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Bezeichnung der Erfindung:
Title of invention:
Titre de l'invention : Acrylate/maleate copolymers, their preparation and use as antiscalants

Klassifikation / Classification / Classement : C08F 222/06

ENTSCHEIDUNG / DECISION
vom / of / du 28 July 1988

Anmelder / Applicant / Demandeur : Pfizer Inc.

Patentinhaber / Proprietor of the patent /
Titulaire du brevet :

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Articles 54(2), 56

Schlagwort / Keyword / Mot clé : New claims submitted in appeal proceedings, novelty (yes), inventive step (yes).

Leitsatz / Headnote / Sommaire

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Case Number : T 37/87 - 3.3.1

D E C I S I O N
of the Technical Board of Appeal 3.3.1
of 28 July 1988

Appellant : Pfizer Inc.
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Decision under appeal : Decision of Examining Division 011 of the European Patent Office dated 1 September 1986 refusing European patent application No. 82 300 606.9 pursuant to Article 97(1) EPC

Composition of the Board :

Chairman : F. Antony
Members : R. Spangenberg
J. Stephens-Ofner

Summary of Facts and Submissions

I. European patent application 82 300 606.9 (published as EP-A-58 073) was refused by a decision of the Examining Division 011 dated 1 September 1986.

The essential ground for refusal was that Claims 12 and 13 lacked novelty with respect to the disclosure in

(1) DE-A-1 495 850.

Another document considered relevant in the examining proceedings was

(2) GB-A-1 519 512.

The independent Claim 12 as rejected read as follows:

"A substantially homogeneous copolymer consisting essentially of (a) from 35 to 65 mole percent acrylic or methacrylic acid units, or a mixture thereof, and (b) from 65 to 35 mole percent maleic anhydride units and having a number average molecular weight of from 500 to 5000."

The Examining Division found that the only feature distinguishing the subject-matter of this claim from the disclosure in (1) was the expression "substantially homogeneous" which did not have a well recognised meaning in the art, and that the Applicant had not been able to demonstrate that there was any technical difference between the copolymers of the prior art in (1) and the claimed ones.

II. On 25 October 1986 the Applicant (Appellant) filed notice of appeal against the above decision, at the same time paying the appeals fee. A statement of grounds was received on 27 December 1986.

The Appellant submitted evidence that a copolymer obtained according to Example 1 of (1) after hydrolysis showed binodal molecular weight distribution which indicates polydispersity and non-uniform copolymer composition.

In response to a communication of the Board the Appellant additionally filed some textbook references explaining that "homogeneous" is understood by those skilled in the art as describing the dispersity of molecular weight distribution, which is indicated by the ratio of weight average molecular weight and number average molecular weight (see for instance Encyclopedia of Polymer Science and Technology, Volume 9, page 194), the respective average molecular weights being indicated in the worked examples of the application-in-suit.

The Appellant was further invited to file observations relating to the question of inventive step with respect to the disclosure in (2) and filed the results of comparative tests which demonstrate that the hydrolysed copolymers according to the application-in-suit are superior in their scale control performance when compared with copolymers obtained "as described in the Examples" of (2).

III. At the oral proceedings which took place on 28 July 1988 the Appellant explained that the above comparative tests had been made with a copolymer obtained following the procedure of Example 1 of (2). At the end of the oral proceedings the Appellant submitted an amended set of

seventeen claims, the independent Claims 1, 11, 14 and 15 reading as follows:

"1. A process for preparing a copolymer consisting essentially of (a) from 35 to 65 mole percent acrylic or methacrylic acid units, or a mixture thereof, and (b) from 65 to 35 mole percent hydrolysed maleic anhydride units having a number average molecular weight of from 500 to 5000 said copolymer being substantially homogeneous with respect to molecular weight distribution and chemical composition as determined by high pressure liquid chromatography, characterised by at first copolymerizing (a) from 35 to 65 mole percent acrylic or methacrylic acid monomer, or a mixture thereof, with (b) from 65 to 35 mole percent maleic anhydride monomer over a period of from 0.3 to 10 hours at a temperature of from 80 to 150°C in the presence of from 5 to 25 weight percent polymerization initiator, based on the total weight percent of said monomers, and from 45 to 90 weight percent of chain-transfer solvent, based on the total weight of said monomers, initiator and solvent,

the solvent and the mode of addition of the monomers to the solvent being such that the monomers and the copolymer remain in solution in the solvent, and the mole ratio of the acrylic and/or methacrylic acid monomer to the maleic anhydride monomer in the solvent is maintained at from 0.005 to 0.2, throughout said period,

and then adding from 40 to 100 weight percent water, based on the weight of the final polymerization solution, to the solution while maintaining said temperature to hydrolyze the copolymer.

11. A copolymer consisting essentially of (a) from 35 to 65 mole percent acrylic or methacrylic acid units, or a mixture thereof, and (b) from 65 to 35 mole percent hydrolysed maleic anhydride units having a number average molecular weight of from 500 to 5000 said copolymer being substantially homogeneous with respect to molecular weight distribution and chemical composition as determined by high pressure liquid chromatography.

14. An aqueous solution containing a copolymer according to any one of Claims 11-13 in an amount of from 1 to 60 percent by weight.

15. A method for the prevention or reduction of scale formation in water containing scale-forming impurities, which comprises mixing with said water from 0.5 to 10 ppm of a copolymer or salt thereof as claimed in Claims 11 to 13."

The Appellant requests that the decision under appeal be set aside and the patent be granted on the basis of the above set of claims.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64. It is thus admissible.

2. The amended set of claims is properly supported by the application documents as originally filed, the new Claim 1 being based on original Claims 1 and 9 and the new Claim 11 being based on original Claims 12 and 14.

The expression "said copolymer being substantially homogeneous with respect to molecular weight distribution and chemical composition as determined by high pressure liquid chromatography" corresponds to the original description, page 11, lines 28-30. The Board is satisfied that this definition is clearly applicable to the whole subject-matter claimed and is consistent with the generally accepted meaning of the expression "homogeneous".

The new Claims 1 and 11 do therefore no longer contain unclear expressions and satisfy the requirements of Articles 84 and 123(2).

3. The claimed subject-matter is novel with respect to (1) and (2):

In (1) there is disclosed a process for producing copolymers of maleic anhydride and, inter alia, acrylic or methacrylic acid (see Claim 1 and page 5, second paragraph) which is characterised by a molar ratio of maleic anhydride to (meth)acrylic acid from 1:0,05 to 1:0.7, the use of 1-15 mole percent of a radical initiator, related to the total weight of the monomers wherein the monomers are polymerised at a temperature where the half-life period of the initiator is less than 20 hours and the initiator and the comonomer are added slowly over a period of at least 6 hours. The solvent can be a polar solvent, e.g. dioxane, acetone or ethyl acetate (page 6, first paragraph).

These reaction conditions fall within the definitions of the first reaction steps of the present Claim 1 of the application-in-suit.

However, (1) does not disclose the hydrolysis step now contained in the process Claim 1. Therefore, the copolymers obtained according to (1) do not contain hydrolysed maleic anhydride units.

In (2) a process for inhibiting the deposition of scale is disclosed, which comprises adding to the evaporator a maleic acid polymer and certain nonionic or anionic surfactants, cf. e.g. Claim 1. According to Example 1, the maleic acid polymer may be a maleic anhydride methacrylic acid copolymer which is obtained by copolymerising 0.149 moles of methacrylic acid with 0.197 moles of maleic anhydride in toluene as a solvent at 90°-100°C using benzoyl peroxide as an initiator, which was added to the solution of both monomers in a period of one hour. The copolymer precipitates from the solution. According to the description, page 2, lines 114-116 the copolymer so obtained is hydrolysed by heating with water.

This process differs from that of Claim 1 of the application-in-suit essentially in two aspects, i.e. in the solvent used which is not a chain transfer solvent in which the copolymer is soluble and in the concentrations of the monomers during the copolymerisation reaction.

The hydrolysed copolymers disclosed in (2), especially Example 1 in combination with page 2, lines 114-116, are not homogeneous as shown by evidence submitted already in the examining proceedings on 6 December 1985. The different molecular weight distribution and chemical composition are the result of the substantial differences of the process for obtaining the known copolymers, the most important of these being the differences in monomer ratio during polymerisation and the different solvents used.

Therefore, the subject-matter of Claims 1 to 17 is not disclosed in the above documents.

4. The claimed subject-matter also involves an inventive step:

The claimed copolymers are used for the inhibition of scale formation, especially in the prevention of alkaline magnesium and calcium scale formation in such processes as the desalination of sea water (see description page 9, lines 25-30). The copolymers disclosed in (2) are also used as scale inhibiting agents. Therefore, the Board considers this document to represent the closest prior art with respect to the hydrolysed copolymers now claimed. As the Appellant has demonstrated in the appeal proceedings, the claimed copolymers, however, have a superior performance in this respect. The technical problem to be solved by the claimed subject-matter may therefore be seen in providing copolymers of maleic acid with acrylic or methacrylic acid having improved scale inhibiting properties.

The Appellant has given sufficient evidence (see also the Comparative Examples 1-6 and Example 9 of the description) to infer that the improved properties demonstrated by comparison of the hydrolysed product of Example 1 of (2) and Example 4 of the application-in-suit are due to the differences in molecular weight distribution and chemical composition between the claimed copolymers and those disclosed in the prior art. The Board therefore is satisfied that the problem stated above is indeed solved.

Document (2) relates to a completely different solution to the problem of improving the inhibition of scale formation. It is stated therein that the use of polymers or copolymers

of maleic acid for that purpose had already been known (page 1, line 68 to page 2, line 32) and in order to improve their performance in this respect it is proposed to use these polymers together with certain anionic or nonionic surfactants.

The approach to the solution of that problem taught by the application-in-suit is to provide a particular type of maleic acid/(meth)acrylic acid copolymer which is not mentioned in (2) and which can only be obtained by careful control of the polymerisation conditions and by performing the polymerisation in special solvents, and which has superior scale inhibiting properties. The disclosure in (2) does not provide any suggestion to look for such a specific group of maleic acid copolymers.

On the other hand, document (1) discloses how to make specific copolymers of maleic anhydride and (meth)acrylic acid but does not provide any suggestion that these polymers should be hydrolysed and - in the hydrolysed form -used for the inhibition of scale formation. Therefore, a person skilled in the art would have had no reason to combine the teachings of documents (1) and (2) in order to solve the above problem and, consequently, the subject-matter of Claims 1 to 17 is not obvious to a person skilled in the art having regard to the cited prior art.

Order

For these reasons, it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the Examining Division with the order to grant a patent on the basis of Claims 1-17, submitted in the oral proceedings, and a description yet to be adapted.

The Registrar The Chairman

F.Klein F.Antony