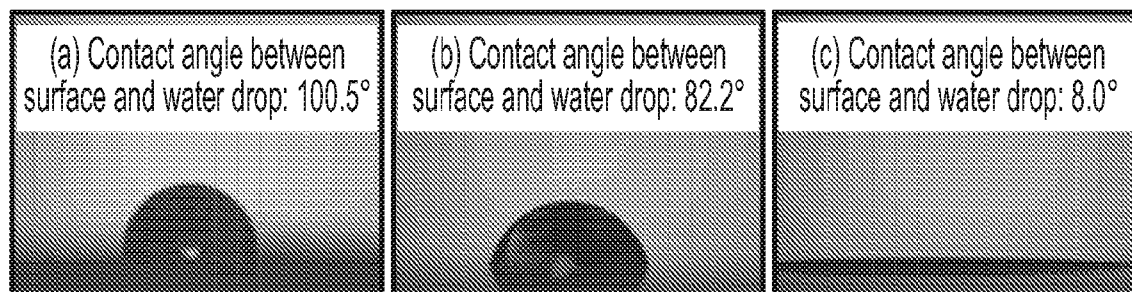


FIG. 1

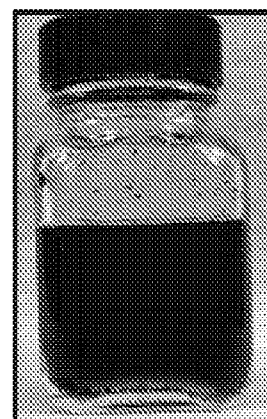
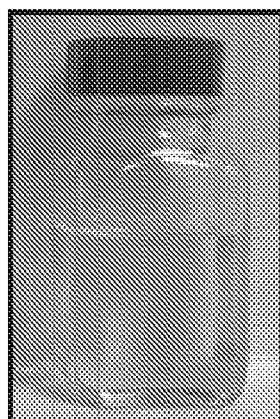
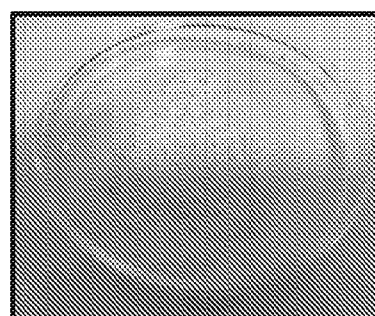


FIG. 2

2/2

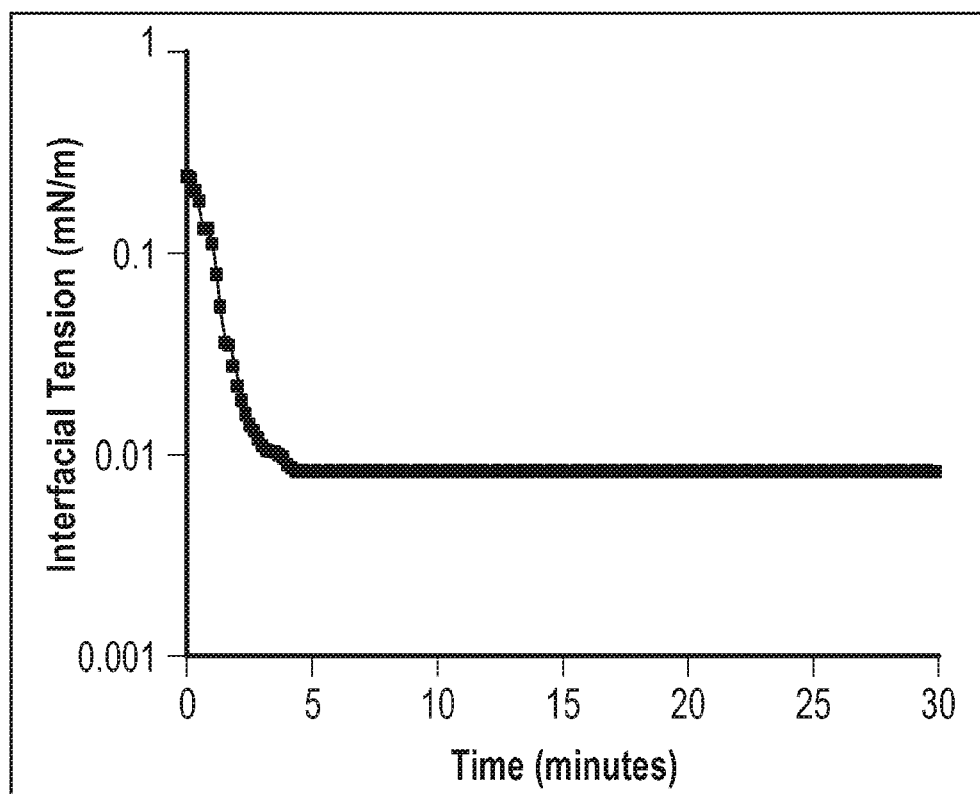


FIG. 3

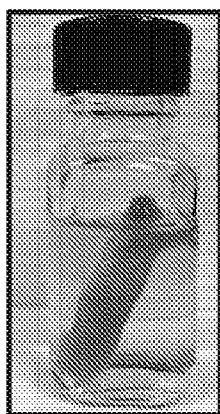


Fig. 4(a) Formulation 3 and organic solid deposit sample at initial contact

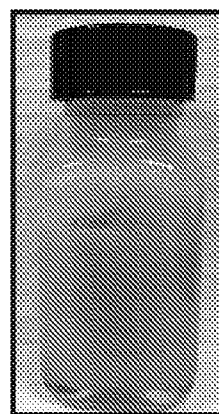


Fig. 4(b) Formulation 3 and organic solid deposit after 3 hours of contact at 150°F (65.5°C)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2017/050944**A. CLASSIFICATION OF SUBJECT MATTER****C09K 8/524(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

C09K 8/524; E21B 37/00; E21B 37/08; C09K 8/32; E21B 43/16; C09K 8/584; C09K 8/00; C09K 8/52

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: method, remove, asphaltenes, paraffins, wellbore, solvent, surfactant

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010-0130384 A1 (LIGHTFORD, STEPHEN CHARLES et al.) 27 May 2010 See paragraphs [0011], [0020]-[0029]; and claim 15.	1-12
A	US 2009-0075846 A1 (QU, QI et al.) 19 March 2009 See the whole document.	1-12
A	US 2014-0121137 A1 (ANDRECOLA, PAUL) 01 May 2014 See the whole document.	1-12
A	WO 2006-104711 A2 (DYER, RICHARD J.) 05 October 2006 See the whole document.	1-12
A	US 2015-0203739 A1 (TALLEY, CHARLES et al.) 23 July 2015 See the whole document.	1-12



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

26 December 2017 (26.12.2017)

Date of mailing of the international search report

26 December 2017 (26.12.2017)

Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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PCT/US2017/050944

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2010-0130384 A1	27/05/2010	AU 2006-343129 A1 AU 2006-343145 A1 AU 2006-343145 B2 BR PI0621602 A2 BR PI0621644 A2 CA 2650334 A1 CA 2650336 A1 CA 2650336 C EG 25181 A EP 2024462 A1 EP 2024463 A1 MX 2008014135 A MX 2008014137 A US 2010-0130389 A1 WO 2007-129332 A1 WO 2007-129348 A1	15/11/2007 15/11/2007 06/12/2012 17/04/2012 09/10/2012 15/11/2007 15/11/2007 03/01/2012 11/10/2011 18/02/2009 18/02/2009 30/03/2009 30/03/2009 27/05/2010 15/11/2007 15/11/2007
US 2009-0075846 A1	19/03/2009	CA 2518000 A1 CA 2570157 A1 CA 2570157 C US 2006-0042796 A1 US 2007-0135310 A1 US 2007-0225174 A1 US 2007-0265171 A1 US 2009-0114394 A1 US 7188676 B2 US 7392845 B2 US 7455111 B2 US 7481273 B2 US 7712533 B2	02/03/2006 23/09/2007 15/06/2010 02/03/2006 14/06/2007 27/09/2007 15/11/2007 07/05/2009 13/03/2007 01/07/2008 25/11/2008 27/01/2009 11/05/2010
US 2014-0121137 A1	01/05/2014	US 2015-0119300 A1 US 8778850 B2	30/04/2015 15/07/2014
WO 2006-104711 A2	05/10/2006	CA 2600493 A1 CA 2600493 C US 2006-0219409 A1 US 2008-0006408 A1 US 2008-0047712 A1 US 2009-0137430 A1 US 7296627 B2 US 7497261 B2 US 7632785 B2 US 7670993 B2 WO 2006-104711 A3	05/10/2006 06/12/2011 05/10/2006 10/01/2008 28/02/2008 28/05/2009 20/11/2007 03/03/2009 15/12/2009 02/03/2010 16/04/2009
US 2015-0203739 A1	23/07/2015	US 2016-0257870 A1 US 9353609 B2	08/09/2016 31/05/2016