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D E C I S I O N
of 19 November 2003

Case Number: T 0647/98 - 3.3.6

Application Number: 95103245.7

Publication Number: 0671507

IPC: D21H 17/00

Language of the proceedings: EN

Title of invention:
Cationic and anionic polyelectrolytes for enhancing the freeness of paper pulp

Applicant:
NALCO CHEMICAL COMPANY

Opponent:
-

Headword:
Pulp treatment/NALCO

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (main request): no - no improvement over the closest prior art; obvious alternative"
"Inventive step (auxiliary request): yes - prior art teaching away from the claimed combination of features; surprising effect"

Decisions cited:
-

Catchword:
-

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Case Number: T 0647/98 **-** 3.3.6

D E C I S I O N
of the Technical Board of Appeal 3.3.6
of 19 November 2003

Appellant: NALCO CHEMICAL COMPANY
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 9 March 1998 refusing European application No. 95103245.7 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: G. Dischinger-Höppler
Members: G. Raths
M.-B. Tardo-Dino

Summary of Facts and Submissions

I. This appeal is from the decision of the Examining Division to refuse the European patent application No. 95 103 245.7 relating to cationic and anionic polyelectrolytes for enhancing the freeness of paper pulp, on the ground that the subject-matter of the then pending claims lacked an inventive step in view of documents

(1) US-A-5 169 497 and

(2) US-A-5 266 164.

In its decision, the Examining Division stated that the subject-matter of Claim 1 differed from the process for improving the freeness of pulp in the presence of enzyme disclosed in document (1) only by a treatment with an anionic polymer after the treatment with a cationic polymer. However, pulp treatment with an anionic polymer after a preceding treatment with the same cationic polymer as in document (1) and the effect thereof on drainage were known from document (2). It was, therefore, obvious to include said treatment with an anionic polymer in the process of document (1) in order to solve the technical problem of further improving the freeness of the pulp.

II. With its statement of grounds of appeal dated 8 June 1998, the Appellant filed a "Test Report" to show that in comparison with the process of document (1), the claimed process increased the freeness of the pulp by more than 40%.

III. In its provisional and non-binding opinion dated 10 December 2001, the Board drew attention to the following:

According to Table II of the application in suit, sequential treatment of pulp with enzyme, cationic and anionic polymer in accordance with Claim 1 can produce pulp freeness which is worsened by up to 22% (Run 1, 3, 5, 7 and 9 to 11) in comparison with pulp which has been treated with the enzyme alone (Run 15). In addition, Table I of the Test Report (see "Control 2" versus "Prior art D1") shows that if such enzyme-treated pulp is further treated with a cationic polymer in accordance with the process of document (1), the freeness of the pulp is increased. Therefore, it had to be expected that most of the runs in Table II of the application in suit representing the claimed subject-matter would give still worse results in comparison with those according to the process of document (1).

Thus, it appeared that the results obtained in the Appellant's Test Report data depend on facts which do not figure in Claim 1 and that the claimed process covers embodiments which do not improve the freeness of the pulp over the process of document (1).

For these embodiments, the technical problem solved in view of document (1) by the additional treatment with an anionic polymer seemed to consist merely in providing a further process for producing pulp having high freeness values.

It was, however, known from document (2) that

sequential treatment with the same cationic and anionic polymers and in the same amounts as in the application in suit (see document (2), column 5, line 51, to column 7, line 2, and column 8, lines 32 to 38; application in suit, page 6, line 4 to page 7, line 20), would have hardly any detrimental effect on drainage efficiency or freeness (column 3, lines 38 to 42).

Therefore, the claimed subject-matter appeared to be obvious since a skilled person would replace the cationic polymer treatment of document (1) by the dual polymer treatment of document (2) in the expectation that the resulting pulp still had a freeness comparable to that obtained by the process of document (1), an improved retention however being possible.

IV. Under cover of a letter dated 10 May 2002, the Appellant submitted a new set of 8 claims, the only independent claim reading:

"1. A process for improving the freeness of paper pulp, which comprises the sequential steps of:

a) adding to the pulp 0.01 - 0.5%, based on the dry weight of the pulp, of a cellulolytic enzyme;

b) allowing the pulp to contact the cellulolytic enzyme for from 30 to 60 minutes at a temperature of at least 40°C;

c) adding 0.010 - 0.080%, based on the dry weight of the pulp, of a water-soluble cationic polymer;

d) adding 0.025 - 0.075%, based on the dry weight of the pulp, of a water-soluble anionic polymer; and

e) forming the thus treated pulp into paper."

The Appellant argued that the specific combination of process steps of Claim 1 provided an unexpected effect and had not been obvious from documents (1) and (2).

V. In an annex to the summons to oral proceedings dated 20 May 2003, the Board drew attention to the fact that the Appellant in its response to the Board's first communication had not addressed the Board's arguments in relation to the alleged effect and submitted that it was not apparent why the Board's arguments and objections should be overcome by the new claims.

VI. Oral proceedings before the Board of Appeal took place on 19 November 2003, in the course of which the Appellant filed a new set of six claims in an auxiliary request. The only independent claim reads:

"1. A process for improving the freeness of paper pulp, which comprises the sequential steps of:

a) adding to the pulp 0.2%, based on the dry weight of the pulp, of a cellulolytic enzyme;

b) allowing the pulp to contact the cellulolytic enzyme for from 30 to 60 minutes at a temperature of at least 40°C;

c) adding 1.350 pounds polymer/ton dry pulp, of a water-soluble cationic acrylamide polymer having a

RSV within the range of 5 to 20 determined using a one molar sodium nitrate solution at 30°C the concentration of the acryl amide polymer in this solution being 0.045%;

d) adding 1.350 pounds polymer/ton dry pulp, of a water-soluble acrylamide anionic polymer; and

e) forming the thus treated pulp into paper."

VII. The Appellant argued that document (1) was the closest prior art since it related to the same technical problem as the application in suit of improving the freeness of pulp in the presence of a cellulolytic enzyme. The solution proposed in document (1) consisted in a sequential treatment of the pulp with enzyme and a **low molecular weight** cationic polymer, i.e. a cationic **coagulant**. There was no suggestion that the pulp be further treated with a **high molecular weight** anionic polymer, i.e. an anionic **flocculant**. Such double polymer treatment was known in the art as the conventional dual polymer treatment. Document (2) was instead concerned with a particular dual polymer treatment using both a high molecular cationic and an anionic flocculant for the different purpose of improving retention. It was stated in document (2) that superior performance is obtained over the conventional dual polymer retention and drainage systems. A combination of documents (1) and (2) would, therefore, not result in the claimed subject-matter. Moreover, it was the general teaching of document (2) that improved retention brings about some worsening of the drainage and that this effect could only be minimised by the particular combination of specific high molecular cationic and anionic polymers. Therefore, document (2) led away from the claimed invention and it was highly surprising that the claimed subject-matter provided an unexpected and substantial improvement of the freeness over the process of document (1) as has been shown in the Test Report.

VIII. The Appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the main request filed under cover of the letter

dated 10 May 2002 or of the auxiliary request filed during the oral proceedings (Claims 1 to 6).

Reasons for the Decision

Main request

1. *Amendments (Articles 84 and 123(2) EPC) and novelty*

The Board is satisfied that the claims comply with the requirements of Articles 84, 123(2) and 54 EPC. Since the main request fails on the ground of lack of inventive step, there is no need to give further details.

2. *Inventive step*

2.1 The application in suit is concerned with the general technical problem existing in the field of papermaking pulp of improving the freeness, i.e. the draining capability of the paper pulp (page 2, line 6, to page 3, line 2, and page 4, lines 10 to 17).

According to the application in suit, the following systems are known for that purpose:

(a) cellulolytic enzymes (page 3, lines 3 to 7);

(b) cellulases in combination with cationic polymers according to document (1) (page 3, lines 8 to 13) and

(c) a "dual polymer retention system" wherein a low molecular weight cationic polymer and a high molecular weight anionic polymer are sequentially mixed to the paper furnish (page 3, lines 14 to 19).

2.2 The Board agrees with the Appellant that document (1) is a suitable starting point for the assessment of inventive step since it is concerned with exactly the same technical problem as the application in suit, the improvement of the freeness of paper pulp (column 1, lines 7 to 29).

For this purpose, document (1) proposes a process comprising the following steps (column 2, lines 21 to 32, and column 3, lines 23 to 43):

(a) adding to the pulp at least 0.05%, preferably 0.1 to 10% based on the dry weight of the pulp, of a cellulolytic enzyme;

(b) allowing the pulp to contact the cellulolytic enzyme for at least 20 minutes, typically for 40 minutes but no longer than 60 minutes at a temperature of at least 20°C, typically 40°C;

(c) adding at least 0.0007% and up to 0.0653% based on the dry weight of the pulp of a water soluble cationic polymer, and then

(d) forming the thus treated pulp into paper.

The process of Claim 1 differs therefrom only in that a water soluble anionic polymer is added after step c) in

an amount of 0.025 to 0.075% based on the dry weight of the pulp.

2.3 The Appellant argued that the technical problem solved by the claimed process in view of document (1) consisted in a further improvement of the freeness of the pulp. This had been shown in its Test Report where an improvement of more than 40% has been achieved (see in the Tables, "Invention" versus "Prior art D1").

2.4 These results are, however, contradicted by the application in suit which shows that, compared with pulp treated with an enzyme only, a worse freeness is achieved in the majority of the examples representing the sequential treatment with an enzyme, a cationic and an anionic polymer in accordance with Claim 1 (cf. Table 1, run 16 and 17 versus Table II, run 1; Table 1, run 18 versus Table III, run 5; Table II, run 16 and 17 versus Table V, run 3, Table VI, run 2 and 16, and Table VII, run 2, 3, 5, 6, 9 and 16).

Further, the data in the Appellant's Test Report show that the sequential treatment with enzyme and cationic polymer according to document (1) provides better results than a treatment with an enzyme alone. This is corroborated by the results given in document (1) (see e.g. Table 7). It is, therefore, a logical consequence, that the above invention examples come off still worse in comparison with the results in document (1).

Therefore, the claimed process covers embodiments which do not improve the freeness of the pulp over the process of document (1). For these embodiments, the technical problem solved in view of document (1) can

only be considered to consist in the provision of a further process for producing pulp of high freeness.

The solution to this problem, i.e. including in the process of document (1) a treatment with an anionic polymer after the treatment with a cationic polymer, is obvious in the art since a skilled person knows from document (2) that dual polymer treatment would hardly affect the drainage efficiency (freeness). Therefore, a skilled person would replace the cationic polymer treatment in document (1) by the dual polymer treatment of document (2) in order to provide simply a further process.

2.5 The Appellant argued that the polymer system used in the application in suit was different from the particular dual polymer system used in document (2) due to the lower molecular weight of the cationic polymer. In the application in suit, the low molecular weight of the cationic polymers was defined via a reduced specific viscosity (RSV) within the range of 5 to 20 determined at 30°C and a concentration of 0.045% of polymer in a one molar sodium nitrate solution. This corresponded to a molecular weight of 50 000, 500 000 and, respectively, 20 000 as used in the Appellant's Test Report and could be calculated by those skilled in the art. Therefore, a combination of documents (1) and (2) would not provide the claimed process features.

2.6 The Board agrees that there exist methods in the art for calculating the molecular weight of polymers from the RSV measured under specific conditions. In the absence of any contradictory evidence, it is further accepted as credible that the RSV data given in the

application in suit (page 6, lines 4 to 14) correspond to the molecular weights in the Test Report for the cationic polymers used therein.

However, particular molecular weights or RSV values do not figure in Claim 1. Therefore, Claim 1 covers embodiments comprising the enzyme treatment combined with the particular dual polymer treatment disclosed in document (2) wherein the cationic polymer is a high molecular weight flocculant.

2.7 The Board, therefore, concludes that for the purpose of providing a further process of producing pulp having high freeness, a skilled person, with a reasonable expectation of success, would have tried to substitute the treatment with a cationic polymer according to the process of document (1) by the dual polymer treatment disclosed in document (2).

Consequently, the subject-matter of Claim 1 of the main request is not based on an inventive step and does not meet the requirements of Article 56 EPC.

Auxiliary request

3. *Amendments (Article 123(2) EPC)*

The amendments made to the claims consist in the introduction of the particular amounts of 0.2% of enzyme and 1.35 pounds per ton dry pulp of both the cationic and the anionic polymer used in run 12 to 14 of Example 5 (see also Table VII) and in the definition of the cationic polymer as a cationic acrylamide polymer having the particular RSV disclosed in the

description for the generally preferred group of cationic polymers derived from acrylamide (page 6, lines 4 to 14).

The type of cationic polymer is not explicitly mentioned in any of the examples. However, no other type of cationic polymer than those derived from acrylamide is mentioned in the application in suit. The Board holds, therefore, that all the examples given in the application in suit are based on cationic acrylamide polymers.

In so far the amendments made to Claim 1 correspond to the particular embodiments of runs 12 to 14 in Example 5. Concerning the remaining feature of Claim 1, the conditions during the enzyme treatment in step b), Example 5 merely states that it was carried out under optimal conditions. Time and temperature are not mentioned there. It is, however, apparent from page 7, lines 9 to 15, and original Claim 1 that the term "optimal" in this respect actually corresponds to a treatment time of from 30 to 60 minutes at a temperature of at least 40°C.

The particular cationic and anionic acrylamide polymers mentioned in dependent claims 2 to 6 are those particularly preferred in accordance with the description on page 6, lines 4 to 17, and original Claims 2 to 6.

Since the application as filed does not contain any indication that the embodiments in runs 12 to 14 of Example 5 are necessarily interrelated with specific cationic and anionic acrylamide polymers or enzyme

treatment conditions within the originally disclosed possibilities, the Board concludes that the particular combination of features set out in the amended claims meets the requirements of Article 123(2) EPC.

4. *Inventive step*

4.1 The results given in Table VII for run 12 to 14 show that particularly high freeness values, namely 600 ml, 575 ml and 555 ml, are obtained with the claimed process as compared with embodiments using lower amounts of anionic and/or cationic polymer. A comparison with run 6 and 17 of Table I (about 320 ml) further suggests that a considerable increase over pulp treated with an enzyme only is achieved. These results are corroborated by the Appellant's Test Report which also shows that embodiments in accordance with the invention improve the freeness over pulp only treated with an enzyme. The Test Report further shows an improvement over the process of document (1) wherein the pulp is treated with an enzyme and a cationic polymer (see also point 2.3 above).

4.2 It is therefore credible that the technical problem solved by the claimed subject-matter in view of document (1) as the closest prior art consists in providing a process for improving the freeness of the pulp.

It remains to be assessed whether, in view of the cited prior art documents, it was obvious for someone skilled in the art to solve this problem by the means claimed.

4.3 In document (1) the cationic polymers to be added to the pulp are exactly the same as in the application in suit, i.e. low molecular weight cationic acrylamide polymers as defined by an RSV of 5 to 20 determined at 30°C and a concentration of 0.045% in a one-molar sodium nitrate solution (column 2, lines 52 to 68, and column 3, lines 54 to 68).

This document does not contain any pointer for a person skilled in the art that the cationic polymer treatment in step (c) (see also 2.2 above) could be replaced by a conventional dual polymer treatment or, in other words, that an anionic flocculant should be added after the cationic coagulant.

4.4 Dual polymer treatment of pulp is the subject of document (2). It discloses that the conventional dual polymer retention and drainage programs with cationic coagulant and an anionic flocculant increase retention, however, at some loss of drainage capability or freeness due to a reduction of the pores in the fibre web (column 1, line 67, to column 2, line 6, and column 2, lines 46 to 66, and column 4, lines 16 to 32). In order to provide superior performance over such conventional dual polymer systems, document (2) recommends using both a high molecular cationic and an anionic polymer, i.e. a cationic and an anionic flocculant having a molecular weight of at least 1 000 000. It is said that retention is thereby increased without undue detrimental effect on drainage efficiency (column 3, lines 28 to 51, column 5, lines 1 to 14 and 51 to 61).

4.5 RSV values of 4 to 22 are given in document (2) for the cationic flocculant, which correspond essentially to those of Claim 1. However, unlike the application in suit, document (2) does not disclose how these values have been obtained. The Board agrees with the Appellant that it is common general knowledge in the art of polymers that the conditions with regard to the solvent, the temperature and the polymer concentration in the solution used for the measurement are indispensable for the calculation of a molecular weight. Therefore, in contrast to the application in suit, no specific meaning can be attributed to the RSV values mentioned in document (2).

As a consequence, document (2), by teaching that a dual polymer system using both a high molecular cationic and an anionic flocculant, would have less deleterious effect on the freeness of the pulp than a conventional dual polymer system wherein the cationic polymer is a low molecular coagulant, leads away from a combination of the latter system with the process of document (1) in the presence of an enzyme in order to improve the freeness of the pulp. Document (2), in particular, does not suggest that this object can be achieved if the cationic polymer in a dual polymer system is an acrylamide polymer having an RSV of from 5 to 20 determined at 30°C in a concentration of 0.045% in a one-molar sodium nitrate solution.

4.6 The Board, therefore, concludes that it was not obvious from the prior art documents to modify the process of document (1) by adding to the paper pulp a water soluble anionic polymer after the addition of the

cationic coagulant and expect that the freeness of the pulp would increase.

4.7 For all these reasons, the subject-matter of Claim 1 involves an inventive step and meets the requirements of Article 56 EPC.

Dependent Claims 2 to 6 refer to specific embodiments of Claim 1 and derive their patentability therefrom.

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 the auxiliary request (Claims 1 to 6) filed during the oral proceedings and a description to be adapted.

The Registrar: The Chairman:

G. Rauh G. Dischinger-Höppler