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Datasheet for the decision of 28 November 2019

Case Number: T 1801/15 - 3.3.09

Application Number: 06799568.8

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Language of the proceedings: EN

Title of invention:
LOW EMISSION ADHESIVE SYSTEM

Patent Proprietor:
Dynea AS

Opponent:
Akzo Nobel Coatings International B.V.

Headword:

Relevant legal provisions:
EPC Art. 56
RPBA Art. 12(4)

Keyword:
Late-filed technical evidence (admitted)
Inventive step (no) - none of the requests

Decisions cited:

Catchword:

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Beschwerdekammern

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Case Number: T 1801/15 - 3.3.09

D E C I S I O N
of Technical Board of Appeal 3.3.09
of 28 November 2019

Appellant: (Opponent)	Akzo Nobel Coatings International B.V. Velperweg 76 6824 BM Arnhem (NL)
Representative:	Akzo Nobel IP Department Velperweg 76 6824 BM Arnhem (NL)
Respondent: (Patent Proprietor)	Dynea AS Svelleveien 33 2001 Lillestrøm (NO)
Representative:	Zacco Norway AS P.O. Box 2003 Vika, 0125 Oslo (NO)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 15 July 2015 concerning maintenance of the European Patent No. 1945729 in amended form.**

Composition of the Board:

Chairman	A. Veronese
Members:	N. Perakis
	F. Blumer

Summary of Facts and Submissions

I. This decision concerns the appeal filed by the opponent against the opposition division's interlocutory decision that the European patent No 1 945 729 as amended meets the requirements of the EPC. The decision was based on the claims of auxiliary request I filed during the oral proceedings of 6 May 2015 and resubmitted in appeal as the main request.

Claim 1 of this request reads as follows:

"1. An adhesive system comprising the following parts that are combined into a two or three component adhesive system:
a) a urea formaldehyde resin adhesive part;
b) a hardener part comprising one or more curing agents(s);
c) a polymer dispersion;
d) a formaldehyde scavenger,
e) a carboxylic acid part
wherein part d) comprises a combination of urea and resorcinol."

II. The documents filed during opposition included:

D1: JP 54 162747 A

D1a: English translation of D1

D3: WO 02/068178 A2

III. The opposition division decided that the subject-matter of claim 1 of auxiliary request I met the requirements of Article 56 EPC. According to the opposition division, the adhesive system of claim 1 differed from

that disclosed in D1/D1a, which represented the closest prior art, in that it additionally comprised a polymer dispersion (component(c)) and a carboxylic acid part (component (e)). These distinguishing features led to the unexpected technical effect of improving the adhesive strength of the adhesive composition. Despite the opponent's objections, the opposition division considered that this technical effect was shown in example 1 (table 4) of the patent in suit, in which "inventive sample 6" was compared with "comparative sample 3". This comparison was meaningful despite the compared compositions differing in other respects, e.g. in the amounts of inorganic acids present, which had allegedly been varied in order to obtain compositions having the same pH. The technical problem was to provide an adhesive composition for wood having improved adhesive strength. The opposition division concluded that the prior art would not have prompted the skilled person to add a polymer dispersion and a carboxylic acid to the adhesive composition of D1/D1a in order to improve its adhesive strength.

IV. The opponent (in the following: the appellant) filed an appeal against the opposition division's interlocutory decision and requested that the decision be set aside and that the patent be revoked in its entirety. With the statement setting out the grounds of appeal the appellant filed an experimental report (D7) to support its argument that the technical evidence of the patent in suit did not show any unexpected effect. According to the appellant, the closest prior art was D1/D1a, the technical problem was the provision of an alternative adhesive system and the claimed subject-matter did not involve an inventive step in view of the obvious combination of D1/D1a with D3.

V. By a letter dated 27 May 2016, the patent proprietor (in the following: the respondent) filed a main request, auxiliary requests I to VII and the following additional documents:

D8: Experimental report

D9: A. Pizzi, "Urea-Formaldehyde Adhesives", Handbook of Adhesive Technology, Chapter 31, 2003, 18 pages

D9a: Contents of Handbook of Adhesive Technology, 2003

D10: Datasheet of Mowiol® polyvinylalcohol product

The respondent requested that the appeal be dismissed or that the patent be maintained on the basis of the claims of any of auxiliary requests I to VII. Furthermore, it requested that D7 not be admitted into the appeal proceedings and that, if D7 was admitted, D8, D9, D9a and D10 also be admitted.

VI. On 20 September 2019 the board issued a communication in preparation for the oral proceedings in which it addressed the issues to be discussed. The board questioned whether the subject-matter of dependent claims 3, 4 and 6 of the main request complied with the requirement of Article 123(2) and (3) EPC. It also noted that these claims were not identical to the corresponding dependent claims upheld by the opposition division.

VII. By a letter dated 26 September 2019, the respondent replaced its previous requests with new requests (a main request and auxiliary requests I to VII) in which the subject-matter of dependent claims 3, 4 and 6 of

the main request and the corresponding dependent claims of all auxiliary requests were amended in order to overcome the objection raised by the board.

Claim 1 of the **main request** is identical to claim 1 of the request upheld by the opposition division (see point I above).

Claim 1 of **auxiliary request I** is based on claim 1 of the main request with the addition of the following feature at its end:

"wherein the carboxylic acid of part e) is chosen from formic acid, acetic acid and lactic acid".

Claim 1 of **auxiliary request II** is based on claim 1 of auxiliary request I with the addition of the following feature after component e):

"wherein at least parts of part c) is (*sic*) a functionalized PVAc".

Claim 1 of **auxiliary request III** is based on claim 1 of auxiliary request II with the addition of the following feature at its end:

"wherein the amount of resorcinol in the adhesive system is from 3 to 10% by weight".

Claim 1 of **auxiliary request IV** is based on claim 1 of auxiliary request III with the carboxylic acid of part e) being limited to lactic acid such that this feature reads:

"wherein the carboxylic acid of part e) is lactic acid".

Claim 1 of **auxiliary request V** is based on claim 1 of auxiliary request III with the addition of the following feature after component e):

"wherein the urea formaldehyde resin of part a) has a molar ratio of formaldehyde to urea (F/U) of 1.1 to 1.5".

Claim 1 of **auxiliary request VI** is based on claim 1 of auxiliary request V with the carboxylic acid of part e) being limited to lactic acid such that this feature reads:

"wherein the carboxylic acid of part e) is lactic acid".

Claim 1 of **auxiliary request VII** is based on claim 1 of auxiliary request VI with the molar ratio of formaldehyde to urea (F/U) being limited such that this feature reads:

"wherein the urea formaldehyde resin of part a) has a molar ratio of formaldehyde to urea (F/U) of 1.25 to 1.35".

VIII. By a letter dated 21 November 2019, the respondent withdrew its request for oral proceedings and announced that it would not attend the oral proceedings scheduled to take place on 28 November 2019.

IX. The oral proceedings took place as scheduled in the absence of the respondent in compliance with Rule 115(2) EPC and Article 15(3) RPBA.

X. The relevant arguments put forward by the appellant (opponent) in its written submissions and during the oral proceedings may be summarised as follows:

Admittance of D7

- The experimental report D7 should be admitted into the proceedings because:

  - it was submitted at the earliest stage of the appeal proceedings, i.e. with the statement setting out the grounds of appeal;

  - it was *prima facie* relevant, since it provided meaningful comparative tests showing that the lactic acid did not improve the gluing properties of the claimed composition;

  - it was submitted as a reaction to the opposition division's finding that the comparative tests in the patent were meaningful, a finding which had been already contested, albeit unsuccessfully, during the opposition proceedings.

Main request: inventive step

Closest prior art

- The subject-matter of claim 1 of the main request lacked an inventive step. D1/D1a was the closest prior art and the claimed adhesive system differed from that described in D1/D1a in that it additionally contained a polymer dispersion and a carboxylic acid.

Technical effect

- The additional components of the adhesive system did not provide any unexpected effect. The comparative tests in the patent in suit were not meaningful since many parameters were simultaneously changed. Contrary to the respondent's assertions, there was no evidence that a variation in the pH caused significant changes in the adhesive strength. The argument that the variation of the amount of aluminium chloride 6-hydrate and monoammonium phosphate in the examples of table 4 was necessary to obtain compositions having the same pH was not convincing. This requirement was not reflected in the wording of the claims either. However, it was reasonable to assume that the amounts of these hardeners in the tested compositions had to be the same to obtain comparable results.

- The tests in D7, set up like those in the patent, but varying only one parameter at a time, showed that:

  - the addition of a carboxylic acid to the adhesive system worsened the shear strength (compare mixtures 6 and 9 with mixture 7);

  - the shear strength and the wood failure heavily depended on the type of the carboxylic acid used (compare mixtures 6 and 9);

  - the presence of monoammonium phosphate was detrimental to the adhesive properties; this could explain why example 6 of the patent, which

contained a lower amount of this agent, performed better than comparative example 3.

- The evidence in D7 could not be ignored on the ground that the error margins and the repetition frequency were not reported, or that the urea formaldehyde resin "Adhesive 1274" from Akzo Nobel was used. Whether or not this resin was available at the filing date was irrelevant. The results in D7 did not show internal inconsistencies.

- The skilled person looking at tables 4 to 7 of D8 with a critical eye and taking into account the standard deviations given in table 7 would not have considered lactic acid to induce any effect.

- The patent in suit did not provide any evidence that the addition of a polymer dispersion to the adhesive system resulted in any particular effect. The polymer dispersion was present in various amounts in all systems tested (except for one in example 5). Furthermore, the systems contained different ingredients or different amounts of the same ingredients.

- There was no evidence that a combination of a polymer dispersion and a carboxylic acid was associated with any technical effect.

Technical problem

- The technical problem in view of D1/D1a was the provision of an alternative adhesive system providing glued products having low formaldehyde emission.

Obviousness

- Various parts of D3, and the teaching of this document as a whole, prompted the skilled person to include a polymer dispersion and a carboxylic acid in the adhesive composition of D1/D1a. Thus, the subject-matter of claim 1 of the main request did not involve an inventive step.

Auxiliary requests I to VII: inventive step

- The subject-matter of claim 1 of the auxiliary requests did not involve an inventive step either, in view of the obvious combination of D1/D1a with D3 and/or the common knowledge (shown e.g. in D9). In this regard, the appellant noted that:

- The specific carboxylic acids mentioned in claim 1 of auxiliary request I were obvious alternatives to those mentioned in D3.

- The polymer dispersion of functionalised PVAc mentioned in claim 1 of auxiliary request II was disclosed in D3.

- The amount of resorcinol mentioned in claim 1 of auxiliary request III was already disclosed in D1/ D1a.

- The selection of lactic acid as the carboxylic acid according to auxiliary request IV was obvious in view of D3.

- The selection of specific molar ratios of formaldehyde to urea (F/U) in the urea formaldehyde resin of claim 1 of auxiliary requests V to VII was

obvious in view of the common general knowledge represented by D9 and the background section of the patent in suit.

XI. The relevant arguments put forward by the respondent (patent proprietor) in its written submission may be summarised as follows:

Admittance of D7

- Document D7 should not be admitted into the appeal proceedings. The appellant should have filed D7 earlier rather than waiting until the appeal stage.

- Furthermore, since the results of D7 were not reliable, this document was not *prima facie* relevant:

  - The warm water test at values as low as 2-4 N/mm^2 gave wood failure values which were inconsistent with those given the patent in suit (table 4).

  - The results of D7 did not indicate any error margin or repetition frequency.

  - The experiments of D7 were carried out with an urea formaldehyde resin (Akzo 1274), which was probably not available at the filing date.

- The respondent repeated the experiments of D7 in D8 using two different resins Prefere®4108 and Prefere®4114, which showed a clear correlation between the values of the warm water test and wood failure. The values obtained in D8 were in line with those reported in table 4 of the patent.

Admittance of D8, D9, D9a and D10

- If D7 was admitted into the appeal proceedings, then the following documents should also be admitted:

  - D8, which was an experimental report filed as a direct response to D7;

  - D9, which was a book extract which disclosed the common general knowledge at the time shortly before the priority date of the patent in suit;

  - D9a, which corresponded to the first pages and contents of D9;

  - D10, which was a datasheet relating to the Mowiol® polyvinylalcohol product

Main request: inventive step

Closest prior art

- D1/D1a was the closest prior art. The claimed adhesive system differed from that disclosed in D1/D1a in that it additionally contained a polymer dispersion and a carboxylic acid.

Technical effect

- The addition of these ingredients led to an unexpected improvement in the adhesive strength while the formaldehyde emission from the glued product was kept low.

- The opposition division had correctly decided that the comparison in the patent in suit of "comparative example 3" and "inventive example 6" was meaningful. The amount of inorganic acids in "inventive example 6" was reduced to compensate for the addition of lactic acid and to obtain systems having the same pH.

- The appellant overlooked the combined effect of the components of the claimed adhesive system and discussed the effect of the polymeric dispersion in isolation. However, example 2 (tables 5 and 6), examples 4A and 4B (table 8), example 5 (tables 9 and 15) and example 6 (tables 16 and 17) of the patent in suit showed that this combination resulted in low formaldehyde emission, high wood failure and good shear strength.

- The experimental report D7, filed by the appellant, showed results which were inconsistent and different from those in the patent, casting doubts on the reliability of those results. Thus, D7 had to be disregarded when assessing inventive step.

Technical problem

- The technical problem in view of D1/D1a was the provision of an adhesive system which had an improved adhesive strength and kept the formaldehyde emission from the glued product low.

Obviousness

- None of the prior-art documents prompted the skilled person to add a polymer dispersion and a

carboxylic acid to the composition of D1/D1a in order to solve the technical problem.

- Contrary to the appellant's argument, even if the skilled person had combined D1/D1a with D3 they would not have arrived at the claimed subject-matter. The comparative example of D3 (table 2) related to a conventional hardener composition comprising citric acid and aluminium sulphate. The skilled person would not have deduced from D3 that such a hardener could be modified to further contain a functionalised PVAc.

Auxiliary requests I to VII: inventive step

- Claim 1 of auxiliary request I limited the carboxylic acids to formic acid, acetic acid and lactic acid.

- Claim 1 of auxiliary request II further specified that the polymer dispersion was a functionalised PVAc. Such a polymer dispersion was used in the examples of the patent in suit and was the preferred embodiment of claim 5.

- Claim 1 of auxiliary request III specified the amount of resorcinol in the adhesive system. According to the description, such a high level of resorcinol was relevant.

- Claim 1 of auxiliary request IV specified that the carboxylic acid was lactic acid, which was the preferred embodiment of granted claim 8.

- Claim 1 of auxiliary requests V to VII specified the F/U molar ratio, which was important for

reducing the formaldehyde emission. The closest prior-art document D1/D1a (table 1) disclosed an adhesive system containing high amounts of free formaldehyde and, thus, having higher F/U molar ratio than that claimed. The skilled person was taught by D9 to solve the problem of high free formaldehyde content by mixing two or more urea formaldehyde resins and/or preresins. This provided the required balance between adhesive strength and low formaldehyde emission.

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

XIII. The respondent (patent proprietor) requested in writing that the appeal be dismissed, with the patent being maintained in the amended form as decided by the opposition division (main request), or, alternatively, that the patent be maintained on the basis of the claims of any one of auxiliary requests I to VII as filed with the letter dated 26 September 2019. Furthermore, it requested that document D7 not be admitted into the proceedings or, if it was admitted, that documents D8 to D10 also be admitted into the proceedings.

Reasons for the Decision

1. Admittance of the late-filed documents D7 to D10 into the appeal proceedings

1.1 In its interlocutory decision the opposition division considered that the experimental tests in the patent in suit provided convincing evidence that lactic acid

improved the gluing properties of the claimed urea formaldehyde resin. During the opposition proceedings the opponent (now appellant) tried to convince the opposition division that the results shown in the patent were not meaningful, but did not succeed.

The experimental report D7, filed by the appellant with its statement setting out the grounds of appeal, can thus be considered a justified reaction to the opposition division's decision. Since D7 was filed at the earliest possible stage of the appeal proceedings and appears to be *prima facie* relevant, in that it contradicts the results of the patent in suit, this document cannot be considered inadmissible in the appeal proceedings (Article 12(4) RPBA).

1.2 D8, D9, D9a and D10 were filed by the respondent together with its reply to the appellant's statement of grounds of appeal. The appellant did not contest their admittance into the appeal proceedings and the board does not see any reason to consider them inadmissible (Article 12(4) RPBA).

2. Main request

The only objection raised by the appellant in its statement setting out the grounds of appeal concerned the inventive step of the claims upheld by the opposition division (the main request in appeal). In particular, the appellant contested the opposition division's interpretation of the technical evidence of the patent in suit and, in consequence, the definition of the technical problem which led the opposition division to acknowledge an inventive step.

2.1 The closest prior art

2.1.1 Claim 1 is directed to a urea formaldehyde adhesive system. As stated in paragraphs [0001] and [0013] of the patent in suit the system is intended for the manufacture of glued products and to fulfil the practical requirements set by the adhesive industry. In particular, the invention aims on the one hand at providing a system having good gluing quality, and on the other hand, at reducing the emission of formaldehyde. The description of the patent in suit explains that the release of formaldehyde from an adhesive is principally determined by the ratio of formaldehyde to urea (F/U) in the adhesive system. As indicated in paragraph [0004], considerable efforts had already been made to reduce this ratio long before the filing date. According to one method, the formaldehyde emission was decreased by reducing the F/U ratio to between 1:1 and 1:2. However, this caused detrimental effects on the adhesive, which became more brittle and showed inferior properties in terms of water resistance, adhesive strength, shelf life, reactivity and curing time (paragraph [0005]). As an alternative to the reduction of the F/U ratio, it was proposed to add scavengers that bind the formaldehyde released when the adhesive is cured.

2.1.2 Both parties consider that D1/D1a represents the closest prior art and the board has no reason to disagree with them. D1/D1a discloses a method for decreasing the formaldehyde released from a formaldehyde-based thermosetting resin. The formaldehyde is released when the formaldehyde-based thermosetting resin is mixed with an additive such as a curing agent (which for the skilled person is a hardener: page 2, lines 14-17). D1/D1a teaches

decreasing the released formaldehyde by mixing 100 parts by weight of the formaldehyde-based thermosetting resin with 5 to 20 parts by weight of urea and 0.5 to 8 parts by weight of resorcinol (page 1, claim). The adhesive system disclosed in D1/D1a combines urea and resorcinol with the resin either simultaneously or sequentially (page 7, last paragraph). Thus, similarly to the claimed invention, D1/D1a teaches combining parts of the adhesive into a two-component adhesive system.

2.1.3 The board agrees with the parties and the opposition division and acknowledges that the claimed adhesive system differs from D1/D1a in that it further comprises a carboxylic acid and a polymer dispersion.

2.2 The technical evidence

2.2.1 The parties disagreed on whether the carboxylic acid part (component (e)) and the polymer dispersion (component (c)) induced an unexpected technical effect in the claimed adhesive system.

2.2.2 The technical effect of lactic acid according to the experimental evidence of the patent in suit

The respondent referred to example 1 of the patent in suit, in particular the adhesive mixture 3 ("comparative example 3") and adhesive mixture 6 ("inventive example 6"), the comparison of which showed that the presence of lactic acid in the composition resulted in a higher wood failure in the cold and warm water test and a higher shear strength. These results are shown below.

Adhesive mixture	Dry test	Cold water test	Warm water test
	N/mm^2 - % WF*	N/mm^2 - % WF*	N/mm^2 - % WF*
Comparative example 3	10.7 - 100	7.5 - 32	3.5 - 0
Inventive example 6	13.7 - 100	7.8 - 74	7.2 - 30

*WF stands for wood failure

However, this comparison concerns adhesive mixtures which differ on account of more parameters than solely the presence or absence of a carboxylic acid (lactic acid). The adhesive mixtures comprise an adhesive, a modifier and a hardener, as follows.

Adhesive mixture	Modifier	Hardener	Adhesive/Modifier + Hardener wt%
Comparative example 3	Modifier 2	Hardener F	100/18.5 + 13.3
Inventive example 6	Modifier 2	Hardener I	100/18.5 + 13.3

Where Modifier 2 comprises:

- 65.9 wt% polymer dispersion
- 21.6 wt% urea
- 12.5 wt% water

Where the composition of the hardeners is:

Hardener	Hardener F	Hardener I
Aluminium chloride 6-hydrate	3.0	4.0
Monoammonium phosphate	6.6	4.0
Polypropyleneglycol	2.2	2.2

Resorcinol	37.4	37.4
Defoamer, colour etc.	0.2	0.2
Xanthan gum		0.45
Lactic acid		5.0
Water	50.6	46.7

As can be seen from these tables, the composition of "inventive example 6" differs from that of "comparative example 3" on account of the (higher) amounts of aluminium chloride 6-hydrate and (lower) amounts of monoammonium phosphate, and in that it additionally contains lactic acid and xanthan gum.

In the decision under appeal the opposition division assumed that the total amounts of aluminium chloride 6-hydrate and monoammonium phosphate were reduced in "inventive example 6" in order to compensate for the presence of lactic acid. This adjustment, which took into account the pKa of all acid ingredients present, was meant to obtain compositions having a similar pH which could be compared and provide meaningful results.

The board is not convinced by this argument. As noted by the appellant, there is no concrete evidence that a variation in the pH may significantly change the adhesive strength of the claimed adhesive system. It is noted that claim 1 specifies neither the pH nor the overall pKa of the combined acids in the system. Paragraph [0036] of the patent in suit indicates that the pH of the hardener is to be kept from 0 to 4. This means that any variation of the pH within this range is considered acceptable. Furthermore, D7 shows that adhesive systems containing the same amounts of aluminum chloride and the same or an even higher amount

of monoammonium phosphate have a pH in this range (1 to 2) regardless of the presence of lactic acid.

Paragraph [0037] indicates that the reactivity of the hardener is determined by the total amount of acid, acid salts and acid-generating salts and that the skilled person has the knowledge to achieve both the required reactivity and the required stability. However, this paragraph does not indicate that the amounts of inorganic acids should be lowered as a whole when a carboxylic acid is present, or that the amounts of the individual acids and salts should be increased and decreased, respectively, as performed in the above-mentioned examples of the patent in suit. Thus, it cannot be concluded that the compositions can be compared to obtain meaningful indications as to the effects of lactic acid.

On the contrary, as stated by the appellant, it is reasonable to assume that the amounts of aluminium chloride 6-hydrate and monoammonium phosphate, which are used as hardener agents according to the patent, will substantially influence the adhesive properties of the claimed adhesive system. For these reasons, it is concluded that the comparative tests shown in the patent in suit, which were conducted using adhesive systems comprising substantially different amounts of these agents, are not suitable to show that lactic acid provides an improvement of the adhesive properties of an adhesive system as defined in claim 1.

2.2.3 The technical effect of a polymer dispersion according to the experimental evidence in the patent in suit

The decision under appeal does not provide any explanation as to the contribution of the polymer dispersion to the alleged technical effect.
Example 5 of the patent in suit allegedly shows improved gluing for adhesive systems with a modifier containing a polymer dispersion (paragraph [0113]). In Example 5 three adhesive systems are compared.

The first adhesive system (5A in this decision), prepared using Prefere®4108, modifier 1 and hardener A, apparently in a 100/18.5+13.3 parts by weight ratio, comprises:

- urea formaldehyde resin Prefere®4108,
- modifier 1, which comprises:
  - 49.5 wt% polymer dispersion,
  - 15.0 wt% urea,
  - 2.2 wt% lactic acid,
  - 16.0 wt% resorcinol,
  - 17.3 wt% water

and

- hardener A, which comprises:
  - 5.6 wt% aluminium chloride 6-hydrate,
  - 4.4 wt% monoammonium phosphate,
  - 1.5 wt% polypropyleneglycol,
  - 60 wt% polymer dispersion,
  - 0.1 wt% defoamer,
  - 28.4 wt% water

The second adhesive system, corresponding to example 2 of the patent (5B in this decision), does not comprise a modifier and comprises:

- urea formaldehyde Prefere®4108, and
- hardener A, which comprises:
  - 5.6 wt% aluminium chloride 6-hydrate,
  - 4.4 wt% monoammonium phosphate

- 1.5 wt% polypropyleneglycol
- 60 wt% polymer dispersion
- 0.1 wt% defoamer
- 28.4 wt% water

The third adhesive system (5C in this decision, paragraph [111] of the patent), prepared using Prefere®4108, modifier 5 and hardener A, apparently in the same 100/18.5+13.3 parts by weight ratio, comprises:

- urea formaldehyde Prefere®4108
- modifier 5 (where PVAc is replaced by Bonit®) which comprises:
  - 15.0 wt% urea
  - 16.0 wt% resorcinol
  - 16.0 wt% Bonit® (i.e. inorganic salts)
  - 53 wt% water

and

- hardener A, which comprises
  - 5.6 wt% aluminium chloride 6-hydrate,
  - 4.4 wt% monoammonium phosphate,
  - 1.5 wt% polypropyleneglycol,
  - 60 wt% polymer dispersion,
  - 0.1 wt% defoamer,
  - 28.4 wt% water

Tables 5, 9 and 10 of the patent show that the presence of a PVAc polymer dispersion improves the gluing properties of the adhesive system. However, as noted by the appellant no meaningful conclusion can be drawn from comparing adhesive system 5C with either 5A or 5B, since not only is the polymer dispersion changed, but other parameters are simultaneously changed too. Moreover, the adhesive system 5C contained a, comparatively, larger amount of water than 5A, which obviously has a negative impact on its gluing

properties (patent paragraph [0113]). Thus, no improvement can be attributed solely to the presence of the polymer dispersion.

The respondent argued that it was the combined presence of lactic acid, polymer dispersion, urea and resorcinol which gave the best results in terms of gluing properties and formaldehyde emission. In this context the respondent compared the results of examples 5 and 6 (tables 9, 15, 16 and 17), which relate to adhesive systems containing this combination, with those of examples 2 (tables 5 and 6) and 4A and 4B (table 8), which relate to adhesive systems not containing that combination. (NB: the respondent took the system in example 4B to contain lactic acid, but this appears to be wrong, so this example is to be seen as comparative).

The respondent's argument is not convincing. The results in these examples cannot be compared because they relate to adhesive systems comprising different hardeners and modifiers. The wood substrates used for the tests are also different. Furthermore, strikingly, the two tests conducted using adhesive systems comprising the same ingredients (examples 5 and 6), but with these ingredients mixed in a different order provide substantially different results in terms of gluing properties and formaldehyde emission. This means that other factors unrelated to the presence of the aforementioned combination of ingredients play a major role in gluing and formaldehyde emission.

For these reasons it is concluded that the experimental evidence in the patent does not show that a carboxylic acid and a polymer dispersion, either alone or in combination with urea and resorcinol, can improve the

adhesive properties of an adhesive system as defined in claim 1.

2.2.4 The experimental report D7

D7 is an experimental report filed by the appellant to confirm that example 1 (table 4) of the patent in suit does not show that lactic acid improves the gluing properties of the claimed adhesive system. In D7 an adhesive system corresponding to "inventive example 6" of table 4 of example 1 of the patent in suit was compared with adhesive systems in which only one parameter was varied at a time. Adhesive 1274, a urea formaldehyde resin from Akzo widely used in the industry was used for the tests. In all adhesive compositions the pH of the hardener was between 1 and 2, i.e. within the range for the hardener disclosed in the patent in suit (paragraph [0036]). The results show that the presence of lactic acid in an adhesive system according to claim 1 (mixture 6) did not result in any improvement in bond quality/gluing quality when compared with a composition which differed only in that lactic acid was replaced by water (mixture 7). Even worse, the presence of lactic acid was detrimental. Mixture 6 did not even achieve the minimum requirement for shear strength of at least 4 N/mm^2 mentioned in paragraph [0067] of the opposed patent.

Furthermore, the results obtained with mixtures 7 and 8 (D7, table F) show that an increase in the amount of monoammonium phosphate in the adhesive composition is detrimental to the properties of the adhesive system. As noted by the appellant, this could explain why "inventive example 6" of the patent in suit performed better than "comparative example 3". The improvement could in fact be due to the lower ammonium phosphate

content in the adhesive system, rather than the presence of lactic acid.

The comparison of mixtures 6, 7 and 9 shows that the use of a carboxylic acid other than lactic acid does not have a positive impact on the adhesive performance either. When lactic acid is replaced with nicotinic acid, the adhesive system does not actually pass the warm test requirement and the observed results are far worse than those observed when no carboxylic acid is used at all. In conclusion, the addition of lactic acid does not lead to any improvement in the properties of the adhesive system, or is even detrimental. Nicotinic acid is even more detrimental.

It is noted that the pH of all tested compositions was between 1 and 2, i.e. within the range indicated in paragraph [0036] of the patent in suit (0 to 4), regardless of the presence or absence of lactic acid, or the amount of aluminium chloride and monoammonium phosphate. These results indicate that, contrary to the respondent's assertions, in order to work within the suitable pH ranges it is not necessary to vary the amounts of the inorganic acids in the hardener mixture as in example 1 of the patent in suit.

The results shown in example 6 of D7 are different from those shown in example 1 of the patent in suit ("inventive example 6"). The different result may be due to the different adhesive used or to differences in the glue-up process, i.e. to factors which are not specified in the claims.

Contrary to the respondent's assertions, the board also considers that:

- The results shown in D7 cannot be considered irrelevant on the ground that error margins or repetition frequencies are not indicated. The patent in suit does not indicate any such error margin or repetition frequency either.

- The results in D7 cannot be considered irrelevant on the ground that a resin different from that used for the tests of the patent in suit was employed. As stated by the appellant, the resin Adhesive 1274 from Akzo is a urea formaldehyde resin widely used in the industry which falls within the definition of "a urea formaldehyde resin adhesive part" in claim 1 of the main request. This has not been contested by the respondent. The fact that this resin might not have been commercially available on the filing date is irrelevant.

- The experimental results in D7 do not show any internal inconsistency or any inconsistency with the results of the patent. The results of D7 might be different from those of table 4 of the patent in suit with regard to the values of wood failure at comparable values of shear strength, but this does not mean that the results of D7 are unreliable. It is noted that no widely accepted correlation has been shown between the values of shear strength and wood failure. Furthermore, the value of wood failure is based on a visual observation (patent in suit, paragraph [0075]), which allows for a certain degree of subjectivity. From an experimental point of view, a confidence level would be needed for a correct evaluation of the data. However, the patent in suit does not give any confidence level either.

For these reasons, it is concluded that D7 provides credible evidence that a carboxylic acid does not improve the gluing properties of the adhesive system described in this report, which is an adhesive system falling within the scope of claim 1.

2.2.5 The experimental report D8

D8 is an experimental report filed by the respondent to show that lactic acid improves the gluing properties of the claimed adhesive system. The tests in D8 were carried out by reworking those of D7 but using different adhesive resins, Prefere®4108 (D8, tables 4 and 6) and Prefere® 4114 (D8, table 5), instead of the Adhesive 1274 from Akzo Nobel used in the tests of D7 (D7, table D, mixtures 6, 7 and 8).

The tests in D8, tables 4, 5 and 6, show a trend of improved shear strength and wood failure in the warm water tests, in the presence of lactic acid.
The appellant noted, however, that the results in table 7, which shows the average of all observed results as well as the standard deviations, do not appear statistically significant (see the calculated standard deviations). Whether or not the results in D8 are suitable to show that lactic acid improves the gluing properties of the tested system is in any case irrelevant because the results in D8 do not disprove the negative findings and the conclusions drawn from the outcome of the tests described in D7. The difference between the results shown in D7 and D8 could be due to the fact that different resins were used (Adhesive 1274 in D7 and Prefere®4108 and Prefere® 4114 in D8) or that different conditions were applied in the processing steps.

Conclusion

Taking into account the results shown in the report D7, it is concluded that the alleged improvement of the gluing properties induced by carboxylic acid, either alone or in combination with a polymer dispersion and the other agents listed in claim 1, does not occur over the entire scope claimed.

2.3 The technical problem and its solution

In view of the above conclusion, starting from D1/D1a as the closest prior art, the technical problem can only be the provision of an alternative adhesive system releasing low amounts of formaldehyde. It has not been contested that this technical problem is solved by the adhesive system of claim 1.

2.4 The issue of obviousness

2.4.1 The question that remains is whether the skilled person starting from the adhesive system of D1/D1a and looking for an alternative adhesive system releasing low amounts of formaldehyde would be prompted by the state of the art to add a carboxylic acid part (component (e)) and a polymer dispersion (component (c)) to the adhesive system described in D1/D1a.

2.4.2 The skilled person would consider the teaching of D3, which similarly to the patent in suit relates to adhesive systems comprising urea formaldehyde resins. The problem of reducing the emission of formaldehyde is also mentioned in D3 and is addressed by the addition of urea (see page 9, fifth paragraph). The adhesive system described in D3 comprises a hardener comprising an acid, an acid salt and/or an acid-generating salt

and a polymer dispersion or a mixture of different polymer dispersions and conventional additives (page 5, lines 10-12). D3 teaches, in particular, that the hardener has to include an acid and an acid salt in order to induce the required adhesive properties (page 7, lines 2-20). With regard to the type of acids which can be used, D3 mentions maleic acid and citric acid among the preferred ones (page 7, lines 10-11). These are carboxylic acids having a low molecular weight.

Furthermore, D3 teaches that the addition of a polymer dispersion to the hardener gives a substantial and unexpected reduction in curing time and an improvement in the characteristics of the glue line compared with the corresponding hardener without said dispersion (page 4, lines 11-23).

2.4.3 Thus, D3 prompts the skilled person to include both a polymer dispersion and a carboxylic acid in the adhesive system of D1/D1a. By doing this, the skilled person would arrive at the subject-matter of claim 1 of the main request without exercising any inventive skill.

2.4.4 The respondent asserted that D3 does not in any way prompt the skilled person to combine a polymer dispersion with a carboxylic acid in a hardener, and referred to table 2. It may be right that this table discloses two tested hardeners; one with a polymer dispersion, namely a functionalised PVAc, and another with a carboxylic acid, namely citric acid. However, this disclosure would not discourage the skilled person from combining a polymer dispersion with a carboxylic acid, since, as the appellant correctly observed, according to the general teaching of D3 these two

components can be combined (page 4, lines 22-23). Thus, this argument by the respondent must fail.

For these reasons the subject-matter of claim 1 does not involve an inventive step and the main request is not allowable.

3. Auxiliary request I

In comparison with claim 1 of the main request, claim 1 of auxiliary request I defines component e) in a more limited manner. This feature reads:

"wherein the carboxylic acid of part e) is chosen from formic acid, acetic acid and lactic acid".

D3 does not disclose these specific carboxylic acids. However, there is no evidence that their selection is associated with any unexpected technical effect. Moreover, these acids are low-molecular-weight carboxylic acids like the acids disclosed in D3. Reference is made to page 7, lines 2-3 of D3, which discloses that the hardener comprises one or more acids and salts and explicitly cites maleic acid and citric acid, which are low-molecular-weight carboxylic acids. Accordingly, the claimed carboxylic acids are arbitrary alternatives to the carboxylic acids disclosed in D3. Thus, following the same reasoning applied when examining the main request it is concluded that the subject-matter of claim 1 of auxiliary request I results from the obvious combination of D1/D1a with D3 and that this request is not allowable either.

4. Auxiliary request II

In comparison with claim 1 of the previous request, the subject-matter of claim 1 of auxiliary request II comprises the additional feature:

"wherein at least parts of part c) is a functionalized PVAc".

There is no evidence that the inclusion of this polymer is associated with any new technical effect. Furthermore, this polymer is disclosed in D3 (page 6, line 1 and page 8, lines 10-19, page 13, table 2 and claim 15). Thus, following the reasoning applied when examining the previous requests, it is concluded that the subject-matter of claim 1 of auxiliary request II results from the obvious combination of D1/D1a with D3 and that this request is not allowable either.

5. Auxiliary request III

In comparison with claim 1 of the previous request, the subject-matter of claim 1 of auxiliary request III comprises the additional feature:

"wherein the amount of resorcinol in the adhesive system is from 3 to 10% by weight".

The adhesive system disclosed in claim 1 of D1/D1a contains 0.5 to 8 parts by weight in addition to 5 to 20 parts by weight of a urea and 100 parts by weight of a formaldehyde-based thermosetting resin. This corresponds to a range from 0.4 to 7 wt% of resorcinol, which means that the amount of resorcinol in the system of D1/D1a overlaps with that of the adhesive system of claim 1 of auxiliary request III. There is also no evidence that the inclusion of this amount of resorcinol is associated with any new technical effect.

Thus, following the same reasoning applied when examining the previous requests, it is concluded that the subject-matter of claim 1 of auxiliary request III results from the obvious combination of D1/D1a with D3 and that this request is not allowable either.

6. Auxiliary request IV

In comparison with claim 1 of the previous request, the subject-matter of claim 1 of auxiliary request IV comprises the limitation that the carboxylic acid of part e) is lactic acid.

This feature is not disclosed in D3. However, as already stated above (point 3), the limitation of the carboxylic acid to lactic acid is not linked to any unexpected technical effect but rather is an arbitrary alternative to the low-molecular-weight carboxylic acids disclosed in D3 (page 7, lines 2-4 and 10-11).

Thus, following the reasoning applied when examining the previous requests, it is concluded that the subject-matter of claim 1 of auxiliary request IV results from the obvious combination of D1/D1a with D3 and that this request is not allowable either.

7. Auxiliary request V

In comparison with claim 1 of auxiliary request III, the subject-matter of claim 1 of auxiliary request V comprises the additional feature:

"wherein the urea formaldehyde resin of part a) has a molar ratio of formaldehyde to urea (F/U) of 1.1 to 1.5".

D1/D1a does neither explicitly indicate nor allow to infer the F/U ratio of the disclosed resins. This document indicates that the amount of free aldehyde in a tested resin is 2.9%. However, this does not necessarily imply, as it is apparently assumed by the respondent, that this resin contains a higher F/U ratio than that indicated in claim 1. As stated by the appellant during the oral proceedings, there is no evidence for this assumption.

Furthermore, D9 (a reference book), which illustrates the common general knowledge in this field, indicates on page 13, last paragraph of the submitted copy, that the skilled person would play around with the molar ratio of formaldehyde to urea in order to find an acceptable compromise between formaldehyde emission and bonding quality. The section of the patent in suit describing the background art (paragraphs [0004] and [0005]) and the respondent (letter dated 27 May 2016, section II) acknowledge that at the priority date of the patent in suit there was a major need for a formaldehyde urea adhesive system having good adhesive properties and low formaldehyde emission. The patent mentions earlier attempts to reduce the F/U ratio and the drawbacks of this approach (scarce gluing properties). Merely selecting a low F/U ratio without showing that the previously described drawbacks have been overcome cannot be considered inventive. Furthermore, no evidence was provided that selecting this ratio was associated with a new technical effect.

Thus, following the reasoning applied when examining the previous requests, it is concluded that the subject-matter of claim 1 of auxiliary request V

results from the obvious combination of D1/D1a with D3 and that this request is not allowable either.

8. Auxiliary request VI

In comparison with claim 1 of the previous request, the subject-matter of claim 1 of auxiliary request VI comprises the limitation that the carboxylic acid of part e) is lactic acid. As already stated (point 6 above), this limitation, which is not disclosed in D3, has not been shown to be associated with any unexpected technical effect but rather is an arbitrary alternative to the low-molecular-weight carboxylic acids disclosed in D3 (page 7, lines 2-4 and 10-11).

Thus, following the reasoning applied when examining the previous requests, it is concluded that the subject-matter of claim 1 of auxiliary request VI results from the obvious combination of D1/D1a with D3 and that this request is not allowable either.

9. Auxiliary request VII

In comparison with claim 1 of the previous request, the subject-matter of claim 1 of auxiliary request VII comprises the additional limitation that "the urea formaldehyde resin of part a) has a molar ratio of formaldehyde to urea (F/U) of 1.25 to 1.35".

This ratio is not disclosed in D1/D1a. However, there is no evidence that its selection is associated with any new unexpected technical effect. Thus, following the reasoning applied when examining the previous requests, and in particular auxiliary request V, it is concluded that the subject-matter of claim 1 of auxiliary request VII results from the obvious

combination of D1/D1a with D3 and that this request is not allowable either.

10. In summary, none of the respondent's requests is allowable.

Order

For these reasons it is decided that:

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

The Registrar: The Chairman:

D. Magliano A. Veronese

Decision electronically authenticated