**Internal distribution code:**

(A) [ - ] Publication in OJ
(B) [ - ] To Chairmen and Members
(C) [ - ] To Chairmen
(D) [ X ] No distribution

# Datasheet for the decision of 2 July 2015

**Case Number:** T 1918/12 - 3.3.10

**Application Number:** 07727911.5

**Publication Number:** 2004598

**IPC:** C07C407/00, C07D301/12, B01D17/04

**Language of the proceedings:** EN

**Title of invention:**

PROCESS FOR PREPARING AN ORGANIC HYDROPEROXIDE, INDUSTRIAL SET-UP THEREFORE AND PROCESS WHEREIN SUCH ORGANIC HYDROPEROXIDE IS USED IN THE PREPARATION OF AN ALKYLENE OXIDE

**Patent Proprietor:**

Shell Internationale Research Maatschappij B.V.

**Opponent:**

AKZO NOBEL CHEMICALS INTERNATIONAL B.V.

**Headword:**

**Relevant legal provisions:**

EPC Art. 100(a), 100(c)

**Keyword:**

Grounds for opposition - added subject-matter (no)
Grounds for opposition - lack of patentability (no)

**Decisions cited:**

**Catchword:**

Europäisches Patentamt
European Patent Office
Office européen des brevets

**Beschwerdekammern**
**Boards of Appeal**
**Chambres de recours**

European Patent Office
D-80298 MUNICH
GERMANY
Tel. +49 (0) 89 2399-0
Fax +49 (0) 89 2399-4465

**Case Number: T 1918/12 - 3.3.10**

# D E C I S I O N
# of Technical Board of Appeal 3.3.10
# of 2 July 2015

| | |
|---|---|
| **Appellant:** (Opponent) | AKZO NOBEL CHEMICALS INTERNATIONAL B.V.<br>Stationsstraat 77<br>3811 MH Amersfoort (NL) |
| **Representative:** | Heinen, Annemieke Willemine<br>Akzo Nobel<br>Intellectual Property Department<br>Velperweg 76<br>6824 BM Arnhem (NL) |
| **Respondent:** (Patent Proprietor) | Shell Internationale Research Maatschappij B.V.<br>Carel Van Bylandtlaan 30<br>2596 HR The Hague (NL) |
| **Representative:** | Matthezing, Robert Maarten<br>Shell International B.V.<br>Intellectual Property Services<br>P.O. Box 384<br>2501 CJ The Hague (NL) |
| **Decision under appeal:** | **Decision of the Opposition Division of the European Patent Office posted on 5 July 2012 rejecting the opposition filed against European patent No. 2004598 pursuant to Article 101(2) EPC.** |

**Composition of the Board:**

| | |
|---|---|
| **Chairman** | P. Gryczka |
| **Members:** | R. Pérez Carlón |
| | D. Rogers |

## Summary of Facts and Submissions

I. The appellant (opponent) lodged an appeal against the decision of the opposition division to reject the opposition against European patent No. 2 004 598.

II. The opposition had been filed on the grounds of added subject-matter (Article 100(c) EPC), insufficiency of disclosure (Article 100(b) EPC), and lack of inventive step (Article 100(a) EPC).

III. The following documents were part of the opposition proceedings:

D4: WO 03/024925
D5: GB 1 251 042
D6: Bitten, J. F. Coalescence of water droplets on single fibers, Journal of Colloid and Interface Science, vol. 33, No. 2, 1970, pages 265-271
D7: E. Müller *et al.* Liquid-Liquid Extraction. Ullmann's Encyclopedia of Industrial Chemistry, 2005, pages 1-60

IV. The main request in these appeal proceedings corresponds to the patent as granted. Claim 1 thereof reads as follows:

*"Process for preparing an alkylaryl hydroperoxide, which process comprises:*

*(a) oxidizing of an alkylaryl compound to obtain an organic reaction product containing alkylaryl hydroperoxide;*

*(b) mixing at least part of the organic reaction product of step (a) with a basic aqueous solution to obtain a mixture of basic aqueous solution and the organic reaction product;*

*(c) separating the mixture of step (b) to obtain a separated organic phase, containing alkylaryl hydroperoxide, and a separated aqueous phase;*

*(d) mixing at least part of the separated organic phase of step (c) with water to obtain a mixture of an aqueous phase and the organic phase; and*

*(e) separating the mixture of step (d) to obtain a separated organic phase, containing alkylaryl hydroperoxide, and a separated aqueous phase;*

*in which process the mixture obtained in step (d) is a dispersion comprising droplets having a Sauter mean droplet size in the range from 30 to 300 micrometer,*

*wherein the droplets are water droplets dispersed in the organic phase; and*

*the separation to a separated organic phase and a separated aqueous phase in step (e) is carried out with the help of a coalescer containing glass fibers."*

The patent as granted contains an independent claim directed to a process for preparing an alkylene oxide comprising the process according to claim 1 (claim 6) and a further independent claim (claim 9), which reads:

*"Industrial set-up for removing basic materials from an organic phase, containing alkylaryl hydroperoxide, which set-up comprises a mixer for mixing the organic*

*phase with water; and a separation vessel connected directly or indirectly to the mixer for separating the obtained mixture into a purified organic phase, containing alkylaryl hydroperoxide, and an aqueous phase; wherein the mixer is a static mixer and the separation vessel comprises one or more coalescers containing glass fibres."*

V. The opposition division concluded that the amendments in claim 1 of the patent as granted found a word for word basis in the application as originally filed and that their combination did not introduce any technical information going beyond its content. It further concluded that the patent in suit contained sufficient information in order to carry out the claimed invention. With respect to inventive step, it considered that document D4 was the closest prior art, that the problem underlying the claimed invention was the provision of an alternative process for preparing an alkylaryl hydroperoxide and that the solution, which was a process characterised by requiring a coalescer containing glass fibres and a dispersion comprising droplets having a Sauter mean droplet size in the range from 30 to 300 micrometer, was not obvious having regard to the prior art. The opposition division thus concluded that none of the grounds mentioned in Article 100 EPC precluded the maintenance of the patent as granted and rejected the opposition.

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

The process of claim 1 resulted from a selection of two lists, namely of the features "alkylaryl compounds" and of the required droplet size, further combined with an additional feature. These features were not disclosed

in combination in the application as originally filed and for that reason claim 1 contained added subject-matter.

The appellant did not further pursue the ground under Article 100(b) EPC, as the respondent did not challenge that document D4 disclosed the separation of a water-in-oil emulsion.

Document D4, which disclosed a process for preparing an alkylaryl hydroperoxide, was the closest prior art. The problem underlying the claimed invention was merely that of providing a further process for preparing an alkylaryl hydroperoxide and the solution was obvious having regard to D5, which disclosed the use of separators having coalescing fibres for separating mixtures containing peroxides. There was no prejudice which would prevent the skilled person from using them in the process of D4. Documents D6 and D7 further proved that these type of coalescers were suitable for growing water droplets in water-in-oil emulsions. For that reasons, the subject-matter of claim 1 was not inventive.

VII. The arguments of the respondent (patent proprietor) relevant for the present decision were the following:

The respondent considered that the appeal was only substantiated with respect to claim 1 of the patent as granted.

The amendments in claim 1 did not represent added subject-matter, since the skilled reader would consider both the droplet size required by claim 1 and that these droplets were water droplets dispersed in the organic phase as combined with the starting material

being an alkylaryl compound.

D4 was the closest prior art. The respondent defined the problem underlying the claimed invention as that of increasing the efficiency of the removal of the basic material present in the process but, even if said problem was merely regarded as providing a further process for preparing an alkylaryl hydroperoxide, the skilled person found no hint towards the claimed solution, with the consequence that the subject-matter of claim 1 was inventive.

VIII. The parties informed the board that they would not attend the oral proceedings, which took place on 2 July 2015.

IX. The requests of the parties were the following:

- The appellant requested, under cover of a letter dated 30 October 2012, that the decision under appeal be set aside and that the European patent No. 2 004 598 be revoked.

- The respondent requested, under cover of a letter dated 5 March 2013, that the appeal be dismissed, or alternatively, that the patent be maintained upon the basis of claims 1 to 8 of the auxiliary request filed under cover of the letter dated 5 March 2013.

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

## Reasons for the Decision

1. The appeal is admissible.

Extent of the appeal:

2. The appellant has provided arguments why the grounds under Article 100(a) and 100(c) EPC should preclude the maintenance of the patent only with respect to claim 1. The patent, however, contains further claims.

Independent claim 6 is directed to a process for preparing an alkylene oxide comprising the process for obtaining an alkylaryl hydroperoxide according to claim 1. Since the conclusion of the board in the present case is that none of the grounds of opposition mentioned against claim 1 preclude the maintenance of the patent, this conclusion can only be the same with respect to claim 6, irrespectively from whether the opposition, and hence these appeal proceedings, would also extend to the latter claim.

Independent claim 9 is directed to an industrial set-up comprising a static mixer and a separation vessel having one or more coalescers containing glass fibres, which is suitable for removing basic materials from alkylaryl hydroperoxide containing organic phases. The appellant has not provided arguments why the grounds of opposition it relied upon should also apply to the industrial set-up of claim 9, and is it not apparent to the board why this should be the case. For this reason, in the absence of any substantiated objection against its subject-matter, these appeal proceedings are considered not to extend to claim 9 as granted.

Added subject-matter:

3. Claim 1 of the main request results from the combination of claims 1 and 4 as originally filed, restricted to one of the two preferred embodiments disclosed on page 4, lines 16-17 (alkylaryl compounds) and to the preferred embodiment that the droplets are water droplets dispersed in the organic phase, disclosed on page 9, lines 33-34. Claims 2-5 find a basis on claims 2, 3, 5 and 6 as originally filed and, lastly, claims 6 and 7 find a basis in claims 7 and 8 combined with claim 9 as originally filed.

The ground under Article 100(c) does not thus preclude the maintenance of the patent as granted.

4. The appellant did not dispute that the application as originally filed disclosed, word for word, the features of claim 1, but it argued that claim 1 amounted to a new, non-disclosed combination.

However, with regard to the type of droplets, the application as originally filed only discloses one embodiment, namely that "the droplets are water droplets dispersed in the organic phase", there is no indication that this feature could not be combined with every further embodiment of the claimed invention, and no apparent technical reason why this should not be the case.

In an analogous manner, the range of droplet size required by claim 1, which was also required by claim 4 as originally filed, corresponds to the broadest possible droplet size disclosed in the application, which neither includes any alternative or links it to any specific embodiment of the claimed invention.

Further, the appellant has not relied on any technical reason why the skilled person would have considered this droplet size not suitable for every embodiment according to the invention, nor is any such reason apparent.

The board therefore concludes that the grounds of opposition under Article 100(c) EPC do not preclude the maintenance of the patent upon the basis of the claims of the main request.

Sufficiency of disclosure:

5. The appellant has not challenged the finding of the opposition division with respect to Article 100(b) EPC, and the board cannot see any reason for departing from the decision taken by the opposition division in this respect.

Inventive step:

6. Claim 1 of the main request is directed to a process for preparing an alkylaryl hydroperoxide including the steps of:

(a) oxidizing an alkylaryl compound,
(b) mixing the product with an aqueous basic solution,
(c) separating an aqueous and an organic phase,
(d) mixing the organic phase with water and
(e) separating the mixture.

Claim 1 further requires

- that step (d) leads to a dispersion comprising water droplets dispersed in the organic phase, wherein said droplets have a Sauter mean droplet

size in the range from 30 to 300 micrometer, and

- that step (e) is carried out with a coalescer containing glass fibres.

7. Closest prior art:

The parties and the opposition division considered document D4 to be the closest prior art, and the board sees no reason to differ from this view.

It is common ground that document D4 discloses a process for preparing an alkylaryl hydroperoxide following steps (a) to (e) according to claim 1, and that it fails to disclose:

- that the mixture obtained after step (d) is a dispersion comprising droplets having a Sauter mean droplet size in the range of 30 to 300 micrometer and
- that the coalescer used in step (e) contains glass fibres.

8. Technical problem underlying the invention:

The parties had different views as to the formulation of the technical problem underlying the invention.

The following analysis of inventive step is carried out under the assumption that only the less ambitious of the alleged technical problems as formulated by the appellant, namely that of providing a further process for preparing an alkylaryl hydroperoxide, has been solved. As the solution to this less ambitious problem is already inventive for the reasons which will be explained below, it is not necessary to examine whether

the more ambitious problem defined by the respondent could also have been considered solved by the process of claim 1.

9. Solution:

The claimed solution is a process which is characterised in that it requires forming a dispersion comprising droplets having a Sauter mean droplet size in the range of 30 to 300 micrometer, and a separation step in a coalescer that contains glass fibres.

10. Success:

In the light of the data provided in the examples of the patent with respect to the preparation and purification of ethylbenzene hydroperoxide, the problem mentioned under point 8. above is considered to be successfully solved by the process of claim 1 of the main request. This has not been challenged by the appellant.

11. Lastly, it remains to be decided whether or not the proposed solution to the objective problem underlying the patent in suit is obvious in view of the state of the art:

11.1 Document D4 discloses carrying out the separation step (e) required by claim 1 using a settling vessel (page 14, line 35) and further separating the hydrocarbonaceous phase thus obtained with the help of a first and a subsequent second coalescer (page 15, lines 1-5). Example 1 discloses using plastic separation funnels and bottles (page 17, lines 17-18).

11.2 None of the documents on file describes the use of a coalescer containing fibres for separating a mixture such as that described in D4 and required by claim 1 of the patent in suit:

11.2.1 Document D5 refers to removing water from organic peroxides such as methyl ethyl ketone peroxide with the aid of cartridges containing microporous material such as glass fibre. D5 does not refer to alkyl peroxides. Methyl ethyl ketone peroxide (HOO-CEtMe-O-O-CEtMe-OOH), albeit also a peroxide, substantially differs from an alkylaryl hydroperoxide (Aryl-CHAlkyl-OOH). Further, D5 refers to removing water (which might contain some acid, see page 1, line 35), whereas the aqueous phase which needs to be removed in the process according to D4 is basic. Already for these reasons, the skilled person would not combine the disclosure of document D5 with that of document D4 without the knowledge of the claimed invention.

11.2.2 Document D6 compares glass fibre-bed coalescers with plastic equivalents for the separation of water from hydrocarbon fluids, which is a mixture chemically different from the mixture disclosed in D4.

11.2.3 Lastly, chapter 4 of document D7 provides a review of the types of coalescer available to the skilled person. D7 discloses that the presence of internals such as fibres in a coalescer allows reducing the settler length (page 42, last paragraph), that a fiber bed is able to enlarge the size of the incoming droplets by at least one order of magnitude (page 44, first full paragraph), and that the fibres are preferably made of glass or stainless steel (page 44, right column, point 1).

However, document D7 does not refer to the purification of any specific compound. A coalescer containing fibres is merely one of the various possibilities at the disposition of the skilled person, as there are settlers without any coalescing aid (see point 4.1 of D7, page 40), settlers containing plates (page 43) and settlers containing membranes (page 45). On page 45 under the heading "selection of appropriate settler", D7 discloses that "the first step in selection of a settler is a careful analysis of separation problems" i.e. that not every settler is suitable for the separation of a defined mixture.

11.3 The skilled person would only apply a settler containing fibres, and in particular containing specific fibres, if he would find an indication that this type of coalescer was effective for the process as in present claim 1 since not every coalescer is an equally suitable alternative. However, such an indication is not found in the state of the art for the reasons explained. Thus, this part of the solution alone involves an inventive step.

It is thus concluded that the requirements of Article 56 EPC are fulfilled by claim 1 of the main request, and, for the same token, by claims 1 to 8 thereof, with the consequence that the ground under Article 100(a) does not preclude the maintenance of the patent as granted.

11.4 The appellant argued that the skilled person had no prejudice against the use of glass fibres, since they were known to be stable in the basic environment of the claimed process.

However, the issue is not whether there is any

prejudice against these fibers, or whether this material is stable under the separation conditions required by claim 1, but whether their use would be obvious for the person skilled in the art, which is considered not to be the case for the reasons explained in the previous point.

11.5 The appellant further argued that the skilled person, trying to perform the process disclosed in D4, would need to select a coalescer material in order to close the gaps in D4's disclosure and would thus be lead to documents D5-D7.

However, document D4 refers to plastic separation funnels and bottles as coalescers. Thus, there is no gap in D4 with respect to the coalescer used or to its material, as alleged by the appellant.

**Order**

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar: The Chairman:

C. Rodríguez Rodríguez P. Gryczka

Decision electronically authenticated