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**Datasheet for the decision
of 12 December 2012**

Case Number: T 1514/11 - 3.3.01

Application Number: 03811753.7

Publication Number: 1562926

IPC: C07D 301/12

Language of the proceedings: EN

Title of invention:

Process for the manufacture of 1,2-epoxy-3-chloropropane

Patentee:

SOLVAY SA

Opponent:

Evonik Degussa GmbH

Headword:

Synthesis of 1,2-epoxy-3-chloropropane/SOLVAY S.A.

Relevant legal provisions:

EPC Art. 56, 54

Keyword:

"All requests - novelty - (yes) - combination of features not disclosed"

"All requests - inventive step - (no) - obvious solution"

Decisions cited:

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Catchword:

-



Case Number: T 1514/11 - 3.3.01

D E C I S I O N
of the Technical Board of Appeal 3.3.01
of 12 December 2012

Appellant: SOLVAY SA
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 11 May 2011
revoking European patent No. 1562926 pursuant
to Article 101(3)(b) EPC.

Composition of the Board:

Chairman: C. M. Radke
Members: J.-B. Ousset
D. S. Rogers

Summary of Facts and Submissions

- I. An appeal was filed against the decision of the opposition division to revoke European patent No. 1 562 926.
- II. Relevant documents for the present decision are the following:
- (1) EP-A-1 085 017
 - (2) WO-A-01/68623
 - (3) WO-A-01/92242
- III. The opposition division found that the subject-matter of the main request was obvious vis-à-vis document (1), that the claims of the first auxiliary request contravened Rule 80 EPC and that the subject-matter of the claims of auxiliary request 2 and 3 contravened the requirements of Article 123(2) EPC.
- IV. The present decision is based on the claims of the main request and on those of the first to fourth auxiliary requests, all submitted by the appellant (patentee) with its statement setting out the grounds of appeal:

Claim 1 of the main request reads as follows:

"1. Process for the manufacture of 1,2-epoxy-3-chloropropane by reaction between allyl chloride and hydrogen peroxide in the presence of a catalyst comprising a zeolite and in the presence of at least one solvent in an epoxidation medium comprising at least one liquid phase, characterized in that the pH of

the liquid phase is controlled and maintained at a value of greater than or equal to 1.5 and less than 4.8."

The only independent claim of the first auxiliary request reads as follows:

"1. Process for the manufacture of 1,2-epoxy-3-chloropropane by reaction between allyl chloride and hydrogen peroxide in the presence of a catalyst comprising a zeolite and in the presence of at least one solvent comprising methanol in an epoxidation medium comprising at least one liquid phase, characterized in that the pH of the liquid phase is controlled and maintained at a value of greater than or equal to 1.5 and less than 4.8."

The only independent claim of the second auxiliary request reads as follows:

"1. Process for the manufacture of 1,2-epoxy-3-chloropropane by reaction between allyl chloride and hydrogen peroxide in the presence of a catalyst comprising a zeolite and in the presence of at least one solvent in an epoxidation medium comprising at least one liquid phase, characterized in that the pH of the liquid phase is controlled and maintained at a value of greater than or equal to 1.5 and less than 4."

The only independent claim of the third auxiliary request reads as follows:

"1. Process for the manufacture of 1,2-epoxy-3-chloropropane by reaction between allyl chloride and

hydrogen peroxide in the presence of a catalyst comprising a zeolite and in the presence of at least one solvent comprising methanol in an epoxidation medium comprising at least one liquid phase, characterized in that the pH of the liquid phase is controlled and maintained at a value of greater than or equal to 1.5 and less than 4."

The only dependent claim of the fourth auxiliary request reads as follows:

"1. Process for the manufacture of 1,2-epoxy-3-chloropropane by reaction between allyl chloride and hydrogen peroxide in the presence of a catalyst comprising a zeolite and in the presence of at least one solvent comprising methanol in an epoxidation medium comprising at least one liquid phase, characterized in that the pH of the liquid phase is controlled and maintained at a value of greater than or equal to 1.5 and less than 4, and in that the amounts of allyl chloride and hydrogen peroxide employed are such that their molar ratio is from 4 to 7."

V. The appellant's arguments can be summarized as follows:

- Document (1) was the closest prior art.
- Within the pH values ranging from 1.5 to 4.8, a high selectivity was obtained for the process claimed in the patent in suit.
- Tables 1 to 3 of document (1) showed that the selectivity dropped for the low pH values and thus

this document taught away from the claimed subject-matter.

- Document (1) did not teach that the pH value could be controlled and maintained in the reaction mixture.
- Examples 2 and 3 of document (4) as well as Tables 4 and 5 showed that the selectivity of the epoxidation reaction increased with increasing pH value.
- Document (1) taught away from the claimed subject-matter, since its preferred pH values ranged from 5 to 9.5 in the presence of an organic solvent.
- Documents (2) and (3) did not disclose the claimed subject-matter.

VI. The respondent (opponent) argued, as far as relevant, as follows:

- Document (1) mentioned the possibility of adding a base either to one or more starting materials or directly to the epoxidation reactor. This thus represented only two alternatives.
- Allyl chloride was disclosed as a preferred starting material in document (1).
- Document (1) disclosed to maintain the pH of the reaction mixture at a value of 4.

- VII. The appellant (patent proprietor) requested that the decision under appeal be set aside and that a patent be granted on the basis of the claims of the main request, or alternatively, on the basis of the claims of one of the auxiliary requests 1 to 4, all filed under cover of a letter dated 9 September 2011.
- VIII. The respondent (opponent) requested that the appeal be dismissed.
- IX. At the end of the oral proceedings the decision of the board was announced.

Reasons for the Decision

1. The appeal is admissible.

Main request

2. Novelty

- 2.1 Document (1) discloses on page 2 (see [0008]) a process for preparing an epoxide by contacting an olefin with a solution of hydrogen peroxide in the presence of a titanium silicalite catalyst (i.e. a zeolite). Furthermore, a base is added either to at least one starting material or directly into the reactor in order to adjust the pH in a range of 4 to 9.5. Allyl chloride as an example of a preferred olefin to be reacted is mentioned on page 3, line 18 of document (1). Document (1) does not, however, disclose the specific combination of features as recited in claim 1 of the patent in suit. That is the selection of allyl chloride

as the olefin, the selection of the overlapping pH range, and the selection of a pH within the region of overlap of the range disclosed in document (1) (i.e. t to 9.5) and the one indicated in present claim 1 (i.e. 1.5 to less than 4.8). Hence, the claimed subject-matter differs from the disclosure of document (1).

The epoxidation reaction disclosed in documents (2) and (3) takes place at a pH ranging from 4.8 to 6.5 (see document (2), page 5, lines 27 to 31 and document (3) page 6, lines 29 to 31). Hence, also these documents do not disclose the subject-matter of present claim 1.

2.2 As present claim 1 is the only independent claim, the subject-matter of the present claims differs from the one disclosed in any of the documents (1), (2) and (3). The board ascertained that no other cited document is relevant as to novelty.

3. Inventive step.

3.1 The board concurs with the parties that document (1) represents the closest prior art (see point 2.1 above). Moreover, the process described in this document aims at improving the selectivity of the epoxidation reaction (see page 2, lines 40 to 42) as does the patent in suit.

3.2 Problem

The problem underlying the patent in suit can thus be seen in the provision of a process to increase the selectivity of the epoxidation of allyl chloride.

3.2.1 According to the jurisprudence of the EPO any improvement should be shown by a comparison with the closest prior art (see T 181/82, OJ EPO 1984, 401, point 5 of the reasons). Furthermore, no example of the patent in suit could be used as a relevant comparative example.

3.2.2 The closest prior art document (1) requires that the pH is adjusted and essentially kept constant within a range of from 4 to 9.5 (see claim 1). In the patent in suit, examples 1 and 3, according to the claimed invention, are compared with examples 2, 4, 5 and 6 where the pH was not regulated at all. These examples thus do not reproduce the teaching of document (1) and cannot serve to compare the examples of the patent in suit with said closest prior art.

As no other comparative tests were provided, there is no evidence that the process claimed in the patent in suit is more selective than the one disclosed in document (1).

Hence, it is not evident that the problem mentioned above was solved.

3.2.3 The problem can thus only be regarded as the provision of an alternative process for the epoxidation of allyl chloride.

3.3 In view of the examples of the patent in suit, this problem is considered as credibly solved by the process described in claim 1.

3.4 Solution

3.4.1 The proposed solution can however not be considered as inventive in view of the disclosure of document (1). This document discloses that the pH of the reaction mixture has a decisive influence on the selectivity of the reaction. Therefore, it suggests adapting the value of the pH in order to optimize the selectivity and the conversion of the epoxidation reaction (see page 2, line 57 to page 3, line 4). Hence, once the nature of the olefin is determined (e.g. allyl chloride), the skilled person has only to vary the pH value within the pH range given on page 2, line 56 of document (1) to arrive at the claimed invention without any inventive skills.

The appellant argued that the results summarized in Tables 1 to 3 of document (1), showed that the selectivity was increased when increasing the pH value.

From this the appellant concluded that the person skilled in the art would not have been inclined to conduct the process at pH values as low as those required in present claim 1.

This argument does not, however, take into account that document (1) not only seeks to improve the selectivity but also to maintain the conversion at a high level (see page 2, lines 40 to 42). Tables 1 to 3 of document (1) show that an increase in pH will not only give rise to an increase in selectivity but also to a decrease in conversion. As this decrease is very sharp at high pH values, the person skilled in the art trying to achieve a high selectivity and an acceptable conversion would

not have considered working at the lower end of the pH range disclosed in document (1), namely in the region overlapping with the one indicated in present claim 1. The appellant's argument, that the person skilled in the art would consider a high conversion of lesser importance, was not based on any evidence and thus not deemed to be persuasive.

- 3.4.2 Document (1) discloses two variants for carrying out the process therein; that the pH control and the addition of the base can either (1) take place in the reactor or, (2) in one or more of the starting materials before that epoxidation takes place. The appellant contended that the latter is preferred and that no example is given of the former and that thus the former could not be carried out by the person skilled in the art.

That the former variant is not the preferred one neither prevent the person skilled in the art from performing the epoxidation reaction according to this method, nor acts as a prejudice against doing so. This argument is also not convincing.

- 3.5 Hence, the board concludes that the subject-matter of claim 1 of the main request lacks an inventive step.

First auxiliary request

4. Inventive step

- 4.1 Claim 1 of the first auxiliary request differs from claim 1 of the main request in that methanol must be present in the reaction mixture.

4.1.1 This feature does not render the claimed matter inventive, since methanol is mentioned in document (1) as the preferred solvent (see page 3, line 41). The person skilled in the art would thus use methanol as a solvent in the process described in point [0008] of document (1) and arrive at the claimed subject-matter without inventive ingenuity. Moreover, no specific technical effect has been shown for the cases where methanol is used as the solvent.

4.1.2 The appellant stressed that the disclosures of paragraphs [0009] and [0016] of document (1) would deter the person skilled in the art from working in the pH range between 4 and 4.8, when the liquid phase contains water and an organic solvent (see page 3, lines 8 to 14 and page 4, lines 11 to 13).

This argument cannot succeed, because these limitations concern the pH values in a hydrogen peroxide solution before it is added to the other constituents (catalyst and olefin), and not the pH value in reactor, when all the constituents were contacted together, as required in the present claims.

4.2 Therefore, the subject-matter of claim 1 of the first auxiliary request is obvious in view of the disclosure of document (1).

Auxiliary request 2

5. Inventive step

5.1 The subject-matter of claim 1 of this request differs from claim 1 of the main request in that the highest pH value is less than 4.

5.2 Although there is no overlap between the pH range of claim 1 of the second auxiliary request and the disclosure of document (1) (see page 2, line 56), since the formulation of claim 1 excludes the specific pH value 4, the board considers that the person skilled in the art, trying to solve the problem as recited in point 3.4 and in the light of the disclosure of document (1) (see page 2, line 57 to page 3, line 2), would also consider pH values slightly under the limit of 4 with the expectation that the epoxidation reaction, if not very selective, would at least take place at a high conversion rate.

5.3 Since the board does not see any technical effect linked to this specific pH range, it comes to the conclusion that claim 1 of the second auxiliary request lacks an inventive step.

Auxiliary request 3

6. Inventive step.

6.1 Claim 1 of the third auxiliary request differs from the wording of claim 1 of the main request in that the presence of methanol and a pH less than 4 are required in the claimed process.

6.2 As explained in points 4.1.1 and 5.2, both features are obvious for the person skilled in the art trying to make available an alternative process for the epoxidation of allyl chloride. It was not demonstrated, that the combinations of these features brings any technical effect which could render the claimed process inventive.

6.3 The subject-matter of claim 1 is thus not inventive.

Auxiliary request 4

7. Inventive step.

7.1 The wording of claim 1 of the auxiliary request 4 differs from the wording of claim 1 of the main request in that the presence of methanol, a pH less than 4 **and** a molar ratio of allyl chloride and hydrogen peroxide ranging from 4 to 7 is now required.

7.2 As explained in point 6.2, the presence of methanol and a pH value less than 4 does not render the claimed matter inventive. The specific molar ratio between allyl chloride and hydrogen peroxide is also not capable of rendering either the claimed matter inventive, since document (1) already mentions that this molar ratio can range from 1.1 to 10 (see page 4, lines 15 to 17). Hence, the combination of these features in a process as claimed in claim 1 of auxiliary request 4 cannot overcome the lack of inventive step.

7.3 The subject-matter of claim 1 of the fourth auxiliary request is not inventive.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

M. Schalow

C. M. Radke