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**Datasheet for the decision
of 20 January 2021**

Case Number: T 0685/18 - 3.3.09

Application Number: 11842769.9

Publication Number: 2643392

IPC: C08J3/24, C08J3/075, B01J20/26,
C08F20/18, C08F220/06

Language of the proceedings: EN

Title of invention:
PREPARATION METHOD OF SUPERABSORBENT POLYMER

Patent Proprietor:
LG Chem, Ltd.

Opponents:
Evonik Operations GmbH
Nippon Shokubai Co., Ltd.

Headword:
Method for preparing a superabsorbent polymer/LG

Relevant legal provisions:
EPC Art. 83

Keyword:
Main request and auxiliary requests 1 and 2 - sufficiency (No)

Decisions cited:

Catchword:



Beschwerdekammern

Boards of Appeal

Chambres de recours

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Case Number: T 0685/18 - 3.3.09

D E C I S I O N
of Technical Board of Appeal 3.3.09
of 20 January 2021

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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 10 January 2018
revoking European patent No. 2643392 pursuant to
Article 101(3) (b) EPC.**

Composition of the Board:

Chairman A. Haderlein
Members: A. Veronese
 D. Rogers

Summary of Facts and Submissions

- I. The appeal was filed by the patent proprietor against the decision of the opposition division to revoke European patent No. 2 643 392.
- II. With their notices of opposition, the two opponents had requested revocation of the patent in its entirety in particular on the ground under Article Article 100(b) EPC.
- III. The opposition division held *inter alia* that the invention claimed in the main request, filed during the oral proceedings before the opposition division, was not sufficiently disclosed and was unclearly defined.
- IV. Claim 1 of the main request read:

*"1. A method of preparing a superabsorbent polymer, including the steps of:
preparing a hydrous gel phase polymer by thermal polymerizing or photo-polymerizing a monomer composition including a water-soluble ethylene-based unsaturated monomer and a polymerization initiator;
drying the hydrous gel phase polymer;
milling the dried polymer;
adding a surface cross-linking agent to the milled polymer; and
elevating the temperature of the polymer including the surface cross-linking agent at a speed of 6°C/min to 8°C/min to a surface cross-linking reaction temperature of 150°C to 200°C, and carrying out a surface cross-linking reaction at 150°C to 200°C,
wherein the surface cross-linking reaction is carried out for 10 minutes to 50 minutes after the temperature*

increase to the cross-linking reaction temperature is completed, and wherein the surface cross-linking agent is a C2-C10 polyhydric alcohol compound."

- V. With its statement setting out the grounds of appeal the patent proprietor (appellant) filed a main request and two auxiliary requests. The main request corresponds to the main request on which the decision under appeal is based. The other requests are new.
- VI. Claim 1 of auxiliary request 1 is identical to claim 1 of the main request.
- VII. Claim 1 of auxiliary request 2 read (amendments with respect to claim 1 of the main request underlined):
- " 1. A method of preparing a superabsorbent polymer, including the steps of:
preparing a hydrous gel phase polymer by thermal polymerizing or photo-polymerizing a monomer composition including a water-soluble ethylene-based unsaturated monomer and a polymerization initiator;
drying the hydrous gel phase polymer;
milling the dried polymer;
adding a surface cross-linking agent to the milled polymer; and
elevating the temperature of the polymer including the surface cross-linking agent at a speed of 6°C/min to 8°C/min to a surface cross-linking reaction temperature of 150°C to 200°C, and carrying out a surface cross-linking reaction at 150°C to 200°C, wherein the surface cross-linking reaction temperature is the average temperature of reactant including the polymer and the surface cross-linking agent included in an effective volume of a reactor for the cross-linking reaction when*

70 to 90% of the whole surface cross-linking reaction time has passed, wherein the effective volume of the reactor is the total volume of the reactant included in the volume of the reactor,
wherein the surface cross-linking reaction is carried out for 10 minutes to 50 minutes after the temperature increase to the cross-linking reaction temperature is completed, and
wherein the surface cross-linking agent is a C2-C10 polyhydric alcohol compound."

VIII. The appellant's arguments, where relevant for the decision, may be summarised as follows.

The patent in suit provided sufficient information to carry out the claimed heating program and to put in practice the claimed method. The "surface cross-linking reaction temperature" mentioned in claim 1 was an average temperature calculated taking into account the "whole surface cross-linking reaction time". The reaction time started immediately after the cross-linking agent was added to the milled polymer and terminated at the end of the 10 to 50 minute period which followed the temperature increase step. This could be inferred from paragraphs [0006], [0009], [0013] to [0015] and [0081], and from example 4 of the patent. Thus, there was no need to monitor the progression of the cross-linking reaction using an analytical method.

IX. The opponents' (respondents') arguments, where relevant for the decision, may be summarised as follows.

The claimed invention was not sufficiently disclosed, because the patent did not teach how to determine the "whole surface cross-linking time" which determined the

claimed "surface cross-linking reaction temperature". The skilled person would not have expected the cross-linking reaction to start immediately after addition of the cross-linking agent. That person would not have expected the cross-linking reaction to be terminated at the end of the 10 to 50 minute period specified in claim 1 either. The only way to determine the "whole surface cross-linking reaction time" was by monitoring the progression of the cross-linking reaction. Since the patent was silent as to how to do this, the skilled person was confronted with an undue burden when carrying out the invention. This applied to all requests. Furthermore, the auxiliary requests were not to be admitted, because they could have been filed during the opposition proceedings.

X. The requests

The appellant requested to set aside the decision under appeal and to maintain the patent on the basis of the main request or, alternatively, upon the basis of one of auxiliary requests 1 to 2, all requests filed with the statement setting out the grounds of appeal.

The respondents requested that the appeal be dismissed.

Reasons for the Decision

Main request

1. *Sufficiency of disclosure*

1.1 In the decision under appeal the opposition division decided that the determination of the "surface cross-linking reaction temperature" mentioned in claim 1 is essential to carry out the invention. Furthermore, that

this temperature depends from the "whole surface cross-linking reaction time": see section II.5., paragraph 2 of the opposition division's decision.

1.2 The parties did not contest this finding during the appeal proceedings. The appellant actually explicitly stated that:

"The Opposition Division is correct insofar that the surface cross-linking reaction temperature depends on the determination of the whole surface cross-linking reaction time, as disclosed in paragraph 13 of the granted patent": see the one but last paragraph on page 2 of the statement setting out the grounds of appeal.

1.3 Paragraph [0013] of the patent teaches indeed that:

"the surface cross-linking reaction temperature may be defined as the average temperature of the reactant including the polymer and the surface cross-linking agent included in the effective volume of the reactor for the cross-linking reaction when 70 to 90% of the whole surface cross-linking reaction time has passed, without particular limitation".

1.4 The patent does not provide a definition for the "whole surface cross-linking reaction time".

1.5 According to the appellant the reaction time:

- starts when the cross-linking agent is added to the polymer,
- encompasses the time required to elevate the temperature to a surface cross-linking reaction temperature, and

- further encompasses the additional 10 to 50 minute time period starting upon completion of the step in which the temperature is elevated.

1.6 Thus, in its opinion, the "whole surface reaction time" starts when the cross-linking agent is added to the polymer and ends upon expiry of the additional 10 to 50 minutes time period. Accordingly, there is no need to monitor the progression of the reaction to determine the "whole" reaction time. Paragraphs [0006], [0009] and [0013] to [0015] of the patent were mentioned by the appellant in support to this interpretation.

1.7 The board is not persuaded that, reading the patent, let alone the aforementioned paragraphs, the skilled person would assume the cross-linking reaction to start immediately after the cross-linking agent is added. These paragraphs mention the sequence of steps mentioned in claim 1. They also describe how to calculate the speed of temperature increase, and the duration of this step. However, they are silent as to when the cross-linking reaction actually starts within the reaction mixture. It cannot be inferred from paragraphs [0006] and [0009] that the reaction starts immediately after addition of the cross-linking agent to the polymer either. As noted by the respondents, in the exemplified methods the cross-linking agent is added to the polymer in a separate step by spraying, at 30°C. The sprayed mixture is then transferred into a reactor, where the temperature is increased to the cross-linking reaction temperature.

1.8 If the appellant's reasoning were followed, this would mean that the time required for spraying (any intermediate storing) and transferring the mixture into

the reactor has to be computed for determining the "whole surface cross-linking reaction time". However, this is not what the skilled person would deduce from the teaching of the patent.

1.9 Furthermore, as observed by the opposition division and the respondents, since a cross-linking temperature in the range of 150°C to 200°C is specified in claim 1, essentially no reaction can be expected to take place at room temperature, or at 30°C, i.e. at the temperature of the aforementioned spraying step. Since the reaction rate of a chemical reaction typically doubles for every 10°C temperature increase, no cross-linking can effectively take place when the cross-linking agent is added to the polymer. The reaction will effectively start only when the temperature is raised and approaches the cross-linking temperature mentioned in claim 1.

1.10 As noted by respondent 1, this is confirmed by the teaching of paragraphs [0006], [0051] and [0054] of the patent, which read, respectively:

"The present invention provides a method of preparing a superabsorbent polymer including: [...] elevating the temperature of the polymer including the surface cross-linking agent at a speed of 3 °C/min to 15 °C/min, and carrying out a surface cross-linking reaction at 100 °C to 250 °C", and

"[...] the temperature of the milled polymer may be elevated to the surface cross-linking reaction temperature at a speed of 3°C/min to 15°C/min so that proper surface cross-linking reaction occurs".

"The surface cross-linking reaction may be carried out within a certain time, [...] after the temperature increase to the cross-linking temperature is completed".

- 1.11 For these reasons, establishing when the cross-linking reaction effectively starts is essential for determining the "whole surface cross-linking reaction time" specified in claim 1. The same applies for determining when the cross-linking reaction is effectively terminated. The end of the 10 to 50 minutes time period mentioned in claim 1 cannot be considered to coincide with the point in time when the cross-linking reaction terminates.
- 1.12 The appellant has drawn attention to paragraph [0081], describing how the "surface cross-linking temperature" was computed, when the methods exemplified in the patent were carried out. This paragraph reads:
- 1.13 *"For reference, surface cross-linking reaction temperature in the examples and the comparative examples was disclosed as the average value of the temperatures at the time of passing 70%, at the time of passing 80%, and at the time of passing 90% of the total surface cross-linking reaction time of 100% after the surface cross-linking reaction was started."*
- 1.14 However, this passage renders even more obscure the meaning of the expression "surface cross-linking reaction temperature": here it is not even clear which percentage of time, among those specified (70%, 80% and 90%), is to be considered for determining the average temperature value.

1.15 Finally, the appellant has argued that example 4 would describe a specific method for carrying out the claimed invention. This argument is not convincing either, because as stated in paragraph [0081], the "surface cross linking temperature" mentioned in the examples was calculated applying the definition mentioned in this same paragraph which, as stated above, is obscure and does not allow a determination of that temperature.

1.16 For these reasons it is concluded that, due to the impossibility of determining the "surface cross-linking reaction temperature", it would be impossible for the skilled person to carry out the invention according to claim 1. Accordingly, the claimed invention is not sufficiently disclosed (Article 83 EPC).

Auxiliary request 1

1.17 Claim 1 of auxiliary request 1 is identical to claim 1 of the main request. Thus, the conclusions drawn for the main request regarding compliance with Article 83 EPC also apply to auxiliary request 1. In view of this finding, there is no need to decide whether or not to admit this request into the appeal proceedings.

Auxiliary request 2

1.18 Claim 1 of auxiliary request 2 has been amended to include the definition of the "surface cross-linking reaction temperature" given in paragraph [0013] of the patent, which is mentioned above in point 1.3.

1.19 As in the case of the main request, due to the impossibility of determining this temperature, the invention claimed in auxiliary request 2 is not sufficiently disclosed. In view of this finding, there

is no need to examine whether or not to admit this request into the appeal proceedings.

Order

For these reasons it is decided that:

1. The appeal is dismissed.

The Registrar:

The Chairman:



A. Nielsen-Hannerup

A. Haderlein

Decision electronically authenticated