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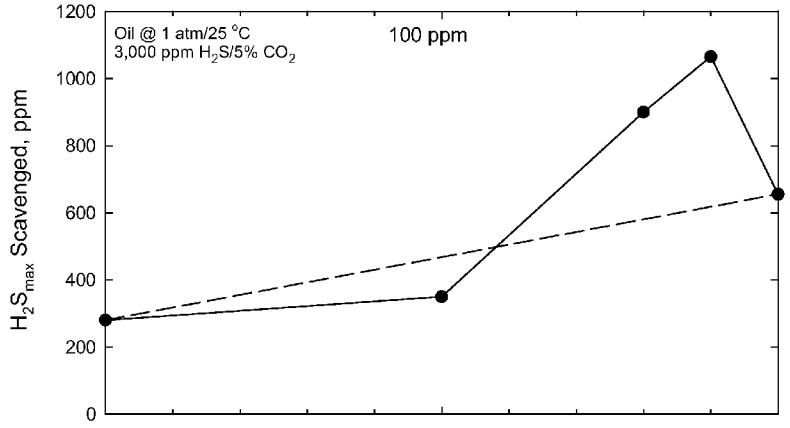
— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(88) Date of publication of the international search report:
7 March 2013

(54) Title: SYNERGISTIC $H_2S$/MERCAPTAN SCAVENGERS USING GLYOXAL

FIG. 2




(57) Abstract: The use of neutral aqueous solutions of glyoxal (pH approximately 6 to 8.5) scavenges $H_2S$ that is present in natural gas and in oil better than glyoxal alone or base alone. The resulting scavenger combination significantly increases the reaction rate and the overall scavenging efficiency, i.e. capacity over glyoxal used alone. A buffer may be optionally used. In another embodiment, the combination of non-nitrogen-containing surfactants and glyoxal results in a significant increase in the reaction rate and the overall scavenging efficiency, i.e. capacity as compared to glyoxal used alone.

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**INTERNATIONAL SEARCH REPORT**

International application No.
**PCT/US2012/027883**

**A. CLASSIFICATION OF SUBJECT MATTER**

***C10G 29/24(2006.01)i, C10G 29/02(2006.01)i, C10L 3/10(2006.01)i, C07C 7/20(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)

C10G 29/24; C10J 3/00; C10G 19/00; C10G 19/08; C09K 8/68; C09K 8/524; C02F 1/58; B01D 53/40

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: scavenging, hydrogen sulfide, mercaptan, dialdehyde, base, non-nitrogen-containing surfactant, buffer, corrosion inhibitor

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X<br>X<br>Y<br>A | US 2008/0056971 A1 (HUGHES) 06 March 2008<br>See the abstract; claims; paragraphs [0058]-[0060]. | 17-18<br>19-21<br>22-23<br>1-16 |
| X<br>X<br>Y<br>A | US 2006/0006121 A1 (SIMPSON et al.) 12 January 2006<br>See the abstract; claims; paragraphs [0060]-[0067]. | 17-18<br>19-21<br>22-23<br>1-16 |
| Y<br>A | US 6306288 B1 (PITTMAN et al.) 23 October 2001<br>See the abstract; claims; column 2, line 66 - column 3, line 42. | 22-23<br>1-21 |
| A | US 7615516 B2 (YANG et al.) 10 November 2009<br>See the abstract; claims; column 3, line 10 - column 4, line 54. | 1-23 |

☐ 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 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 | Date of mailing of the international search report |
|---|---|
| 28 DECEMBER 2012 (28.12.2012) | **02 JANUARY 2013 (02.01.2013)** |

| Name and mailing address of the ISA/KR | Authorized officer |
|---|---|
| Korean Intellectual Property Office<br>189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan City, 302-701, Republic of Korea<br>Facsimile No. 82-42-472-7140 | SEO Sang Yong<br>Telephone No. 82-42-481-5576 |

Form PCT/ISA/210 (second sheet) (July 2009)

# INTERNATIONAL SEARCH REPORT

International application No.
**PCT/US2012/027883**

**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

See the extra sheet.

1. ☒ As all required addtional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

**Remark on Protest**

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
☒ No protest accompanied the payment of additional search fees.

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2012/027883**

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| US 2008/0056971 A1 | 06.03.2008 | None | |
| US 2006/0006121 A1 | 12.01.2006 | US 2007-241062 A9 | 18.10.2007 |
| US 6306288 B1 | 23.10.2001 | None | |
| US 7615516 B2 | 10.11.2009 | AU 2006-206524 A1 | 27.07.2006 |
| | | AU 2006-206524 B2 | 16.12.2010 |
| | | AU 2006-206524 C1 | 14.07.2011 |
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| | | US 7851414 B2 | 14.12.2010 |
| | | WO 2006-078723 A2 | 27.07.2006 |
| | | WO 2006-078723 A3 | 22.02.2007 |
| | | WO 2006-078723 A8 | 04.10.2007 |

Box III

Invention 1: a method for scavenging hydrogen sulfide and/or mercaptans from a fluid selected from the group consisting of an aqueous phase, a gaseous phase, a hydrocarbon phase and mixtures thereof, the method comprising contacting the fluid with a composition in an effective amount for synergistically scavenging hydrogen sulfide and/or mercaptans, where the composition comprises: at least one dialdehyde, and at least one second component selected from the group consisting of at least one base, at least one non-nitrogen-containing surfactant, and combinations thereof; where synergistically scavenging is defined as the amount of hydrogen sulfide and/or mercaptans scavenged is greater as compared with a composition having a greater amount of dialdehyde where the second component is absent (claims 1-16).

Invention 2: a composition for scavenging hydrogen sulfide and/or mercaptans from a fluid, the composition comprising: at least one dialdehyde; and at least one second component selected from the group consisting of: at least one base; at least one non-nitrogen-containing surfactant and combinations thereof (claims 17-23).