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**Datasheet for the decision
of 29 January 2015**

Case Number: T 0134/12 - 3.3.10

Application Number: 06700970.4

Publication Number: 1841720

IPC: C07C35/08, C07C49/403,
C07C29/132, C07C45/53

Language of the proceedings: EN

Title of invention:
PROCESS FOR PREPARING CYCLOHEXANONE AND CYCLOHEXANOL

Patent Proprietor:
DSM IP Assets B.V.

Opponents:
Kisaragi Associates
Projektbüro für Neue Energien
BASF SE

Headword:

Relevant legal provisions:
EPC Art. 100(a), 54(2), 56

Keyword:
Novelty (no) - main request
Inventive step (no) - first auxiliary request

Decisions cited:

Catchword:



**Beschwerdekammern
Boards of Appeal
Chambres de recours**

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Case Number: T 0134/12 - 3.3.10

D E C I S I O N
of Technical Board of Appeal 3.3.10
of 29 January 2015

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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 18 November
2011 rejecting the oppositions filed against
European patent No. 1841720 pursuant to Article
101(2) EPC.**

Composition of the Board:

Chairman	P. Gryczka
Members:	R. Pérez Carlón
	F. Blumer

Summary of Facts and Submissions

I. The appellant (opponent 3) lodged an appeal against the decision of the opposition division to reject the oppositions against European patent No. 1 841 720.

II. Three oppositions had been filed, on the ground that the subject-matter of the claims of the patent as granted was not novel and did not involve an inventive step (Article 100(a) EPC). The first of them was withdrawn during opposition proceedings.

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

D1: EP 0 659 726 A1

D2: EP 0 004 105 A1

IV. Claim 1 of the patent as granted (main request) reads as follows:

"Process for preparing cyclohexanone and cyclohexanol, said process comprising

(a) neutralising acids and/or carbon dioxide present in an organic solution further comprising cyclohexylhydroperoxide by mixing the organic solution with a first aqueous base solution to form a first mixture comprising a first aqueous phase and a first organic phase,

(b) separating first aqueous phase from first organic phase,

(c) discharging first aqueous phase,

(d) decomposing cyclohexylhydroperoxide present in said first organic phase by mixing said first organic phase with a second aqueous base solution to form a second mixture comprising a second aqueous phase and a second organic phase comprising cyclohexanone and cyclohexanol,

(e) separating the second aqueous phase from the second organic phase,

(f) feeding at least a portion of said separated second aqueous phase to said neutralising (a),

characterised in that the process further comprises feeding such a portion of the first aqueous phase to the decomposing that the pH of the first aqueous phase is higher than 8.5, measured at 25°C."

V. Claim 1 of the first auxiliary request, filed with the response to the grounds of appeal, differs from claim 1 of the main request only in that its characterising portion reads as follows:

"characterised in that the process further comprises feeding such a portion of the first aqueous phase to the decomposing that the pH of the first aqueous phase is higher than 8.5, measured at 25°C; and

dividing said separated second aqueous phase into two parts, feeding one part (part A) of said separated second aqueous phase to the neutralising (a) and feeding the other part (part B) of said separated second aqueous phase to the decomposing (d); wherein

the first aqueous base solution is part A of said

separated second aqueous phase, a part of the second aqueous base solution is part B of said separated second aqueous phase and another part of the second aqueous base solution being an aqueous solution of an alkali metal hydroxide."

- VI. The opposition division considered that the subject-matter of claim 1 of the patent as granted was novel, since D1 did not disclose all the features of claim 1 in combination, and D2 failed to disclose a process comprising the characterising portion of claim 1.

The opposition division further considered that document D2 was the closest prior art, that the problem underlying the claimed invention was providing a process with an improved phase separation after the decomposing step, and that the solution, which was a process characterised in that it comprised the step of feeding such a portion of the first aqueous phase to the decomposing that the pH of the first aqueous phase was higher than 8.5, measured at 25°C, was not obvious in the light of the available prior art. For these reasons, the opposition division concluded that the ground under Article 100(a) EPC did not preclude the maintenance of the patent as granted, and it therefore rejected the oppositions.

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

Claim 1 of the main request required "feeding such a portion of the first aqueous phase to the decomposing that the pH of the first aqueous phase is higher than 8.5". The pH of the feed of Example II of D2, corresponding to the first aqueous phase required by claim 1, was 10 and, hence, already higher than 8.5. In

such a situation, claim 1 did not require feeding any first aqueous phase to the decomposing, so its subject-matter was not novel over Example II of D2.

Example II of D2 was the closest prior art for the subject-matter of claim 1 of the first auxiliary request. The problem underlying the claimed invention was providing an improved process in terms of environmental impact, energy, apparatus and costs by comparable good conversion and selectivity. The proposed solution, which was a process in which the first aqueous base solution consisted of part A of the separated aqueous phase, merely amounted to suppressing effluent stream (24) and feed (23) from the process of Example II of D2, and such a solution was obvious for the person skilled in the art since D2 already disclosed that the amount discharged through (24) needed to be relatively small and, by recycling (24), feed (23) would no longer be required. Claim 1 of the first auxiliary request was for these reasons not inventive.

VIII. The arguments of the respondent relevant for the present decision were the following:

The characterising portion of claim 1 of the main request required feeding a part of the first aqueous base to the separator, independently of the pH of said first aqueous base. Since the process of Example II of document D2 did not include this step, the subject-matter of claim 1 of the patent as granted was novel over document D2.

Example II of D2 was the closest prior art for the process that was the subject of claim 1 of the first auxiliary request. The problem underlying the claimed

invention was that of providing an improved process in terms of environmental impact, energy, apparatus and costs by comparable good conversion and selectivity. The claimed solution was a process wherein the first aqueous base solution fed to the neutralising (a) consisted of part A of the separated second aqueous phase. Said solution avoided the polluting combustion of basic effluents required by D2 and was not obvious for the person skilled in the art, with the consequence that the subject-matter of claim 1 of the first auxiliary request was inventive.

- IX. Opponent 2 (party as of right) did not provide any written arguments and was not represented at the oral proceedings before the board, which took place on 29 January 2015.
- X. The final requests of the parties were the following:
- The appellant requested that the decision under appeal be set aside and that European patent No. 1 841 720 be revoked.
 - The respondent requested that the appeal be dismissed or, subsidiarily, that the decision under appeal be set aside and that the patent be maintained on the basis of the first auxiliary request as filed with letter dated 28 August 2012.
- XI. At the end of the oral proceedings, the decision was announced.

Reasons for the Decision

1. The appeal is admissible.

Main request:

2. Novelty:

2.1 It has not been disputed that Example II of document D2 discloses a process having all the features required by the preamble of claim 1.

2.2 The parties were, however, divided as to whether this example disclosed the characterising portion of claim 1, namely feeding such a portion of the first aqueous phase to the decomposing that the pH of the first aqueous phase is higher than 8.5, measured at 25°C.

2.2.1 Example II of document D2 discloses that the feed labelled as (11) in figure 1, which corresponds to the "first aqueous phase" required by claim 1, has a pH of 10. This finding was not disputed.

2.2.2 It was further not disputed that Example II of D2 does not disclose feeding a part of feed (11), i.e. of the first aqueous phase, to the decomposing step (13). The key issue to be examined is whether, even in the absence of such a feeding step, Example II of D2 discloses a process including "feeding such a portion of the first aqueous phase to the decomposing that the pH of the first aqueous phase is higher than 8.5", as required by claim 1.

2.2.3 The proprietor argued that feeding a portion of the first aqueous phase to the decomposing was a mandatory feature of claim 1 of the main request, even if the pH of the aqueous phase was already above the required limit.

2.2.4 The board considers, however, that the wording of claim 1 "feeding *such a portion* of the first aqueous phase to the decomposing that the pH of the first aqueous phase is higher than 8.5" links the amount of first aqueous phase which needs to be fed to the decomposing to the difference between the pH of said aqueous phase and that required by claim 1. A portion of the first aqueous phase needs to be fed to the decomposing only on condition that its pH is not higher than 8.5. Whenever the pH of the first aqueous phase is already higher than 8.5, no such feeding needs to be carried out.

The process of Example II of D2, in which a first aqueous phase (11) with pH=10 is completely discharged, thus fulfils the condition of the characterising portion of claim 1.

For these reasons, claim 1 of the main request is not novel, with the consequence that the ground mentioned under Article 100(a) EPC precludes the maintenance of the patent as granted.

Auxiliary request:

3. Novelty:

3.1 Claim 1 of the first auxiliary request, which results from the combination of claims 1, 9 and 10 as granted, contains the features:

"dividing said separated second aqueous phase into two parts, feeding one part (part A) of said separated second aqueous phase to the neutralising (a) and feeding the other part (part B) of said separated second aqueous phase to the decomposing (d); wherein

the first aqueous base solution is part A of said separated second aqueous phase, a part of the second aqueous base solution is part B of said separated second aqueous phase and another part of the second aqueous base solution being an aqueous solution of an alkali metal hydroxide."

- 3.2 The board interprets the wording of claim 1 "the first aqueous base solution is part A of said separated second aqueous phase" as requiring that the first aqueous base solution consists of part A of the separated second aqueous phase, thus excluding adding to the first aqueous base solution anything beyond said part A. This interpretation was not contested by the parties.

Example II of document D2 requires adding further base via line (23) to part A of the separated second aqueous phase, which is recycled via lines (20), (21) and (7) to the neutralising reactor (6).

Similarly, figure 1 of document D1 in combination with the passage on page 5, lines 11 to 26, discloses feeding further base through line (5) to part A of the separated second aqueous phase (line 10), whereas this embodiment is excluded from the wording of claim 1.

The subject-matter of claim 1 of the first auxiliary request is thus novel over the prior art opposed to it (Article 54 EPC).

4. Inventive step:

- 4.1 Closest prior art:

Example II of D2 describes a process for preparing cyclohexanone and cyclohexanol by reacting cyclohexane (1) and air (3) in reactor (2) to form a mixture comprising cyclohexylhydroperoxide (5). Said mixture is sent to a neutralisation step (6), where it is treated with a first basic aqueous solution (7). The product obtained is sent through line (9) to a separator (10), from which a first aqueous phase (11) having a pH of 10 is discharged. The organic phase is fed through (12) to the decomposing step (13), and the product of this step is separated in (17) into a second organic phase (18) and a second aqueous phase (19).

A part of the second aqueous phase (19) is purged (24) and the remainder (20) is split into lines (22), which is fed to the decomposing, and (21), see page 7, lines 31-32, which, together with further base (23) (page 7, line 8) is fed back to the neutralising (6).

The process disclosed in Example II of D2 does not disclose feeding to the neutralising an aqueous base solution consisting of second aqueous base (21), since further base is added to it through feed (23).

4.2 Technical problem underlying the invention:

The respondent considered that the technical problem underlying the claimed invention was providing an improved process in terms of environmental impact, energy, apparatus and costs by comparable good conversion and selectivity.

4.3 Solution:

The claimed solution is a process characterised in that the first aqueous base solution fed to the neutralising

(a) consists of one part (part A) of the separated second aqueous phase.

4.4 Success:

In favour of the respondent, it is considered that the problem as defined above has been successfully solved by the features of claim 1.

4.5 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 prior art:

Example II of document D2 discloses that effluent stream (24), through which part of the separated second aqueous phase (19) is discharged, should be relatively small in order to minimise the loss of hydroxide (page 7, lines 29 to 31).

The skilled person, trying to solve the problem of obtaining a process with a lower environmental impact, which requires less energy, simplified apparatus and lower costs, would recycle the totality of the second basic aqueous phase (19) instead of discharging a part through effluent stream (24), as it is already taught in D2 that such a stream should be small.

By recycling stream (24) through line (19), the process would not require further (fresh) base or any other further component to be fed at this point. It is obvious for the skilled person that such a modification reduces the costs of adding additional base at this stage, that discharging less base is environmentally advantageous, and that the claimed process simplifies the required equipment since it needs two feeds less, one for the discharge (24) and one for the further feed

(23).

A process for preparing cyclohexanone and cyclohexanol such as that which forms the subject-matter of claim 1 nevertheless requires the addition of further base, since it is a reagent consumed in the process. Line (14) of Example II of D2 provides such a point for feeding (fresh) base, such that the claimed process, characterised in that the first aqueous base solution fed to the neutralising consists of part A of the separated second aqueous phase, can be carried out without any further adjustment of the process of Example II of D2.

The board concludes for these reasons that the subject-matter of claim 1 is not inventive, with the consequence that the first auxiliary request is not allowable.

- 4.6 The respondent argued that Example II of D2 required a combustion step of aqueous effluents (11) and (24). A solid product was obtained, which was dissolved in water and supplied to the neutralisation (page 8, lines 1-7) through lines (23) and (7). In contrast, the claimed invention did not require this polluting combustion step, which simplified the equipment and reduced the energy consumed.

However, these optional, additional steps are disclosed in D2 (page 8, lines 1-7) after it has fully disclosed the embodiment of adding an aqueous solution of sodium carbonate through lines (23) and (7) (page 7, lines 7-8) without said steps. Thus, the claimed process does not represent a simplification of the prior art, since Example II of D2 already discloses a process which does

not include a combustion step of aqueous effluents.
This argument of the respondent is thus unconvincing.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:

The Chairman:



C. Rodríguez Rodríguez

P. Gryczka

Decision electronically authenticated