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D E C I S I O N
of 3 February 2003

Case Number: T 0102/00 - 3.3.1

Application Number: 95916254.6

Publication Number: 0755376

IPC: C07C 231/08

Language of the proceedings: EN

Title of invention:
Aqueous process for preparing amido-carboxylic acids

Applicant:
EASTMAN CHEMICAL COMPANY

Opponent:
-

Headword:
Amido-carboxylic acids/EASTMAN

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes) - non obvious solution"

Decisions cited:
-

Catchword:
-

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Case Number: T 0102/00 - 3.3.1

D E C I S I O N
of the Technical Board of Appeal 3.3.1
of 3 February 2003

Appellant: EASTMAN CHEMICAL COMPANY
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Representative: Wibbelman, Jobst, Dr. Dipl.-Chem.
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 30 August 1999 refusing European patent application No. 95 916 254.6 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: A. J. Nuss
Members: P. P. Bracke
S. U. Hoffmann

Summary of Facts and Submissions

I. The appeal lies from the Examining Division's decision, dispatched on 30 August 1999, refusing European patent application No. 95 916 254.6, published as WO 95/28382, due to lack of inventive step.

II. In particular, the Examining Division was of the opinion that the claimed process was rendered obvious by the disclosures of documents

(1) US-A-2 867 654 and

(2) US-A-2 956 068,

since the claimed process differed from the one disclosed in document (1) only by the use of a carboxylic acid or ester instead of a carboxylic anhydride and since it was known from document (2) that a carboxylic acid may react with an amine in the presence of water.

III. With the statement setting out the grounds of appeal, dated 20 December 1999, the Appellant filed a set of 8 claims, with the only independent claims reading:

"1. A process for preparing amido-carboxylic acids wherein hydrolysis and amidation reactions are conducted simultaneously in water, said process comprising the steps of:

(A) reacting at a temperature of 150°C-300°C for 2 to 10 hours, a mixture containing

(1) a nitrogen containing compound selected from the group consisting of butyrolactam, valerolactam, epsilon-caprolactam, beta-propiolactam, and delta-valerolactam;

(2) 2 to 4 moles of a carboxylic acid compound per mole of the nitrogen containing compound, said carboxylic acid compound having 8 to 20 carbon atoms selected from the group consisting of a carboxylic acid, a carboxylic acid ester and combinations thereof; and

(3) 20 to 40 moles of water per mole of the nitrogen containing compound, to form a reaction mixture containing an amido-carboxylic acid; and

(B) cooling the reaction mixture formed in step (A) to a temperature of less than 150°C to achieve phase separation of an organic layer containing the amido-carboxylic acid, and an aqueous layer; and

(C) separating the amido-carboxylic acid containing organic layer from the aqueous layer."

The Appellant argued that it was the essence of the invention that the presence of water in an amount which permits the phase separation does not inhibit formation of the amido-carboxylic acid product and that it provides amido-carboxylic acid products which contain very little, if any, lactam oligomers. Since document (1) was concerned with suppressing the formation of by-products of an entirely different kind from an entirely different reactant as the claimed process and since document (2) neither gave any hint to react a lactam with 2 to 4 moles of carboxylic acid or ester in the

presence of 20 to 40 moles of water nor how to suppress the formation of lactam oligomers, the claimed process was not made obvious by the disclosures of documents (1) and (2).

IV. The Appellant requested that the decision be set aside and the case be remitted to the first instance with the order to grant a patent on the basis of the claims attached to the statement setting out the grounds of appeal, dated 20 December 1999, and a description to be adapted.

Reasons for the Decision

1. The appeal is admissible.

2. *Article 123(2) EPC*

Present Claim 1 is supported by Claim 1 and by the following passages of the application as filed:

- page 4, lines 25 to 27, describing suitable lactams;

- page 6, lines 27 to 29, citing the preferred number of carbon atoms in the carboxylic acid or carboxylic acid esters;

- page 8, lines 22 to 24, citing the preferred amounts of water; and

- page 9, lines 5 to 9, describing the required temperature for phase separation.

The content of present Claim 2 corresponds with the content of Claim 3 as filed and Claims 3 to 8 are identical with Claims 4 to 9 as filed respectively.

Consequently, Claims 1 to 8 meet the requirement of Article 123(2) EPC.

3. *Novelty*

After examination of the cited prior art documents, the Board has reached the conclusion that the claimed process was not described in any of those documents.

In particular, the claimed process differs from the process described in document (1) at least by the nature of the reactants and of the final compounds. From the process described in document (2) the claimed process differs at least by the requirement that per mole of the nitrogen containing compound 2 to 4 moles carboxylic acid compound and 20 to 40 moles of water must be present.

As novelty was not disputed by the Examining Division, it is not necessary to give detailed reasons for this finding.

4. *Inventive step*

4.1 In accordance with the "problem-solution approach" applied by the Boards of Appeal to assess inventive step on an objective basis, it is in particular necessary to establish the closest state of the art forming the starting point, to determine in the light thereof the technical problem which the invention addresses and solves, and to examine the obviousness of

the claimed solution to this problem in view of the state of the art.

4.2 The "closest state of the art" is normally a prior art document disclosing subject-matter aiming at the same objective as the claimed invention and having the most relevant technical features in common.

Since Claim 1 relates to a process of preparing amido-carboxylic acids by reacting a lactam with a carboxylic acid and since document (2) is the only cited prior art document describing such reaction, only document (2) can serve, as the closest prior art, as a suitable starting point for evaluating the inventive merit of the invention.

4.3 Document (2), which is referred to on page 2, lines 13 to 19, of the application as filed, describes a process for preparing amido-carboxylic acids of formula R-CO-$[NH-(CH_2)_n-CO]_x$-OH by reacting a lactam with a free carboxylic acid at a temperature of 150-300°C, wherein the initiation of the reaction may be facilitated by adding small quantities of water, as for example, 0.1-20% and preferably 0.1-0.5% of the entire reaction mixture (see column 1, lines 18 to 27 and 34 to 38, and column 2 lines 11 to 14 and 26 to 29). Document (2) also states that the reaction product consists not only of amido-carboxylic acids wherein x=1 but also of amido-carboxylic acids wherein x is greater than 1, which are produced in particular when the lactam is used in greater than equimolar amounts with respect to the carboxylic acid. Moreover it states that up to 10 mols of lactam may be used per mol of carboxylic acid and that, even when effecting the reaction with equimolar quantities of the fatty acid and the lactam,

formation of amido-carboxylic acids wherein x is greater than 1 will not always be entirely suppressed (see column 2, lines 38 to 53). Furthermore, it is clear from column 5, lines 1 to 5, that even in reactions leading to amido-carboxylic acids having an average number of x = 1 or lower amido-carboxylic acids wherein x is greater than 1 are obtained.

4.4 The Board interprets the passage on page 2, lines 26 to 29, of the application as filed, that the "amido-carboxylic acids obtained by this process essentially contain one molecule of amino acid and one molecule of carboxylic acid" that the amido-carboxylic acids obtained by the claimed process are essentially free of such amido-carboxylic acids described in document (2) wherein x is greater than 1. This was confirmed by the Appellant in the second paragraph on page 2 of the letter dated 20 December 1999 stating that "the amount of water required by the claims of the present application also provides an amido-carboxylic product which contains very little, if any, lactam oligomers, referred to in Applicant's examples as diamidoacid and triamidoacid".

Therefore, starting from the disclosure of document (2) the problem underlying the patent in suit must at least be seen in providing a process for reacting lactams with carboxylic acids to form amido-carboxylic acids formed by one molecule of lactam and one molecule of carboxylic acid, ie forming no oligomeric lactams.

4.5 The application in suit claims to solve this problem by the process defined in Claim 1.

4.6 The first point to be considered in assessing inventive

step is then whether it has been convincingly shown that by the process according to Claim 1 the problem underlying the patent in suit has effectively been solved.

From the data provided in Tables I, II and III in the experimental part of the application as filed it follows that in all examples according to the claimed process the lactam oligomers, presented as diamido caproic acid, are present in the organic layer in amounts lower than 0.1% or in undetectable amounts and that amido-carboxylic acids are effectively formed.

Considering those data, the Board has no reason to challenge that a credible case has been put forward that with the claimed process the problem underlying the invention has effectively been solved.

4.7 Therefore, it remains to be decided, whether in the light of the teachings of the cited documents a skilled person seeking to solve the above-mentioned problem would have arrived at the claimed process in an obvious way.

4.8 Document (2) teaches the use of water as initiation facilitating agent in an amount of 0.1 to 20% of the entire reaction mixture. This general teaching is, however, completely silent about the influence of water on the formation of oligomeric amido-carboxylic acids. It is only in example 5 that the reaction of a lactam with a carboxylic acid in the presence of considerable amounts of water is described. Namely, example 5 describes a reaction of 3 moles caprolactam with 1 mole lauric acid and 5.55 moles (100 g) water. However, a direct comparison of example 5 with the data obtained

in example 3, describing the same reaction in the absence of water, does not provide a skilled person with any information that water would influence the formation of oligomeric amido-carboxylic acids. Moreover, as example 5 is related to the reaction of a molar excess of lactam instead of a molar excess of carboxylic acid, this example could not give any hint that by reacting a lactam with a carboxylic acid in the presence of water as defined in present Claim 1 the formation of oligomeric amido-carboxylic acids could be avoided to a large degree.

As, thus, the combination of the parameters of step (A) in the claimed process is neither suggested in the general teaching of document (1) nor in any of its examples, for this reason alone, the process of Claim 1 as the solution to the above stated problem is not obviously derivable therefrom.

4.9 The question arises then, whether the process of Claim 1 is rendered obvious by the combined teaching of documents (1) and (2).

Document (1) discloses a process of reacting an á-monoamino acid with an anhydride in the presence of water, which acts as a moderator for the reaction and prevents the formation of oxazolines, oxazolones and O-acyl or S-acyl derivatives (column 1, line 60 to column 2, line 24).

In column 2, lines 27 to 40, of document (1) it is stated that it was surprising that the acylation with an anhydride could take place in the presence of water and that thereby the additional desirable effect was obtained that undesired side reactions are minimised.

Therefore, the Examining Division was of the opinion, that a skilled person had only to substitute the anhydride by a carboxylic acid or acid ester in order to come to the claimed process and that such substitution was evident.

However, the teaching in document (1) that the side reactions are minimised must be seen in the complete context of its disclosure. As it is the aim of the process described in document (1) to prevent or to minimize the formation of oxazolines, oxazolones and O-acyl or S-acyl derivatives, the minimisation of the formation of side reactions is to be understood as the minimisation of such undesired compounds. It may not be deduced therefrom that any side reaction would be prevented. As document (1) is completely silent about the formation of oligomeric amido-carboxylic acids, a skilled person could not deduce from the teaching of this document that by reacting a lactam with 2 to 4 moles of a carboxylic acid or ester per mole of lactam in the presence of 20 to 40 moles of water per mole of lactam the formation of oligomeric amido-carboxylic acids could be prevented or minimised. This document does not contain any useful teaching when trying to solve the above mentioned problem.

4.10 The process of Claim 1 is thus not rendered obvious by the isolated teaching of any of documents (1) and (2) nor by the combined teaching thereof.

Claims 2 to 8 derive their patentability from the same inventive concept as Claim 1 on which they depend.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to grant a patent on the basis of Claims 1 to 8 attached to the statement setting out the grounds of appeal, dated 20 December 1999, and a description yet to be adapted.

The Registrar: The Chairman:

N. Maslin A. Nuss