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File Number: T 796/91 - 3.3.3

Application No.: 84 302 554.5

Publication No.: 0 122 797

Title of invention: Process for producing granular, water-swella-
ble crosslinked acrylic copolymer, and its use

Classification: C08F 220/54

D E C I S I O N
of 27 January 1993

Proprietor of the patent: MITSUI PETROCHEMICAL INDUSTRIES, LTD.

Opponent: Chemische Fabrik Stockhausen GmbH

Headword:

EPC Articles 54, 56 and 114

Keyword: "Novelty (confirmed) "
"Inventive step (process claim: yes; use claim: no)"
"Late-filed test report - not admitted"



Case Number : T 796/91 - 3.3.3

DECISION
of the Technical Board of Appeal 3.3.3
of 27 January 1993

Appellant :
(Opponent)

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Representative :

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Respondent :
(Proprietor of the patent)

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Representative :

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Decision under appeal :

Interlocutory decision of the Opposition Division
of the European Patent Office dated 3 July 1991,
posted on 6 August 1991 concerning maintenance of
European patent No. 0 122 797 in amended form.

Composition of the Board :

Chairman : F. Antony
Members : C. Gérardin
G. Davies

Summary of Facts and Submissions

- I. The mention of the grant of the patent No. 0 122 797 in respect of European patent application No. 84 302 554.5 filed on 13 April 1984 and claiming the priorities of 14 April 1983, 16 September 1983 and 11 October 1983 from three earlier applications in Japan, was published on 15 July 1987 on the basis of five claims, of which Claim 1 reads as follows:

"A process for producing a granular, water-swella-ble crosslinked acrylic copolymer, which comprises copolymerizing in an aqueous medium in the presence of a radical polymerization initiator a monomeric mixture comprising (a) at least one acrylic amide monomer selected from acrylamide, methacrylamide and N-methyl substitution products of these amides and (b) at least one acrylic crosslinkable comonomer selected from N,N'-alkylene or arylene-bisacrylamides, N,N'-alkylene- or (C₆) arylene bismethacrylamides, alkylene-bisacrylates, alkylene-bismethacrylates, alkylene glycol-bisacrylates, polyalkylene glycol-bisacrylates, alkylene glycol-bismethacrylates and polyalkylene glycol-bismethacrylates, the proportion of the comonomer (b) being 0.01 to 5 moles per 100 moles of the acrylic amide monomer (a), forming a granular copolymer and drying the resulting granular copolymer characterised by (i) drying the resulting granular polymer at a temperature of 105 to 150°C, or (ii) heat-treating the resulting granular copolymer in the presence of moisture under substantially sealed conditions at a temperature of 100 to 160°C."

Claims 2 and 3 are dependent claims directed to preferred embodiments of the process according to the main claim. Further, Claim 4 is an application claim concerning the use of granular water-swella-ble crosslinked acrylic

copolymer produced by a process according to any of Claims 1 to 3 as an artificial soil for hydroponics. Lastly, Claim 5 was a further dependent use claim.

II. On 13 April 1988 the Opponent filed a Notice of Opposition against the grant of the patent and requested revocation thereof in its entirety for the grounds falling under Article 100(a) EPC, more specifically for lack of novelty and inventive step of the process and, further, for lack of inventive step of the applications. These objections, which were emphasised and elaborated in several later submissions as well as during oral proceedings, were based essentially on the following documents:

- (4) DE-B-2 737 941,
- (6) EP-A2-0 037 138 = JP-A-145 908/1981,
- (7) DE-A-3 228 121,

the last two being cited after the normal opposition period.

III. By an interlocutory decision within the meaning of Article 106(3) EPC delivered orally on 3 July 1991, with written reasons posted on 6 August 1991, the Opposition Division held that there were no grounds of opposition to the maintenance of the patent in suit in amended form, the amendment consisting in the deletion of Claim 5. In this decision it was first stated that novelty of the process was given, since, on the one hand, document (4) was directed to very general soil improving polyelectrolytes which did not suggest the specific copolymers used in the patent in suit, and, on the other hand, the polymer described in Example 5 of the late-filed document (7) contained too high an amount of units derived from acrylic acid. An inventive step could be acknowledged for the process as well, since none of the documents relied upon

by the Opponent invited the skilled person to carry out the drying step at a temperature between 105 and 150°C. Moreover, the prior art polymer particles did not have the same combination of water solubility, shape retention, transparency and performance when used as artificial soil as the polymer particles obtained by the claimed process; it followed that the subject-matter of Claim 4 involved an inventive step.

IV. The Appellant (Opponent) thereafter filed a Notice of Appeal against this decision on 12 October 1991 and paid the prescribed fee at the same time. In the Statement of Grounds of Appeal filed on 16 December 1991 and in a later written submission as well as during oral proceedings held on 27 January 1993, the Appellant maintained its previous objections of lack of novelty and inventive step of the process as well as lack of inventive step of the application. More specifically, the process disclosed in Example 5 of document (7), which involved the polymerisation of a monomer mixture comprising acrylamide followed by a drying step within the terms of the patent in suit, was regarded as novelty destroying. Further, document (4) mentioned explicitly that polyacrylamides crosslinked with methylene-bisacrylamide were suitable by themselves as artificial soils. Additionally, new experimental test reports provided evidence that products obtainable by the processes according to documents (4) and (7) exhibited the same combination of properties as the products used as artificial soils in the patent in suit.

V. In its written and oral submissions the Respondent (Patentee) objected in the first place to the admission of document (7) and of the experimental test reports into the procedure. In substance, Example 5 of this citation was not even relevant, because the amount of acrylic acid was excessive and the patent in suit was not

concerned with the polymer itself. As far as document (4) was concerned, there was no indication that the polymer, when prepared from acrylamide and a polyfunctional monomer within the terms of the patent in suit, was dried or heat-treated as required in Claim 1; further, proper interpretation of this citation did not show that the resulting polymers could be used alone for the growing of plants.

VI. As an alternative to the remittal of the case to the first instance in order to examine the opposition on the basis of the late-filed materials, the Appellant filed on 5 August 1992 a new Claim 1 to be considered as the main claim of the first auxiliary request, wherein it was additionally specified that the monomer mixture comprised "optionally (c) an unsaturated monomer copolymerisable with the monomer (a) and the comonomer (b)", ..., "the proportion of monomer (c) being up to 60 moles per 100 moles of the acrylic amide monomer (a) ...".

During oral proceedings the Appellant further submitted an amended Claim 4 to be considered together with Claims 1 to 3 of the main request as the second auxiliary request. This new claim reads as follows: "A process according to any one of Claims 1 to 3 which further comprises using the granular water-swelling crosslinked acrylic copolymer as an artificial soil for hydroponics".

Subsequently, the Appellant invited the Board, as a third auxiliary request, to consider the maintenance of the patent in suit on the sole basis of the process Claims 1 to 3 of the main request.

VII. The Appellant requested that the decision under appeal be set aside and that the patent be revoked, or,

alternatively, that the matter be referred back to the Opposition Division.

The Respondent requested that the appeal be dismissed and that the patent be maintained on the basis of Claims 1 to 4 as upheld by the Opposition Division as main request; or on the basis of Claim 1 filed on 5 August 1992 and Claims 2 to 4 as upheld by the Opposition Division as first auxiliary request; or on the basis of Claims 1 to 3 of the main request and Claim 4 submitted during the oral proceedings as second auxiliary request; or on the basis of Claims 1 to 3 of the main request as third auxiliary request.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is admissible.
2. The first point to be decided is whether the late-filed technical evidence and documents on which the Appellant relied during both the opposition procedure and the appeal procedure, should be admitted at all for consideration.

This applies in the first place to document (7) which was cited for the first time on 27 June 1991, thus more than three years after the normal opposition period pursuant to Article 99(1) EPC and only six days prior to the oral proceedings before the Opposition Division. Since, in spite of this late citation, this document was eventually accepted, then abundantly discussed during these proceedings (see minutes thereof) and dealt with in detail in the interlocutory decision (see Reasons for the Decision, point 5.2), the Board regarded it as

inappropriate to exclude the document from the appeal proceedings.

By contrast, the Board has decided not to admit for consideration the comparative test report submitted together with the Statement of Grounds of Appeal. As explained by the Chairman in his introductory statement to the oral proceedings, these experiments were supposed to illustrate the properties of acrylamide polymers according to documents (4) and (7), whereas the main issue to be decided during these proceedings was the patentability of the process of preparation, i.e. the question whether a specific combination of process features was novel and inventive or not. It is evident that the late-filed comparative test report could not contribute to providing an answer to this question and that, consequently, the Board could only disregard it pursuant to Article 114(2) EPC. The same applied to the document concerning ethylcellulose joined in annex to this test report.

For the same reasons, the Board decided not to admit as technical evidence the samples of polymer powder which the Appellant sought to display during the oral proceedings and on which the Respondent was not in a position to comment.

Main request

3. The current wording of the claims does not give rise to any objections under Article 123 EPC.

The present set of claims only differs from the claims as granted by the deletion of Claim 5. The only differences between the claims as granted and the claims as originally filed concern the wording of the main claim. The first difference consists in the addition of N,N'-(C₆)arylene

bismethacrylamides to the list of acrylic crosslinkable comonomers (b); this amendment, which aimed at a full correspondence between the description and the claims, is supported by page 5, lines 6/7 of the original application. The second difference consists in the incorporation of the expression "characterised by (i) drying the resulting granular polymer", whereby the two-part form was adopted for the claim; since this technical feature was already present in the original version of the claim, the amendment did not result in an extension beyond the content of the application as filed.

4. The patent in suit concerns a process for producing a granular, water-swellaible crosslinked acrylic copolymer and its use as an artificial soil for hydroponics. Although the submissions by the parties were based mainly on documents (4) and (7), in the Board's view it is more coherent and systematic to start from a document which discloses both the process of preparation of such a product and the specific application thereof; for this reason, document (6), which has been cited in the introductory section of the description of the patent in suit (page 2, lines 14 to 37) in the form of the corresponding Japanese patent, is regarded as the closest state of the art. This document relates to a water-exchangeable non-toxic polymeric material derived from an acrylic amide monomer and an acrylic crosslinkable comonomer, a process for its production and its use as an artificial soil. More specifically, the process described there comprises (1) dissolving acrylamide and N,N'-methylene-bisacrylamide in a weight ratio between 9:1 and 99:1 together in water with the maximum weight ratio of the monomers to water being kept at 2:8, (2) optionally adding an N-substituted acrylamide monomer further so that the weight ratio of the monomers to water does not exceed said maximum ratio, (3) adding at least one finely

pulverised polymerisation initiator, suspended and/or dissolved, while stirring the resulting aqueous solution, (4) copolymerising the monomers at a temperature higher than 50°C, (5) granulating the resulting gel and washing the granules to a maximum acrylamide monomer content of not more than 0.1% by weight based on the weight of the final product, and (6) drying the granules at a temperature lower than 100°C to a maximum moisture content of 12% by weight based on the final product, and thus completely copolymerising and curing the granules (page 4, paragraph 5 to page 6, paragraph 2). In practice, however, the water swellability of these granules is not high enough and the performance as an artificial soil, especially for hydroponics, cannot be regarded as fully satisfactory.

In the light of this shortcoming, the technical problem underlying the patent in suit can thus be seen to be the definition of an improved process of preparation, whereby the water swellability of the granules and their performance as an artificial soil are enhanced.

According to the characterising part of the main claim of the patent in suit this problem is to be solved by (i) drying the granular polymer at a temperature of 105 to 150°C, or (ii) heat-treating the granules in the presence of moisture under substantially sealed conditions at a temperature of 100 to 160°C.

In view of the experimental data in the patent in suit, which show that a final drying step carried out according to embodiment (i) or (ii) improves the water swellability of the granules and, thereby, their performance for hydroponics, the Board is satisfied that the above-defined technical problem is effectively solved.

5. Neither the general disclosure of document (7), nor the specific embodiment according to Example 5 thereof can be regarded as novelty destroying for the process as far as the starting compounds are concerned.

5.1 This document describes the radical polymerisation in an aqueous medium of ethylenic monomers, optionally together with water-soluble polyunsaturated crosslinking agents (Claim 1 in conjunction with page 9, lines 28 to 30). The list of suitable monomers includes acrylamide, methacrylamide, further N-substituted acrylamides and N-substituted methacrylamides, as well as mixtures thereof (Claim 6 and page 9, lines 14 to 26). The list of crosslinking agents includes N,N'-methylene-bisacrylamide and N,N'-methylene-bismethacrylamide (page 9, line 32 to page 10, line 2). The combination of an acrylic amide monomer (a) and an acrylic crosslinkable comonomer (b) in the patent in suit can thus be regarded as the selection of two specific starting compounds within two lists of products.

The present case corresponds thus to the situation discussed in the decision T 12/81, OJ EPO 1982, 296, wherein the Board took the view that a specific combination of two starting substances chosen in two lists of some length was to be regarded as a new selection in the sense that the combination actually selected from a wide range of possibilities had not been disclosed to the public (see Reasons for the Decision, points 13 to 14.2).

It follows that the general disclosure of document (7) does not anticipate the claimed process.

5.2 In Example 5 read together with Example 1 of document (7) the monomer mixture consists of 120 g of acrylic acid neutralised with 51 g of NaOH (98%), 30 g of acrylamide, 0.75 g of N-methylolacrylamide and 0.15 g of N,N'-methylene-bisacrylamide. These amounts correspond respectively to 1.66, 0.42, 0.0074 and 0.001 moles, which means that acrylic acid is the main monomer, the two acrylamide compounds are comonomers and N,N'-methylene-bisacrylamide is a crosslinking comonomer, i.e. that the resulting polymer is a copolymer of acrylic acid. This does not correspond to the situation in the patent in suit; from the wording of the main claim, in particular from the definition of the monomer composition, wherein the acrylic amide monomer (a) is referred to as the monomer and the crosslinking agent (b) as the comonomer, it is clear that the resulting polymers can only be copolymers of an acrylic amide.

It follows that the process according to Example 5 does not anticipate the claimed subject-matter either.

5.3 Since novelty of the claimed subject-matter can be acknowledged on the basis of the compositional features, it is not necessary to consider the other features of the process.

6. It still remains to be decided whether that subject-matter involves an inventive step with regard to the teaching of the documents relied upon by the Appellant.

6.1 As correctly argued by the Respondent in the Counterstatement of Appeal (page 3, paragraph 4), document (6) does not provide an incentive to carry out the final drying step according to embodiment (i) or (ii), as specified in the main claim of the patent in suit.

According to the prior art process the granular polymer is dried in hot air at $95 \pm 5^\circ\text{C}$, whereby pellets having a water content lower than 12% by weight, preferably lower than 3% by weight, are obtained; this range of temperature has been found essential to ensure an optimal degree of crosslinking (Claims 1 and 6; page 5, paragraph 6 to page 6, paragraph 1). There is thus no reason for the skilled person to deviate from these working conditions, in particular to assume that the polymer should be treated at a higher temperature range.

- 6.2 Although the polymers obtained in document (7) exhibit a combination of properties which makes them suitable in the field of agriculture, it is in fact doubtful that the skilled man would even consider such teaching in order to solve the problem defined in point 4 above.

From the discussion of this citation when dealing with the issue of novelty it appears that the class of polymers envisaged therein is very broad and that their chemical composition is not essential provided that the granular polymers have the desired combination of properties (see Claim 1). In this respect, emphasis is laid on applications requiring a high liquid absorption capacity, such as sanitary napkins and paper diapers, or a high dehydration activity, such as separation of water from oil (page 6, lines 5 to 20; page 13, lines 11 to 25). In the Board's view, the reference to agriculture in these passages cannot be equated with the suitability of these polymers as an artificial soil for hydroponics; moreover, Example 5 is silent regarding the proposed use of the copolymer produced. Furthermore, the comparison of the absorbent capacity of saline of the polymers produced in Example 1, wherein the monomer composition consists basically of 150 g acrylic acid alone, and in Example 5, wherein acrylic acid is copolymerised with two acrylic

amide comonomers (see point 5.2 above), shows that the incorporation of these acrylamide comonomers lowers the absorption capacity; this result leads rather away from a process based on acrylamide as main monomer in order to provide a polymer with high moisture absorption characteristics. The same applies to the passage on page 10, lines 4 to 12 referred to by the Appellant, which mentions that water swellability can be influenced by the amount of crosslinking monomer, thus by a compositional feature, which is completely different from the heat treatment required in the patent in suit.

For these various reasons, the teaching of document (7) cannot contribute to the solution of the above-defined technical problem.

6.3 Document (4) describes granular polyelectrolytes which, as will appear hereinafter when dealing with the patentability of the use claim, can be used alone for the growing of plants (claim in conjunction with column 3, lines 61 to 65). These polyelectrolytes generally defined as crosslinked polymers can be in particular polyacrylamides, which have been partially hydrolysed and crosslinked with N,N'-methylene-bisacrylamide (column 4, lines 60 to 64 and column 25, lines 5 to 9); this specific product is said there to be described in more detail in US-A-3 670 731. However, neither the description of document (4), nor that of this reference document (see column 3, lines 31 to 69) indicates a method of preparation of such granular polyacrylamide, let alone specifies the features of the drying step. This means that document (4) cannot lead a skilled person to operate along the lines defined in the main claim of the patent in suit.

- 6.4 From the foregoing it follows that the process features in Claim 1 of the patent in suit must be regarded as non-obvious and that, consequently, the subject-matter of the main claim involves an inventive step.
7. The same applies to dependent Claims 2 and 3, which are directed to preferred embodiments of the process according to Claim 1 and whose inventiveness is supported by that of the main claim.
8. The critical aspects to consider in order to decide about the patentability of the use claim are the applications and the properties of the polyelectrolytes described in document (4).
- 8.1 As correctly pointed out by the Appellant in both its written and oral submissions, these polyelectrolytes are suitable as soil additives as well as artificial soil (column 3, lines 62 to 65); the practical advantages in the case of the latter application are emphasised in several passages of column 11 of the citation. There it is specified that (a) the plant roots grow into the polyelectrolyte hydrogel itself and thereby come into contact with water and the other active agents incorporated within the hydrogel (lines 24 to 28), (b) the crosslinked hydrogel clings to the plant roots (lines 33 to 36), (c) there is much less destruction of seedlings during shipping and transplanting operations with plants which have been grown in such hydrogels (lines 47 to 53), and (d) plants can be rendered more resistant to moisture stress by contacting the roots with an aqueous slurry of the particulate crosslinked hydrogels prior to planting in the soil, whereby a significant amount of hydrogel adheres to the plant roots (lines 54 to 63). In the Board's view, these passages unambiguously disclose the use of these polyelectrolytes as an artificial soil.

- 8.2 The properties which are required from the poly-electrolytes in the framework of these applications correspond to those put forward by the Respondent in support of an inventive step.

This applies in the first place to shape retention, since, on the one hand, the purpose of crosslinking in the prior art document is to ensure water insolubility of the poly-electrolytes (column 2, lines 37 to 39) and, on the other hand, gel strength is described as an essential feature of the hydrogel particles (column 7, lines 8 to 10). Further, these polyelectrolytes have the desired water swellability, since they are able to absorb more than 100 times their own weight of water (column 2, lines 35 to 42). As to transparency, although the citation does not make any explicit reference to this property, it must be assumed that the prior art hydrogel particles are transparent, since gels derived from acrylamide copolymerised with N,N'-methylene-bisacrylamide are generally transparent (Encyclopedia of Polymer Science and Technology, John Wiley & Sons, 1964, Vol. 1, page 187, lines 3 to 11).

- 8.3 Thus, in the absence of any advantageous property or surprising effect, the use of a granular water-swellable crosslinked acrylic copolymer produced by a process within the terms of the patent in suit as an artificial soil for hydroponics does not involve an inventive step.

9. It follows that, although the process is regarded as patentable, the main request has to be rejected, since a request can only be decided in its entirety.

First auxiliary request

10. The only difference in the wording of the claims with regard to the main request consists in a slightly amended definition of the monomeric mixture in Claim 1, which is said to comprise optionally up to 60 moles per 100 moles of the acrylic amide monomer (a) of an unsaturated copolymerisable monomer (c) (see point VI above). This compositional feature being supported by the description of the patent as granted, page 3, lines 13/14 and 38 to 40, which correspond to page 5, lines 21 to 24 and page 6, lines 28 to 32 of the application as originally filed, no objection arises having regard to Article 123 EPC.

11. When dealing with the issue of novelty (point 5 above), the Board took the view that the wording of Claim 1 according to the main request allowed the presence of further monomer(s) in minor amounts, i.e. in molar ratios which did not change the general definition and properties of the resulting copolymer. The fact that such compositional feature is explicitly envisaged in Claim 1 according to the first auxiliary request does not change the situation regarding the patentability of the process; all the arguments in favour of the patentability of the main process claim according to the main request apply thus self-evidently here as well. However, since the use specified in Claim 4 cannot be regarded as inventive, the first auxiliary request must be rejected in its entirety.

Second auxiliary request

12. As it appears from point VI above, the new Claim 4 filed during oral proceedings is drafted as a process claim incorporating the features of the use Claim 4. This heterogeneous combination of process features and application features renders the claim fundamentally unclear, thus not clearly allowable.

In the Decision T 153/85 "Alternative claims/AMOCO CORPORATION" published in OJ EPO 1988, 1, where similarly a Board was faced with alternative claims filed only during oral proceedings, the view was taken that "when deciding on an appeal during oral proceedings, a Board may justifiably refuse to consider alternative claims which have been filed at a very late stage, ..., if such alternative claims are not clearly allowable" (Reasons for the Decision, point 2.1, paragraph 3).

For this reason, in the present case, the Board refuses to admit into consideration the set of claims submitted during oral proceedings as second auxiliary request.

Third auxiliary request

13. This set of claims consisting only of the three process claims according to the main request, there can be neither formal objections to the admissibility of these claims, nor substantive objections to their patentability.
14. Although the subject-matter of the claims according to the third auxiliary request meets the requirements of Article 56 EPC, a final decision on the version in which to maintain the patent cannot yet be made, since it remains to adapt the description in order to bring it into line with the claims as amended, in particular with the absence of any use claim. For that purpose, the case is remitted to the first instance.

Order

For these reasons, it is decided that:

1. The decision under appeal is set aside.

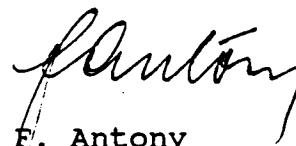
2. The main and first auxiliary requests are rejected.
3. The second auxiliary request is not admitted.
4. The case is remitted to the first instance with the order to maintain the patent on the basis of the third auxiliary request, i.e. Claims 1 to 3 as granted, and a description yet to be adapted.

The Registrar:



E. Gorgmaier

The Chairman:



F. Antony