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**Datasheet for the decision  
of 16 January 2023**

**Case Number:** T 1518/20 - 3.3.09

**Application Number:** 14792045.8

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B01J20/26, C08J3/24

**Language of the proceedings:** EN

**Title of invention:**  
HIGHLY ABSORBENT RESIN

**Patent Proprietor:**  
LG Chem, Ltd.

**Opponents:**  
NIPPON SHOKUBAI KABUSHIKI KAISHA  
Evonik Operations GmbH

**Headword:**  
Highly absorbent resin/LG CHEM

**Relevant legal provisions:**  
EPC Art. 56  
RPBA 2020 Art. 13(2)

**Keyword:**

Inventive step - main request, auxiliary requests 1 and 2 (no)  
Amendment after summons - exceptional circumstances (no)

**Decisions cited:**

T 0588/93



**Beschwerdekammern**

**Boards of Appeal**

**Chambres de recours**

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Case Number: T 1518/20 - 3.3.09

**D E C I S I O N**  
**of Technical Board of Appeal 3.3.09**  
**of 16 January 2023**

**Appellant:**  
(Opponent 1)  
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**Party as of right:**  
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**Decision under appeal:**  
**Interlocutory decision of the Opposition  
Division of the European Patent Office posted on  
22 April 2020 concerning maintenance of the  
European Patent No. 2881419 in amended form.**

**Composition of the Board:**

<b>Chairman</b>	A. Haderlein
<b>Members:</b>	C. Meiners
	F. Blumer

## Summary of Facts and Submissions

- I. This decision concerns the appeal filed by the opponent 1 (appellant) against the opposition division's interlocutory decision finding that, on the basis of the first auxiliary request filed during oral proceedings before the opposition division, the patent in suit (hereinafter "the patent") met the requirements of the EPC.
- II. In their notices of opposition, opponents 1 and 2 had requested that the patent be revoked in its entirety based, *inter alia*, on the ground for opposition under Article 100(a) EPC in combination with Article 56 EPC (lack of inventive step).
- III. The following documents are relevant for the decision:  
  
D1 US 2010/0119312 A1  
D11 WO 2012/070845 A2  
D15 Letter from the proprietor dated 24 January 2017 (XP0555491), filed during the examination phase of the patent
- IV. In its decision, the opposition division found, *inter alia*, that the then main request lacked novelty; however, the subject-matter of the then first auxiliary request was, *inter alia*, considered novel and inventive in view of document D1 as the closest prior art.
- V. With its reply to the statement of grounds of appeal, the patent proprietor (respondent) filed a first and a second auxiliary request.

VI. Oral proceedings were held before the board. At the oral proceedings, the patent proprietor filed a third auxiliary request and requested that this request be admitted into the appeal proceedings.

VII. Wording of the relevant claims

Claim 1 of the first auxiliary request held allowable by the opposition division (main request) reads as follows:

*"A method for preparing the superabsorbent polymer of which centrifuge retention capacity (CRC) for a physiological saline solution is 28.5 g/g or more, absorbency under pressure (AUP) of 0.7 psi for the physiological saline solution is 23 g/g or more, liquid permeability (SFC) is  $22 \times 10^{-7}$  or more, and gel strength is 7500 to 10,800 Pa, wherein the methods of measurement of CRC, AUP, SFC and gel strength are disclosed in the description,*

*wherein the superabsorbent polymer includes a powdery base polymer prepared by polymerizing water-soluble ethylene-based unsaturated monomers having acidic groups which are at least partially neutralized, using an internal crosslinking agent; and a surface crosslinking layer comprising a surface crosslinked polymer prepared by further crosslinking the powdery base polymer, which is formed on the powdery base polymer, using a surface crosslinking agent, the method including:*

*the step of performing thermal polymerization or photopolymerization of a monomer composition containing a water-soluble ethylene-based unsaturated monomer, a polymerization initiator, and an internal crosslinking agent to form a water-containing gel polymer;*

*the step of drying the water-containing gel polymer;*

*the step of pulverizing the dried polymer; and  
the step of adding a surface crosslinking agent to the pulverized polymer to perform a surface crosslinking reaction,*

*wherein the internal crosslinking agent includes one or more selected from the group consisting of a di(meth)acrylate of a polyol having 2 to 20 carbon atoms and a poly(meth)acrylate of a polyol having 2 to 20 carbon atoms;*

*the surface crosslinking agent includes one or more selected from the group consisting of a substance satisfying  $\delta_p < 12 \text{ (J/cm}^3\text{)}^{1/2}$ , a substance satisfying  $4 < \delta_H < 6 \text{ (J/cm}^3\text{)}^{1/2}$  and a substance satisfying  $\delta_{tot} > 31 \text{ (J/cm}^3\text{)}^{1/2}$ ,  $\delta_p$ ,  $\delta_H$ , and  $\delta_{tot}$  being defined as Hansen solubility parameters; and*

*the step of the surface crosslinking reaction is performed under conditions of a maximum reaction temperature of 190 to 200°C and a total reaction time of 0.5 to 1 hour, and wherein the step of the surface crosslinking reaction is performed for 20 minutes to 40 minutes until the temperature reaches 180°C, and then maintained at 180°C or higher for 35 minutes to 45 minutes."*

Claim 1 of the first auxiliary request differs from claim 1 of the main request in that the surface-crosslinking agent necessarily includes a substance satisfying  $\delta_p < 12 \text{ (J/cm}^3\text{)}^{1/2}$  and a substance satisfying  $\delta_{tot} > 31 \text{ (J/cm}^3\text{)}^{1/2}$ ; in addition, the concentration of the water-soluble ethylene-based unsaturated monomer is limited to 20% to 60% by weight, based on the monomer composition containing the raw materials of the superabsorbent polymer and a solvent.

Compared with claim 1 of the first auxiliary request, claim 1 of the second auxiliary request contains the additional limitation that the substance satisfying  $\delta_p < 12 \text{ (J/cm}^3\text{)}^{1/2}$  is ethylene glycol, 1,4-butanediol, 1,6-hexanediol, propylene glycol, 1,2-hexanediol, 1,3-hexanediol, 2-methyl-1,3-propanediol, 2,5-hexanediol, 2-methyl-1,3-pentanediol, 2-methyl-2,4-pentanediol, tripropylene glycol or glycerol and the substance satisfying  $\delta_{tot} > 31 \text{ (J/cm}^3\text{)}^{1/2}$  is ethylene glycol, 1,3-propanediol or glycerol.

Compared with claim 1 of the second auxiliary request, claim 1 of the third auxiliary request filed during the oral proceedings before the board is further limited by stipulating that the substance satisfying  $\delta_p < 12 \text{ (J/cm}^3\text{)}^{1/2}$  is propylene glycol and that the substance satisfying  $\delta_{tot} > 31 \text{ (J/cm}^3\text{)}^{1/2}$  is 1,3-propanediol.

VIII. The appellant's arguments, where relevant to the decision, can be summarised as follows:

- With regard to inventive step, document D1 could be considered the closest prior-art document. The claimed method differed from D1 by the crosslinking step being performed by heating the surface-treated polymer for 20 to 40 minutes until the temperature reached 180 °C, and then maintaining the temperature at 180 °C or higher for 35 to 45 minutes. The objective technical problem to be solved was to provide an alternative method for preparing superabsorbent polymers (SAPs). The solution was obvious in view of D11. In particular, neither D1 nor D11 contained any technical prejudice against conducting experiments in the claimed time and temperature ranges. The selection of heating-up rates and the selection of the



surface-crosslinking time required in claim 1 of the main request were arbitrary selections of the preferred ranges disclosed in D11. Therefore, the subject-matter of claim 1 did not involve an inventive step.

- The auxiliary requests 1 and 2 were not to be admitted and were not allowable either. In particular, they lacked clarity.

The respondent's arguments, where relevant to the decision, can be summarised as follows:

- With regard to inventive step, the subject-matter of claim 1 of the main request was not obvious to a skilled person over D1 as the closest prior art. A comparison of the material properties of the polymer prepared in Example 2 of the patent with those obtained when reproducing Example 2 of D1 and the experiments described in D15 demonstrated that the claimed method led to improved properties of the prepared polymers. It followed that the heating time and conditions had a substantial influence on the properties of the SAPs. The purported technical effects, including improved rewetting properties, could be obtained across the full scope of claim 1. The prior art did not hint at the specific combination of surface-crosslinking agents and heating conditions and the resulting technical effects. Therefore, the subject-matter of claim 1 involved an inventive step.

The auxiliary requests were allowable for similar reasons. They were restricted to specific combinations of surface-crosslinking agents which differed from those used in the examples of D1. The

SAPs prepared in accordance with claim 1 of the auxiliary requests exhibited superior gel strength and rewetting properties compared with the SAPs obtained in the examples of D1.

IX. Final requests

The appellant requested that the decision under appeal be set aside and that the patent be revoked in its entirety.

The respondent requested that the appeal be dismissed or, alternatively, that the patent be maintained on the basis of one of the following auxiliary requests:

- first or second auxiliary requests, filed together with the reply to the grounds of appeal;
- third auxiliary request, filed during oral proceedings before the board.

**Reasons for the Decision**

1. *Inventive step - main request*

1.1 The patent

The patent is concerned with providing a superabsorbent polymer which has excellent initial absorbency and water retention under pressure even after a long period of time; see paragraphs [0001] and [0012] of the patent.

## 1.2 Closest prior art

It is common ground between the parties that document D1, and in particular Example 2 of this document, can be taken as a suitable starting point for assessing whether the subject-matter of independent claim 1 involves an inventive step. D1 was also considered the closest prior art in the decision under appeal. Like the patent, D1 is concerned with providing surface-crosslinked superabsorbent polymers exhibiting excellent absorbency. They have high water/liquid centrifuge retention capacity (CRC), absorption under pressure (AUP) and liquid permeability (SFC). D1 also mentions gel strength as a material property (see paragraph [0004]).

D1 is thus directed to the same purpose as the patent in suit. Consequently, D1 is a suitable starting point for assessing the inventive step of the subject-matter of independent claim 1.

## 1.3 Distinguishing feature

According to the impugned decision, the subject-matter of claim 1 differs from D1 (at least) in that the crosslinking reaction is carried out by heating the surface-treated polymer for 20 to 40 minutes until the temperature reaches 180 °C and, after this, maintaining the temperature at 180 °C or higher for 35 to 45 minutes. It is common ground between the parties that this is the distinguishing feature, as was discussed during the oral proceedings before the board.

- 1.4 Technical effect and objective technical problem
- 1.4.1 In the decision under appeal, it was concluded that even if the objective technical problem were formulated as that of providing an alternative method for obtaining a superabsorbent polymer, the proposed solution would not be obvious. The board indeed considers the problem to be solved to be that of providing an alternative method for obtaining a superabsorbent polymer. The reasons for this are as follows.
- 1.4.2 The board observes that no comparative example is on file which could demonstrate the isolated effect of the heating conditions as specified in claim 1 (the distinguishing feature as outlined above) in comparison with corresponding heating conditions applied in the surface-crosslinking step in Example 2 of D1.
- 1.4.3 This would mean comparing like with like, while only varying the distinguishing feature, in this case the surface-crosslinking conditions, in an otherwise identical polymerisation process using the same amount and kind of reactants and equivalent molar amounts of the same (surface and internal) crosslinking groups.
- 1.4.4 In this context, the appellant correctly observed that the surface-crosslinking agent 1,4-butanediol used in Example 2 of D1 had been used in lower amounts and had a higher molecular weight than the corresponding agent 1,3-propanediol utilised in Example 2 of the patent. This means that the molar amount of surface-crosslinking agent in Example 2 of D1 is lower than in Example 2 of the patent, accordingly leading to significantly fewer crosslinking points in the polymer (in Example 2 in D1).

- 1.4.5 Consequently, it is concluded that neither the data provided in D15 nor the supplemental data submitted by the patent proprietor in Table A on page 12 of the respondent's reply to the statement of grounds of appeal can corroborate any technical effect causally linked to the distinguishing feature over D1.
- 1.4.6 From the data provided in the patent, it can be inferred that an increased degree of crosslinking of the polymer shell is proportional to AUP, SFC and gel strength, whereas the CRC seems to be inversely proportional to the crosslinking density/degree (see reaction time and maximum reaction temperature in Table 2; cf. paragraph [0004] of D1).
- 1.4.7 It follows that no technical effect has been substantiated which could be causally linked to the distinguishing feature.
- 1.4.8 Hence, the objective technical problem underlying the subject-matter of claim 1 is to provide an alternative method for preparing a superabsorbent polymer having high CRC, AUP, SFC and gel strength.
- 1.5 Obviousness
  - 1.5.1 Starting from D1 as the closest prior art, a skilled person seeking to provide a mere alternative surface-crosslinking process for superabsorbent polymers exhibiting good CRC, AUP, SRC and gel strength would have applied the teaching of D11 to the polymer synthesis process found in the examples of D1. Both documents relate to the preparation of superabsorbent polymers having high water absorbency, also under pressure. The latter is effected by a surface-

crosslinking step, as in D1. The post-polymerisation surface-crosslinking step in D11 is modular and decoupled from the polymerisation step. Consequently, the board concludes that the surface-crosslinking process in D11 can be integrated into the manufacturing process in D1 without major adaptations. As in D1, the surface-crosslinking agents proposed in D11 include, *inter alia*, monopropylene glycol, 1,3-propanediol and 1,4-butanediol and combinations of these. Furthermore, D11 teaches that when applying a heating rate from 3 °C/min to 15 °C/min during the surface-crosslinking step, the properties of the superabsorbent polymer are superior in terms of water-holding capacity, absorbing power under pressure and less displeasure of a user due to wetness (page 21, lines 20 to 23). The teaching of D1 and that of D11 are thus technically compatible.

- 1.5.2 A skilled person would thus consider applying the teaching of D11 to the preparation process in D1 with a reasonable expectation of succeeding in arriving at SAP materials with (at least) comparable properties.
  
- 1.5.3 The respondent argued that even considering the objective technical problem of providing an alternative method for preparing SAPs, the subject-matter of claim 1 was not obvious. In particular, D11 gave no pointer that would cause a skilled person to select the heating conditions stipulated by claim 1. As was held in T 588/93, even when considering the problem posed to be that of providing an alternative, an inventive step could not be denied automatically. By contrast, some kind of a pointer was needed which would prompt a skilled person to apply the relevant teaching from the prior art. Three selections from three ranges had to be made in D11 (to arrive at the heating conditions in claim 1). This meant selecting the heating rate and the

crosslinking temperature (cf. page 2, lines 18 to 20 and page 3, line 2 of D11, respectively). Furthermore, the duration of the crosslinking/heating could vary in D11 between 1 and 120 minutes (see page 13, lines 24 to 27); however, the examples of D11 did not point to the feature combination in claim 1, as the total duration of the heating/crosslinking step, the heating-up time, the crosslinking temperature and/or time in Examples 1 to 5 did not match those stipulated in claim 1.

1.5.4 The board, however, concurs with the appellant that, for providing an alternative method, no particular pointer from the prior art is needed to combine the teaching of secondary sources of information with that of the closest prior art. In such a scenario, in the absence of any counter-indicators that would provide teaching leading away from applying the relevant disclosure in order to modify the solution proposed in the closest prior art, a skilled person would apply such teaching rather than being conceptually and notionally confined to the disclosure of the provided examples. The case at hand also differs from that underlying T 588/93, in which the (closest) prior art adduced contained teaching leading away from modifying a feature characterised in this teaching as being essential. In the case at hand, however, no such constellation is apparent.

1.5.5 The general technical teaching of D11 proposes durations for the *preferred* heating-up rates of 6 °C to 8 °C (about 19 to 25 minutes for heating from a starting temperature of 30 °C to 180 °C), a most preferred surface-crosslinking reaction temperature of 150 °C to 200 °C, and a most preferred surface-crosslinking reaction time of 10 to 50 minutes. The specific reaction time needed to provide the necessary

degree of surface-crosslinking is temperature-dependent. This time period and applied temperature are varied in D11 (about 180 °C in Examples 1 to 3 at heating rates between 3 °C/min and 10 °C/min and a reaction time of 20 minutes; 200 °C in Example 4 at a heating rate of 7 °C/min and a reaction time of 10 minutes; 180 °C in Example 5 at a heating-up rate of 3 °C/min, a reaction time of 20 minutes and a starting temperature of 60 °C instead of 30 °C, as applied in Examples 1 to 4).

- 1.5.6 When starting from e.g. Example 2 of D1 by modifying a heating-up period within the preferred heating rate window from 6 °C to 8 °C envisaged in D11, correlating to a heating period of about 19 to 25 minutes for heating from a starting temperature of 30 °C to 180 °C, and implementing a surface-crosslinking reaction time of 35 to 45 minutes, a skilled person would arrive at the subject-matter of claim 1 in an obvious way. Such an adaptation would mean accomplishing the necessary degree of surface-crosslinking to maintain CRC, AUP, SFC (and inherently gel strength) values as obtained in Example 2 of D1.
- 1.5.7 Therefore, the subject-matter of claim 1 lacks an inventive step and does not meet the requirement of Article 56 EPC.

## 2. *Inventive step - first and second auxiliary requests*

- 2.1 The above conclusions regarding a lack of inventive step in respect of the main request apply, *mutatis mutandis*, to the subject-matter of claim 1 of the first and second auxiliary requests. The polymer used in Example 2 of D1 is prepared in Production Example 1. The concentration of the water-soluble ethylene-based



unsaturated monomer used in Production Example 1 falls within the corresponding range stipulated in claim 1 of the first and second auxiliary requests.

2.2 Moreover, a technical effect that can be causally ascribed to the additional limitations introduced into each claim 1 has not been corroborated which could be observed across the full scope of claim 1 (see, in particular, points 1.4.2 to 1.4.7 above). Consequently, the additional limitations introduced into claim 1 do not change the conclusion that the subject-matter of claim 1 provides the obvious solution to the objective technical problem of providing *alternative* manufacturing methods for superabsorbent polymers for the reasons indicated above: D1 also proposes using surface-crosslinking agents (and their combinations) meeting the Hansen solubility parameter criteria as specified in claim 1 (see above). In the absence of a corroborated technical effect obtained across the full scope of claim 1, substituting the combination of surface-crosslinking agents used in Example 2 of D1 with a combination of such agents encompassed by claim 1 does not confer an inventive step. This would mean using e.g. 1,3-propanediol (also proposed in D1 and D11) instead of 1,4-butanediol as a second surface-crosslinking agent and adjusting the surface-crosslinking density, if necessary.

2.3 Therefore, these claim requests do not involve an inventive step and do not meet the requirement of Article 56 EPC either.

### 3. *Admittance - third auxiliary request*

3.1 The respondent submitted a third auxiliary request at the oral proceedings before the board and requested

that it be taken into account by the board (Article 13(2) RPBA 2020).

- 3.2 Under Article 13(2) RPBA 2020 any amendment to a party's appeal case made after the expiry of a period specified by the board in a communication under Rule 100(2) EPC or, where such a communication is not issued, after notification of a summons to oral proceedings will, in principle, not be taken into account unless there are exceptional circumstances, which have been justified with cogent reasons by the party concerned.
- 3.3 When asked by the chairman what exceptional circumstances were invoked, the respondent stated that the request *prima facie* limited the surface-crosslinking agents to the very specific combination used in the examples of the patent in suit.
- 3.4 The board, however, observes that the corresponding objections to the main request regarding a lack of inventive step had already been presented in the statement of grounds of appeal and were held to be convincing by the board and also held to apply to the first and second auxiliary requests. The respondent thus has not presented exceptional circumstances, justified with cogent reasons, for the late request to be considered by the board. No new issues were raised at the oral proceedings before the board which would justify the very late filing of a claim request in the course of the oral proceedings, either.

Furthermore, it is not clear to the board how the limitation to the specific surface-crosslinking agents used in the examples of the patent could *prima facie* overcome the above conclusions regarding lack of

inventive step in relation to claim 1 of the main request and to claim 1 of the first and second auxiliary requests. The above reflections (see in particular point 2.2 above) also consider the use of e.g. 1,3-propanediol instead of 1,4-butanediol as the second surface cross-linking agent used in e.g. Example 2 of D1. Taking the third auxiliary request into account would thus also have been detrimental to procedural economy. The board thus did not take the request into account (Article 13(2) RPBA 2020).

**Order**

**For these reasons it is decided that:**

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:

The Chairman:



M. Schalow

A. Haderlein

Decision electronically authenticated