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**Datasheet for the decision
of 25 February 2016**

Case Number: T 2194/13 - 3.3.10

Application Number: 06827569.2

Publication Number: 1954913

IPC: E21B43/17, E21B43/22,
C09K8/584, C09K8/62

Language of the proceedings: EN

Title of invention:

METHODS FOR RECOVERING OIL FROM AN OIL RESERVOIR

Applicant:

Solvay USA Inc.

Headword:

Relevant legal provisions:

EPC Art. 56

Keyword:

Inventive step - (no) - all requests

Decisions cited:

T 0020/81, T 0197/86

Catchword:



Beschwerdekammern
Boards of Appeal
Chambres de recours

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Case Number: T 2194/13 - 3.3.10

D E C I S I O N
of Technical Board of Appeal 3.3.10
of 25 February 2016

Appellant: Solvay USA Inc.
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Representative: Gillard, Richard Edward
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Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 17 May 2013
refusing European patent application
No. 06827569.2 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman P. Gryczka
Members: R. Pérez Carlón
T. Bokor

Summary of Facts and Submissions

- I. The appellant (applicant) lodged an appeal against the decision of the examining division to refuse European patent application No. 06 827 569.2.
- II. The documents forming part of the examination proceedings included the following:
- | | |
|----|--|
| D1 | US 3,199,586 |
| D3 | US 6,703,352 |
| D5 | US 3,292,698 |
| D6 | Viscosifying Surfactants for Chemical EOR,
16th European Symposium on Improved Oil
Recovery, Cambridge, UK, 12-14 April 2011 |
- III. The examining division considered that either D1 or D5 was the closest prior art, that the problem underlying the claimed invention was to provide an alternative method for enhancing the recovery of oil from a reservoir, and that the solution, which was characterised by using specific viscoelastic surfactants, was taught by D3. For that reason, the method of claim 1 was not inventive.
- IV. With the statement setting out the grounds of appeal, the appellant filed a main request and first to fourth auxiliary requests. Fifth to eleventh auxiliary requests were filed under cover of a letter dated 25 November 2015.

Claim 1 of the main request reads as follows:

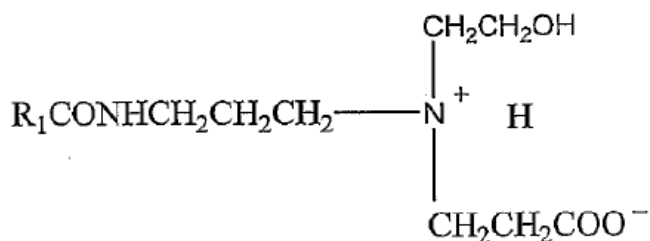
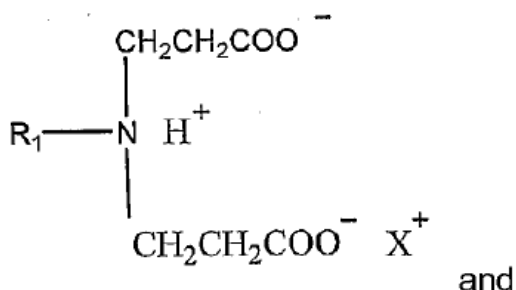
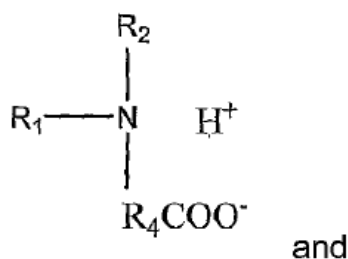
"A method for enhancing the recovery of oil from a reservoir, comprising:

a) *introducing a flooding fluid into the reservoir, wherein the fluid has the following:*

i) *water and*

ii) *0.1 wt% to 20 wt%, based on the total weight of the flooding fluid of one or more non-polymeric, viscoelastic surfactants selected from the group of:*

one or more zwitterionic surfactants, one or more amphoteric surfactants according to any of the formulae



wherein R_1 represents a hydrophobic moiety of alkyl, alkylarylalkyl, alkoxyalkyl, alkylaminoalkyl or alkylamidoalkyl; wherein alkyl represents a group that contains from

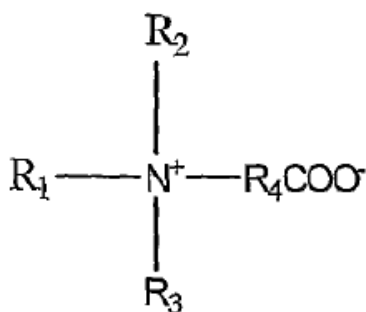
16 to 24 carbon atoms that is branched or straight chained and saturated or unsaturated; wherein R_2 is an aliphatic chain having from 1 to 30 carbon atoms in which the aliphatic group is branched or straight chained and saturated or unsaturated; and wherein R_4 is a hydrocarbyl radical with chain length 1 to 4, and wherein X^+ is a cation, and combinations thereof; and

- b) extracting the oil through a wellbore at a location different than the point of introduction of the flooding fluid into the reservoir."

Claim 1 of the first and fifth auxiliary requests require a flooding fluid containing one or more viscoelastic zwitterionic surfactants.

Claim 1 of the second and seventh auxiliary requests requires a flooding fluid containing one or more zwitterionic surfactants of the formula

"

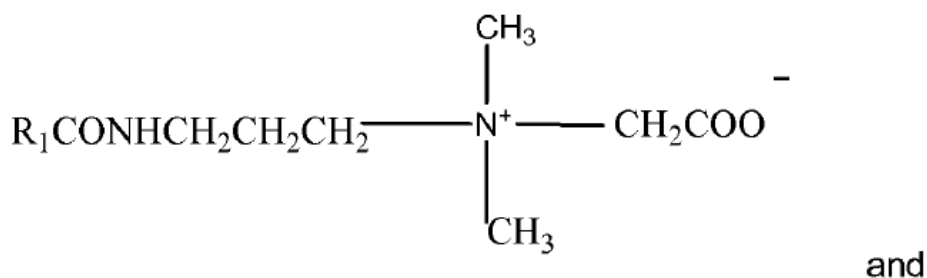
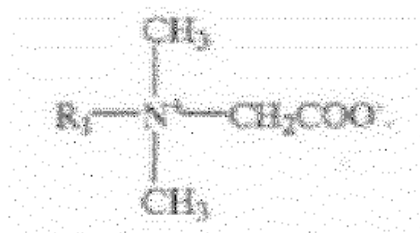
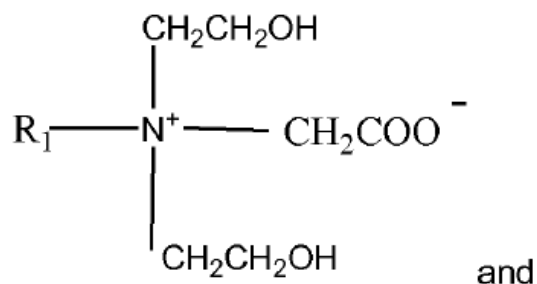


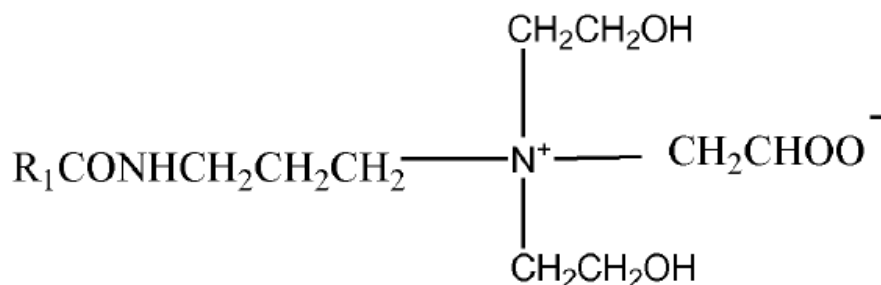
wherein R_1 represents a hydrophobic moiety of alkyl, alkylarylalkyl, alkoxyalkyl, alkylaminoalkyl or alkylamidoalkyl; wherein alkyl represents a group that

contains from 16 to 24 carbon atoms that is branched or straight chained and saturated or unsaturated; wherein R^2 and R_3 are, independently alkyl, alkenyl, arylalkyl, hydroxyalkyl, carboxyalkyl, and hydroxyalkyl-polyoxyalkylene, branched or straight chained and saturated or unsaturated and having from 1 to 30 carbon atoms; and wherein R_4 is a hydrocarbyl radical with chain length 1 to 4."

Claim 1 of the third and eighth auxiliary requests requires a flooding fluid containing one or more zwitterionic surfactants of the formula

"





wherein R1 represents a hydrophobic moiety of alkyl containing from 16 to 24 carbon atoms, may be branched or straight chained and may be saturated or unsaturated, alkylarylalkyl, or alkoxyalkyl."

Claim 1 of the fourth and ninth auxiliary requests requires a flooding fluid containing a viscoelastic surfactant according to the second or third general formula of claim 1 of the third and eighth auxiliary requests.

Claim 1 of the fifth auxiliary request limits the method of claim 1 of the main request by requiring X⁺ to be an inorganic cation.

Claim 1 of the tenth auxiliary request contains all the features of claim 1 of the fifth auxiliary request and defines zwitterionic surfactants as "having a permanently positively charged moiety in the molecule regardless of pH and a negatively charged moiety at alkaline pH".

Lastly, claim 1 of the eleventh auxiliary request limits the method of claim 1 of the tenth auxiliary request by requiring a flooding fluid having zwitterionic surfactants.

- V. The arguments of the appellant relevant for the present decision were the following:

Document D5, which disclosed a flooding method that required viscoelastic surfactants, was the closest prior art. The problem underlying the claimed invention was to provide a superior method for enhancing the recovery of oil from a reservoir. The claimed solution, characterised by using zwitterionic or amphoteric viscoelastic surfactants, credibly solved that problem. A direct comparison with the method of D5 was not necessary, as its technology was very old and had changed significantly developed over the years. D6, which tested two surfactants according to the claimed invention and standard polymeric thickeners, provided a comparison which reflected the real-life situation and the prevalent technology at the date of filing.

Even if the technical problem had to be reformulated as to provide an alternative method for enhancing the recovery of oil from a reservoir, the claimed solution was not obvious, as D3 and D5 referred to different technologies and the skilled person would thus take into consideration the teaching of D3 with the benefit of hindsight only. The claimed process was, therefore, inventive.

- VI. Oral proceedings before the board of appeal took place on 25 February 2016.

- VII. The final request of the appellant was that the decision under appeal be set aside and that a patent be granted upon the basis of the main request or, subsidiarily, of one of the first to eleventh auxiliary requests, the main request and first to fourth auxiliary requests having been filed with the statement setting out the grounds of appeal, and the fifth to eleventh auxiliary requests having been filed with a letter dated

25 November 2015.

VIII. At the end of the oral proceedings, the decision was announced.

Reasons for the Decision

1. The appeal is admissible.

Main request, inventive step

2. The claimed invention relates to a method for enhancing the recovery of oil from a reservoir by using a flooding fluid comprising water and one or more viscoelastic surfactants selected from zwitterionic surfactants and specific amphoteric surfactants.

3. Closest prior art

The examining division and the appellant considered that document D5 was the closest prior art and the board sees no reason to differ.

It has not been disputed that document D5 discloses a method for enhancing the recovery of oil from a reservoir by introducing a flooding fluid (column 1, lines 12-13) whereby oil is displaced and produced from another well or wells (column 1, lines 27-29). The flooding fluid contains water (column 2, line 46) and a further component in an amount sufficient to provide a solution which is viscoelastic and shear hardening. This further component is selected from (1) undecane-3-sodium sulfate and cyclohexylammonium chloride or (2) sodium elaidate, sodium chloride and caustic (column 2, lines 47-51).

The method of D5 does not use zwitterionic or amphoteric viscoelastic surfactants, as required by the claimed method.

4. Technical problem underlying the invention

The appellant defined the technical problem underlying the claimed invention as to provide an improved method for enhancing the recovery of oil from a reservoir, achieving a higher recovery than that of the prior art.

5. Solution

The solution to this technical problem is the claimed method of enhancing the recovery of oil from a reservoir by introducing a flooding liquid containing water and a viscoelastic surfactant, and extracting the oil through a wellbore at a different location, characterised in that said viscoelastic surfactant is selected from zwitterionic and amphoteric surfactants.

6. Success

The appellant has not disputed that there is no direct comparison on file with the method of the closest prior art D5, let alone a comparison reflecting solely the effect of the distinguishing features of the claimed invention.

The appellant relied, however, on the results obtained in D6 to show that the problem formulated in point 4. above had been credibly solved by the features of claim 1.

Document D6 compared erucic amodipropyl betaine (A) and erucic amidopropyl sultaine (B), which are surfactants

according to the invention, and a polymeric thickener (HPAM).

On page 14, conclusions, document D6 disclosed that the tested surfactants "induced an increase in Recovery Factor of 10% regarding conventional polymer flood". Taking into account that D5 had been completely superseded by more modern technology, and that the tested surfactants were more effective than the prevalent technology at the filing date represented by the use of thickening polymers, the claimed method should be superior to the older technology of D5.

- 6.1 According to established case law, in cases where comparative tests are chosen to demonstrate an inventive step with an improved effect over a claimed area, the nature of the comparison with the closest prior art must be such that the effect is convincingly shown to have its origin in the characterising features of the invention. For this purpose, it may be necessary to modify the elements of comparison so that they differ only by such characterising features (see T 197/86, OJ EPO 1989, 371, Reasons 6.1.2 and 6.1.3).

- 6.2 The appellant argues that, due to the age of document D5, the results obtained by the claimed method must necessarily be superior, as D5 relates to a technology superseded by surfactant/polymer combinations.

However, there is no reason why a more recent technology should necessarily be superior in every aspect to any older equivalent. Even if the use of thickening polymers was an improvement over the use of the viscoelastic surfactants of D5, that does not inevitably mean that the former led to an increased Recovery Factor and

viscosity compared with the latter, as the choice of a particular technology depends on a large number of factors. This argument of the appellant is thus unconvincing.

- 6.3 The appellant further argued that it could not obtain the surfactants of D5 for carrying out comparative tests. However, it did not provide any evidence of that. For this reason alone, this argument is not convincing.

In addition, the board was able to find providers of sodium elaidate, cyclohexylammonium chloride, and 3-undecanol, which is a starting material for obtaining the corresponding sodium sulfate. The board informed the appellant in the communication annexed to the summons for oral proceedings of this circumstance, which it did not challenge.

- 6.4 Lastly, the appellant argued that the surfactants of D5 were not capable of sufficiently enhancing viscosity and for that reason required the additional presence of a thickener. In contrast, the claimed method could be carried out without polymeric thickeners, as a flooding liquid containing the surfactants required by claim 1 already had an adequate viscosity (document D6, figure 5). That represented a further improvement over the method of D5.

However, the method of D5 does not require polymeric thickeners. For that reason alone, this alleged advantage cannot represent an improvement over the method of D5.

- 6.5 As the data provided do not allow a direct comparison with the closest prior art, since they do not differ from one another solely by virtue of the distinguishing

feature of the claimed invention, and the argument of the appellant that more recent technology would necessarily be superior in every aspect to any older equivalent is not convincing, it is concluded that it has not been proven that the problem formulated in 4. above has been credibly solved.

7. Reformulation of the technical problem

7.1 According to the case law, alleged but unsupported advantages cannot be taken into consideration in determining the problem underlying the invention (T 20/81, OJ EPO 1982, 217, Reasons 3, last paragraph). As the alleged improvement lacks the required support, the technical problem as defined above needs to be reformulated as providing a further method for enhancing the recovery of oil from a reservoir.

It is not disputed that this technical problem has been solved by the method subject-matter of claim 1, which requires viscoelastic surfactants selected from zwitterionic and amphoteric surfactants.

8. It remains to be decided whether or not the proposed solution to the objective problem defined above is obvious in view of the state of the art.

8.1 Document D5 relates to a method of flooding or secondary recovery. It discloses the high viscosity of the flooding fluid to be essential in order to avoid fingers or bulges developing (column 1, lines 56-65), and that it is also essential to reduce the interfacial tension by adding surfactants (column 2, lines 8-18). D5 teaches that both can be achieved by using aqueous solutions of viscoelastic surfactants.

The skilled person, trying to obtain an alternative flooding method, would seek to maintain those essential properties of the flooding fluid of D5, i.e. reduced interfacial tension and viscoelasticity, and it would thus turn to other suitable viscoelastic, detergent aqueous compositions and be led to a document such as D3.

Document D3 discloses zwitterionic and amphoteric surfactants (column 3, line 34) such as oleamidopropyl betaine (example 6) capable of forming viscoelastic aqueous solutions suitable as fracturing fluids (column 2, lines 14-17), for carrying materials excavated during boring, excavating and trenching operations (column 8, lines 51-54), as drift control agents for agricultural formulations (column 2, lines 18-20), as industrial drift control agents (column 3, lines 53-55), or as rheology modifiers for personal care formulations and house cleansers (column 9, lines 55-57). The skilled person thus finds in D3 the teaching that the surfactants required by claim 1 of the main request provide viscoelasticity to aqueous solutions, and that they are used in a wide variety of fields, including the fracturing of subterranean formations, which is usually carried out under more demanding conditions than those required in a flooding process. The skilled person would thus use these surfactants in order to obtain a method further to that disclosed in D5, and would then arrive at the claimed invention without using inventive skills.

- 8.2 The appellant argued that the skilled person would not have combined the teaching of D5 with that of D3, as they were aimed at very different processes. In a fracturing method, viscoelasticity was required in order to suspend proppants, which were not used in a flooding

process. None of the documents on file referred to both fracturing and flooding, which further proved that they were completely different technologies.

However, document D3 is not restricted to fracturing but discloses, in its broadest aspect, the viscoelastic surfactants required by the method of claim 1 to be suitable for a large variety of different uses that have in common merely that viscoelasticity is required. For this reason, this argument of the appellant is not convincing.

8.3 The appellant further argued that document D3 did not disclose whether the surfactants disclosed were capable of reducing interfacial tension. However, such a property, inherent to any surfactant, necessarily derives from its structure, as these molecules have a large hydrophobic part and a charged, hydrophilic moiety.

8.4 As the method of claim 1 of the main request is not inventive (Articles 52 and 56 EPC), this request is not allowable.

9. Auxiliary requests

9.1 The appellant has acknowledged that the auxiliary requests on file either sought to overcome formal objections or limited the claimed method by closely defining the chemical nature of the surfactants required by claim 1.

9.2 Since document D3 discloses zwitterionic surfactants according to each of the general formulae required by claim 1 of the auxiliary requests, the arguments given above with respect to claim 1 apply also to the methods

of claim 1 of all auxiliary requests, with the consequence that none of the requests on file is allowable.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



C. Rodríguez Rodríguez

P. Gryczka

Decision electronically authenticated