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**Datasheet for the decision
of 11 September 2012**

Case Number: T 1310/10 - 3.3.09
Application Number: 01996313.1
Publication Number: 1341422
IPC: A23L 3/3571, A23C 9/12,
A21D 8/04
Language of the proceedings: EN

Title of invention:

Process for prevention of Maillard reaction in foodstuffs

Patent Proprietor:

DuPont Nutrition Biosciences ApS

Opponent:

NOVOZYMES A/S

Headword:

-

Relevant legal provisions:

EPC Art. 54, 56, 83, 123(2)
RPBA Art. 12(4), 13(3)

Keyword:

"Auxiliary requests 3 to 10 (admitted into the proceedings)"
"Experimental evidence filed after issue of summary to attend oral proceedings (not admitted - not timely filed so that the opponent had the possibility to reply)"
"Inventive step (no; none of the requests)"

Decisions cited:

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Catchword:

-



Case Number: T 1310/10 - 3.3.09

DECISION
of the Technical Board of Appeal 3.3.09
of 11 September 2012

Appellant: DuPont Nutrition Biosciences ApS
(Patent Proprietor) Langebrogade 1
Postboks 17
DK-1001 Copenhagen K. (DK)

Representative: Alcock, David
D Young & Co LLP
120 Holborn
London EC1N 2DY (GB)

Respondent: NOVOZYMES A/S
(Opponent) Krogshøjvej 36
DK-2880 Bagsvaerd (DK)

Representative: Stevens, Ian Edward
Potter Clarkson LLP
The Belgrave Centre
Talbot Street
Nottingham NG1 5GG (GB)

Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 19 April 2010
revoking European patent No. 1341422 pursuant
to Article 101(3) (b) EPC.

Composition of the Board:

Chairman: W. Sieber
Members: N. Perakis
R. Menapace

Summary of Facts and Submissions

I. This decision concerns the appeal by the proprietor of European patent No. 1 341 422 Danisco A/S (now DuPont Nutrition Biosciences ApS) against the decision of the opposition division to revoke the patent.

II. The patent was granted with 14 claims, independent claims 1 and 14 reading as follows:

"1. A process for the prevention and/or reduction of Maillard reaction in a heated foodstuff containing (i) a protein, a peptide or an amino acid and (ii) a reducing sugar, the process comprising contacting the foodstuff with an enzyme capable of oxidising a reducing group of the sugar, wherein the enzyme is contacted with the foodstuff during its preparation, or after the foodstuff has been prepared yet before the foodstuff is subjected to conditions which may result in the Maillard reaction, and the foodstuff is a dairy foodstuff, a milk based or milk containing foodstuff, a gratin, an egg based foodstuff, an egg containing foodstuff, a shallow or deep fried foodstuff, or potato; wherein the enzyme is capable of oxidising the reducing group of a monosaccharide and the reducing group of a disaccharide, and wherein the enzyme is capable of oxidising the sugar at the 1 position."

"14. Use of an enzyme for the prevention and/or reduction of Maillard reaction in a heated foodstuff containing (i) a protein, a peptide or an amino acid and (ii) a reducing sugar, wherein the enzyme is capable of oxidising a reducing group of the sugar, wherein the enzyme is contacted with the foodstuff

during its preparation, or after the foodstuff has been prepared yet before the foodstuff is subjected to conditions which may result in the Maillard reaction, and the foodstuff is a dairy foodstuff, a milk based or milk containing foodstuff, a gratin, an egg based foodstuff, an egg containing foodstuff, a shallow or deep fried foodstuff, or potato; wherein the enzyme is capable of oxidising the reducing group of a monosaccharide and the reducing group of a disaccharide, and wherein the enzyme is capable of oxidising the sugar at the 1 position."

III. The opponent, Novozymes A/S, had requested revocation of the patent in its entirety based on the grounds of Article 100(a) EPC (lack of novelty and lack of inventive step), Article 100(b) and Article 100(c) EPC. The documents filed by the opponent included the following:

- D1: D. Scott, "Glucose Conversion in Preparation of Albumen Solids by Glucose Oxidase-Catalase System", *Agricultural and Food Chemistry*, 1(11), 1953, 727-730;
- D3: WO 96/39851 A1;
- D4: US 5 626 893 A;
- D7: J. P. Borel et al, "Two dimensional paper chromatography for detection of oxidation of maltose by glucose oxidases", *J. Chromatog.*, 1971, 55, 425-428;
- D8: E.S.A. Biekman, "Toepassing van enzymen bij de verwerking van aardappelen tot consumptieproducten", *VTM Voedingsmiddellentechnologie*, 22(20), 1989, 51-53;

- D9: N. Low *et al*, "Reduction of Glucose Content in Potatoes with Glucose Oxidase, *Journal of Food Science*, 54(1), 1989, 118-121;
- D10: Z. Jiang *et al*, "Reduction of Nonenzymatic Browning in Potato Chips and French Fries With Glucose Oxidase", *Journal of Food Processing and Preservation*, 13, 1989, 175-186;
- D11: C. Poulsen *et al*, "Purification and Characterization of a Hexose Oxidase with Excellent Strengthening Effects in Bread", *Cereal Chemistry*, 75(1), 1998, 51-57;
- D14: A.G. Rand Jr, "Direct Enzymatic Conversion of Lactose to Acid: Glucose Oxidase and Hexose Oxidase", *Journal of Food Science*, 37, 1972, 698-701;
- D17: WO 96/40935 A1;
- D18: D.J. Dawson, "Fermentation Studies on Thermotolerant Starters used in High-Temperature Cheddar Cheese Manufacture", *The Australian Journal of Dairy Technology*, July-September 1958, 139-143;
- D19: M.A. Thomas, "Browning Reaction in Cheddar Cheese", *The Australian Journal of Dairy Technology*, December 1969, 185-189;
- D20: M.E. Bley *et al*, "Factors Affecting Nonenzymatic Browning of Process Cheese", *J Dairy Sci*, 68(3), 1985, 555-561;
- D21: M.E. Johnson *et al*, "Nonenzymatic Browning of Mozzarella Cheese", *J Dairy Sci*, 68(12), 1985, 3143-3147;
- D22: E. Spreer, *Milk and Dairy Product Technology*, Marcel Dekker, Inc, 1998, 22-23.

IV. The opposition division's decision, which was announced orally on 8 March 2010 and issued in writing on

19 April 2010, was based on a main request and auxiliary requests 1 to 11.

- (a) Independent claims 1 and 12 of the main request read as follows:

"1. A process for the prevention and/or reduction of Maillard reaction in a heated foodstuff containing (i) a protein, a peptide or an amino acid and (ii) a reducing sugar, the process comprising contacting the foodstuff with an enzyme capable of oxidising a reducing group of the sugar, wherein the enzyme is contacted with the foodstuff during its preparation, or after the foodstuff has been prepared yet before the foodstuff is subjected to conditions which may result in the Maillard reaction, and the foodstuff is a dairy foodstuff; wherein the enzyme is capable of oxidising the reducing group of a monosaccharide and the reducing group of a disaccharide, and wherein the enzyme is capable of oxidising the sugar at the 1 position."

"12. Use of an enzyme for the prevention and/or reduction of Maillard reaction in a heated foodstuff containing (i) a protein, a peptide or an amino acid and (ii) a reducing sugar, wherein the enzyme is capable of oxidising a reducing group of the sugar, wherein the enzyme is contacted with the foodstuff during its preparation, or after the foodstuff has been prepared yet before the foodstuff is subjected to conditions which may result in the Maillard reaction, and the foodstuff is a dairy foodstuff;

wherein the enzyme is capable of oxidising the reducing group of a monosaccharide and the reducing group of a disaccharide, and wherein the enzyme is capable of oxidising the sugar at the 1 position."

- (b) Independent claims 1 and 11 of auxiliary request 1 differ from independent claims 1 and 12 of the main request only by the additional feature "and wherein the reducing sugar is lactose".
- (c) Independent claims 1 and 14 of auxiliary request 2 are identical to independent claims 1 and 14 as granted.
- (d) The sole claim of auxiliary request 3 is identical to independent claim 14 as granted.
- (e) The sole claim of auxiliary request 4 is identical to independent claim 12 of the main request.
- (f) The sole claim of auxiliary request 5 is identical to independent claim 11 of auxiliary request 1.
- (g) The sole claim of auxiliary request 6 differs from the claim of auxiliary request 5 only in that the foodstuff is cheese.
- (h) The sole claim of auxiliary request 7 corresponds to claim 1 of auxiliary request 6, with the further specification that the cheese is mozzarella.

- (i) Independent claims 1 and 13 of auxiliary request 8 correspond to independent claims 1 and 14 as granted, with the further limitation "wherein the enzyme is hexose oxidase (EC1.1.3.5)".
- (j) The sole claim of auxiliary request 9 is identical to independent claim 13 of auxiliary request 8.
- (k) The sole claim of auxiliary request 10 corresponds to the claim of auxiliary request 9, with the further specification that the foodstuff is cheese.
- (l) Claim 1 of auxiliary request 11 corresponds to claim 1 of auxiliary request 1 with the following amendments: "... wherein the enzyme is contacted with the foodstuff ~~during its preparation, or~~ after the foodstuff has been prepared by spraying the enzyme on the foodstuff as a solution or dispersion yet before ...".

V. The opposition division's position can be summarised as follows:

- Contrary to the opponent's contention, the opposed patent meets the requirements of Article 83 EPC.
- Although the term "heated foodstuff" in claims 1 and 12 of the main request (also present in claims 1 and 14 as granted) is not explicitly disclosed in the application as filed, it is implicit in the whole disclosure of the patent that the foodstuff on which occurrence of Maillard reaction is to be prevented/reduced is a heated foodstuff. Therefore,

said term meets the requirements of Article 123(2) EPC.

- The subject-matter of claims 1 and 12 of the main request lacks novelty over the disclosure of example 7 of D4. The anticaking agent used in this example contains glucose oxidase, which is, as demonstrated in particular by D7, an enzyme capable of oxidising not only the reducing group of a monosaccharide at the 1 position but also the reducing group of a disaccharide at the 1 position.
- The subject-matter of claims 1 and 11 of auxiliary request 1 does not involve an inventive step in view of the obvious combination of D4 with D17.
- The subject-matter of claims 1 and 14 of auxiliary request 2 lacks novelty over the disclosure of D4 for the reasons given for the main request.
- Auxiliary requests 3 to 10 were not admitted into the proceedings. On the one hand they were late-filed and could not be considered as a reaction to a fresh piece of evidence or argument submitted by the opponent. On the other hand they could not be considered as *prima facie* representing a serious attempt by the proprietor to overcome the objections with regard to novelty (auxiliary requests 3 and 4) and inventive step (auxiliary requests 5 to 10).
- The subject-matter of auxiliary request 11 lacks inventive step in view of the obvious combination of D4 with D17 and common general knowledge.

VI. On 16 June 2010 the patent proprietor (hereinafter: the appellant) filed an appeal and on the same day paid the appeal fee.

VII. The statement setting out the grounds of appeal was submitted on 27 August 2010, including further documents to demonstrate that glucose oxidase was not capable of oxidising maltose.

The appellant requested reinstatement of the patent with the claims as set forth in the main request appended to the decision under appeal, or alternatively on the basis of any of the auxiliary requests appended thereto.

VIII. The opponent (hereinafter: the respondent) filed its observations on the appeal with letter dated 23 December 2010, including a further document and requesting that the appeal be dismissed. It also submitted that auxiliary requests 3 to 10, which had not been admitted by the opposition division, should remain inadmissible.

IX. With letter of 11 July 2012 the appellant filed document D41 which included a declaration from one of the inventors (Jorn Broch Søre) and the results of an experiment.

X. With letter of 30 July 2012 the respondent requested that the board exercise its discretion and refuse to admit D41 into the proceedings.

XI. Oral proceedings before the board were held on 11 September 2012. The final requests of the parties were as follows:

The appellant requested that the decision under appeal be set aside and that the patent be maintained with the claims as set forth in the main request, or alternatively on the basis of one of auxiliary requests 1 to 11, all appended to the decision under appeal.

The respondent requested that the appeal be dismissed.

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

- Contrary to the assertions of the respondent, the requests on file fulfilled the requirements of Articles 123(2), 83 and 54 EPC. In particular with regard to novelty, the subject-matter of the main request was novel over D4.
- D41, which had not been deliberately withheld, was *prima facie* highly relevant for inventive step and therefore should be admitted into the proceedings. It was so brief and simple that the respondent had had sufficient time to review and respond to it. Finally, it was clear, concise and easy to follow, so that procedural economy was not prejudiced.
- The subject-matter of the main request involved an inventive step. D4 should be considered as the closest state of the art. D4 did not disclose an

enzyme capable of oxidising the reducing group of a monosaccharide and the reducing group of a disaccharide wherein the enzyme was capable of oxidising the sugar at the 1 position.

- The skilled person looking for an alternative process for the prevention and/or reduction of Maillard reaction in a dairy foodstuff in general or in cheese, or even in mozzarella cheese, would be motivated to consider the alternative solutions disclosed in D4 itself, such as the addition of polydimethyl siloxane, the control of the pH of the foodstuff or the inclusion of emulsifying agents. Further alternative solutions could be found in D18 to D21 such as control of the starter culture, the use of calcium precipitates in the cheese manufacture, the use of regulating salts and of specific strains to ferment galactose, or even washing the curd.

- Thus the skilled person would not, without hindsight, have consulted D17 which did not relate to Maillard reaction and did not concern other dairy products than milk.

- The subject-matter of auxiliary request 1 involved also an inventive step. In addition to the reasons provided for the main request, the skilled person would not find any motivation in the prior art to use the hexose oxidase disclosed by D17, since it was known from D11 and D14, for example, that this enzyme had low affinity for lactose, the specific sugar of the foodstuff of this request. On the contrary, the skilled person would have been

motivated to use the enzyme lactase which decomposed lactose to glucose and galactose as disclosed in D4, example 7, formula 8.

- Although not admitted by the opposition division, auxiliary requests 3 to 10 had been filed with the statement of grounds of appeal and should therefore be admitted into the appeal proceedings.

 - Furthermore, the subject-matter of auxiliary requests 3 to 11 involved an inventive step for the reasons given for the main request and auxiliary request 1. In particular, regarding auxiliary request 7 it should be remarked that D17, which disclosed only milk as a dairy foodstuff, would not be considered relevant by the skilled person. Especially because during the manufacture of mozzarella cheese (the specific dairy product of this auxiliary request) only low amounts of lactose were produced (see D21, Abstract and Introduction) and the skilled person would be motivated to look for an enzyme with a high specificity for lactose rather than considering hexose oxidase with a low specificity for it.
- XIII. The relevant arguments put forward by the respondent in its written submissions and during the oral proceedings may be summarised as follows:
- Notwithstanding the other deficiencies already raised before the opposition division, the subject-matter of the main request lacked an inventive step in view of the obvious combination of D4 with D17.

- D41 should not be admitted into the proceedings because it had been filed only two months before the oral proceedings without any explanations as to why it had been filed so late. Moreover, this technical evidence was not clear, concise and easy to follow, as alleged by the appellant, and put the respondent in a disadvantageous position.

- For the issue of inventive step it should first be established what was the technical background at the priority date of the patent in suit. It was well known at that time that Maillard browning could be avoided in several types of foodstuff, including cheese, by removal of sugars using an oxidising enzyme (glucose oxidase) (see D1, D8, D9, D10 and D20). It was also known that the presence of sugars such as lactose and galactose in dairy products could cause Maillard browning (D20 and D22).

- D4, example 7, should be considered to represent the closest state of the art, as it taught the skilled person that reduction in browning was achieved through the removal of sugars by enzymes. Assuming novelty over D4 (which was not acknowledged) the enzyme preparations used in D4 differed from the claimed one because they were not capable of oxidising both a mono- and a disaccharide at the 1 position.

- The technical problem based on D4 as the closest state of the art was to provide an alternative method to prevent browning.

- Starting from D4, example 7, the skilled person would be motivated to look in the state of the art for enzymes alternative to those of D4 and would certainly consider D17. This document, which disclosed a hexose oxidase, provided a simplified enzymatic formulation compared to that of D4, since fewer enzymes would have to be used. The enzyme of D17 was effective on a broad range of sugar substrates and in view of its quality and purity was suitable for reducing the sugar content of a food product. In view of its "significant practical implication" for its action on lactose in milk it could also be used generally in dairy products.

- The subject-matter of auxiliary request 1, which specified that the reducing sugar was lactose, did not involve an inventive step for the reasons given in relation to the main request.

- The subject-matter of auxiliary request 2 also did not involve an inventive step for the same reasons as the main request.

- Auxiliary requests 3 to 10 should not be admitted into the proceedings because they had not been admitted by the opposition division. These requests failed to address the inventive step problems.

- In any case, the subject-matter of these requests lacked an inventive step in view of the obvious combination of D4 with D17, for the reasons given regarding the previous requests. D4 disclosed that the dairy foodstuff was a cheese, in particular mozzarella cheese, so that the specification of the

dairy foodstuff as mozzarella cheese in auxiliary requests 6, 7 and 10 could not overcome the inventive step objection. D17 disclosed the enzyme hexose oxidase (EC1.1.3.5) and thus the specification of this enzyme in auxiliary requests 8 to 10 could not overcome the inventive step objection either. Moreover, D17 disclosed dairy products and its disclosure was compatible with cheese such as mozzarella cheese.

- The subject-matter of auxiliary request 11 did not involve an inventive step for the reasons given by the opposition division. The step of spraying an enzyme solution or dispersion onto a foodstuff was not associated with any technical effect related to the prevention of Maillard browning in foodstuffs.

Reasons for the Decision

1. The appeal is admissible.
2. Admittance of D41
 - 2.1 With letter dated 11 July 2012, i.e. two months before the oral proceedings to be held before the board, the appellant filed document D41, including a declaration from one of the inventors accompanied by results of an experiment. The experiment had been carried out in order to further support the data in the patent regarding the technical effect of the claimed process. Specifically, it had been carried out to compare the process of the patent in suit with a process as described in D4. The appellant held that the results of

the experiment demonstrated that the claimed process was a more efficient process for preventing and/or reducing the Maillard reaction.

2.2 This technical evidence amended the appellant's case as far as the technical effect of the claimed invention is concerned. Following Article 13(3) RPBA, amendments sought after oral proceedings have been arranged - the board had issued summons to oral proceedings with a communication dated 10 May 2012 - are not admitted if they raise issues which the board or the other party (here the respondent) cannot reasonably be expected to deal with without adjournment of the oral proceedings.

2.3 According to the respondent, the appellant's late submission of D41, just two months before the oral proceedings and almost two years after the filing of the statement of the grounds of appeal, deprived it of the chance to fully consider and respond to the new experimental results by consulting its own technical experts, who were not immediately available. The board agrees with the respondent that it was not possible to understand why experiments the appellant believed to be "of such brevity and simplicity" could not have been performed sooner and the results filed earlier in order to give the respondent a chance to repeat the experiments and/or to perform its own experiments.

2.4 In the present case the board also considers that the technical evidence of the appellant was filed objectively too late, since no timely reaction from the respondent could be expected. In this context it is noted that it took the appellant two months to file D41 after the summons to oral proceedings. Even if the

respondent had filed its own experiments within a similar time period (and this is what one must expect from fair proceedings), this would have meant that the respondent's reply would have been filed somewhere near or even at the oral proceedings. This would have complicated the issue even further since neither the parties nor the board would have had time for a proper analysis of the case.

- 2.5 Under these circumstances the board declined to admit D41 into the proceedings (Article 13(3) RPBA).

Main request

3. The respondent argues that the subject-matter of the main request does not fulfil the requirements of Articles 123(2)/100(c), 83/100(b), 54 and 56 EPC. However, in the present case it is not necessary to elaborate on the first three issues for the following reason: even if the board decided on these issues in favour of the appellant, in particular with regard to novelty (namely because glucose oxidase used in example 7 of D1, as alleged by the appellant, is not capable of oxidising the reducing group of a disaccharide at the 1 position), the claimed process would still not fulfil the requirements of Article 56 EPC in view of the obvious combination of D4 with D17 as set out below.

4. Inventive step

4.1 Closest state of the art

4.1.1 The aim of the patent in suit is to reduce or prevent Maillard browning in certain foodstuffs. The patent acknowledges at paragraphs [0008] and [0009] that Maillard browning was known before the priority date and that browning could be prevented by removing sugar. It was also known that sugars could be removed by oxidation using an enzyme (D1: abstract; page 727, right hand column, lines 15-23; D8: first page, left-hand column, "Summary", lines 10-14; D9: abstract; D10: abstract). The reduction of Maillard browning via enzymatic oxidation of sugars (glucose oxidase/catalase system) has been studied not only in non-dairy foodstuffs (egg in D1; potato products in D8, D9 and D10) but also in dairy products such as cheese (D4).

4.1.2 The board in agreement with the parties considers that D4, example 7, should be considered to represent the closest state of the art since it belongs to the same technical field and has the most technical features in common with the claimed invention, and therefore constitutes the most promising springboard towards it.

D4 is directed to a method of treating a divided cheese product with an anticaking agent for improved functionality. A specific object of D4 is to provide an anticaking agent for use on cheese in the pizza pie industry, wherein the agent promotes the melt of the cheese, reduces browning, and improves flavour (column 2, lines 25-28). In column 3, lines 44-46 it is stated that browning can also be reduced by direct

addition of enzymes that remove sugars from the cheese. Thus, although the term "Maillard reaction" is not explicitly mentioned, it is immediately evident to the person skilled in the art that D4 is concerned with Maillard reaction in cheese products and the reduction thereof.

In example 7 of D4, various enzyme preparations were added to freshly diced mozzarella cheese. The pizza bake analysis in table 7 shows that browning of mozzarella cheese on baked pizza is reduced (no browning) by including an enzyme preparation, namely a mixture of glucose oxidase, galactose oxidase and catalase (formulas 6 and 7) or a mixture of glucose oxidase, galactose oxidase, lactase and catalase (formula 8).

The effect of the enzymes used in D4 on sugars is known. Thus it is known from D4 itself (column 13, lines 54-56) and D1 (bridging paragraph of pages 727/728) that glucose oxidase oxidises glucose to gluconic acid and hydrogen peroxide (i.e. glucose oxidase is capable of oxidising the reducing group of a monosaccharide at the 1 position). Galactose oxidase metabolises galactose (a monosaccharide) to D-galactohexodialdose and hydrogen peroxide, i.e. galactose oxidises at carbon 6 leaving the reducing end of the sugar unchanged (see patent in suit, page 4, line 24). Furthermore it is generally known that lactase catalyses the breakdown of lactose to glucose and galactose. Thus the presence of lactase in formula 8 of example 7 is indicative of the recognition by the authors of D4 of the need to remove also lactose in order to prevent browning. The presence of lactose in mozzarella cheese is acknowledged in the

patent in suit (see paragraph [0009]). This was also confirmed by the appellant during the oral proceedings before the board, referring to D21 in order to support this statement.

Hence the process of claim 1 differs from the disclosure of D4 in that an enzyme is used which is capable of oxidising the reducing group of both a monosaccharide and a disaccharide at the 1 position.

4.2 The technical problem

The patent in suit relates to the control of Maillard reaction in a foodstuff (paragraph [0001]). This reaction typically comprises the interaction of the nitrogen compounds with the aldehyde group of a reducing sugar or other carbonyl compounds and leads to the formation of a brown material (paragraph [0003]). The browning of the Maillard reaction is undesirable in dairy products cooked at a high temperature, as the browning reaction is not easily controlled and the brown colour becomes too dark and forms black blisters (paragraphs [0005] and [0006]). The use of a specific enzyme which oxidises the reducing group of a monosaccharide and a disaccharide at the 1 position allows the provision of a process for the prevention and/or reduction of Maillard reaction in a dairy product.

D4, example 7, already discloses a process for the control/reduction of Maillard reaction in mozzarella cheese. The pizza bake analysis in table 7 shows no browning for the enzyme preparations of formulas 6 to 8. Therefore, the objective technical problem in view of

D4 consists in providing an alternative process for the prevention and/or reduction of Maillard reaction in a dairy foodstuff. This is the problem cited by the appellant during the oral proceedings before the board and the board agrees with it.

Furthermore, the board is satisfied that the patent in suit contains technical evidence (examples 1-4, 6,7, 9-11) which shows that the technical problem is solved when the specific enzyme hexose oxidase is used. This is an enzyme known in the art for its capability to oxidise the reducing group of mono- and disaccharides at the 1 position (see D3: page 5, line 30 to page 7, line 9; D11: page 51, full left-hand column; page 54, table II; page 55, left-hand column, lines 1-9; D14: page 698, middle column, lines 8-18; page 701, left-hand column, line 15 to middle column, line 7; D17: page 1, line 8 to page 2, line 16).

4.3 Obviousness

4.3.1 The person skilled in the art starting from D4, example 7, and looking for an alternative process for the prevention and/or reduction of Maillard reaction in a dairy foodstuff would find in the state of the art the motivation to replace the enzyme preparations in formulas 6 to 8 of example 7 by hexose oxidase without the need for an inventive step.

Such a motivation is to be found in D17 disclosing the enzyme hexose oxidase, which is manufactured in industrially appropriate quantities and at a quality and purity level which renders the hexose oxidase according to D17 suitable for any relevant industrial

purpose including the manufacturing of food products such as in dairy products (abstract; page 4, lines 22-28). According to D17, hexose oxidase is capable of oxidising the reducing group of mono- and disaccharide at the 1 position (page 1, line 8 to page 2, line 16), which makes hexose oxidase useful in a method for reducing the sugar content of a food product (page 6, lines 12-17). Thus D17 suggests hexose oxidase as an appropriate enzyme to be used in preventing and/or reducing the Maillard reaction in a dairy foodstuff since this is based on the elimination of sugars from the foodstuff.

- 4.3.2 The board agrees with the respondent that example 7, table 7, demonstrates the efficiency of using enzyme preparations in mozzarella cheese. The comparison of formula 4 (without enzyme) with formulas 5 to 8 (with enzyme), in particular formulas 6 to 8 (best results with respect to browning) would motivate the skilled person to further investigate enzyme formulation in order to find alternative enzyme formulations. In doing so the skilled person would obviously consider the disclosure of D17.
- 4.3.3 The board does not accept the appellant's argument that the skilled person would not have consulted D17 because D4 itself mentions other alternatives to eliminate sugars from dairy foodstuffs. More specifically, D4 discloses that browning of cheese can be avoided by the addition of polydimethyl siloxane (example 3), by controlling the pH of the cheese (example 9) or by including emulsifying agents in the cheese (column 21, lines 1-3 and column 21, line 53 to column 22, line 3). However, the board considers the contention of the

appellant, that the skilled person would be prevented from looking in the state of the art for further alternatives and would not have consulted D17, as unfounded because no reason can be seen and the appellant has not provided any in order to explain why the skilled person looking for an alternative solution would limit himself to D4 and would ignore any other relevant prior art.

4.3.4 Also the argument of the appellant that the skilled person looking for an alternative would have rather turned to the disclosures of D18 to D21 and not of D17 is not convincing. It is not contested that D18 to D21 describe further possible alternatives in order to avoid/reduce browning in dairy products due to Maillard reaction. D18 discloses the use of specific starter cultures in cheese manufacture (page 139, left-hand column under the heading "Introduction"), D19 discloses the use of a calcium co-precipitate in processed cheese (abstract; page 188, right-hand column, last paragraph); D20 discloses controlling browning of the cheese by regulating salt and by using specific strains to ferment galactose (page 555, abstract) and D21 discloses controlling browning by washing the curd (page 3147, paragraph bridging the two columns). However, the fact that other alternatives exist does not mean that the skilled person would have ignored D17.

4.4 In view of the above considerations the board concludes that the subject-matter of claim 1 of the main request does not involve an inventive step. The same conclusion applies *mutatis mutandis* to the subject-matter of claim 12 which relates to the use of an enzyme, defined in the same manner as in claim 1, for the prevention

and/or reduction of Maillard reaction in a heated dairy foodstuff.

Auxiliary request 1

5. The subject-matter of claim 1 of this request differs from the subject-matter of claim 1 of the main request in that the reducing sugar is lactose. Thus, as pointed out by the appellant, claim 1 of auxiliary request 1 requires that lactose be present in the foodstuff and that the enzyme also be capable of oxidising the reducing group of lactose.

Notwithstanding the objections under Article 123(2) and 83 EPC maintained by the respondent, the claimed subject-matter lacks an inventive step as will be explained below.

6. Inventive step

- 6.1 D4, example 7, formula 8, should be considered to represent the closest state of the art because it is the only enzymatic preparation which also comprises the enzyme lactase. As generally known, lactase catalyses the breakdown of lactose to glucose and galactose (D17: page 2, lines 9-11). As pointed out in point 4.1 above, the presence of lactase in formula 8 is an indication of the fact that the authors of D4 already considered the need to remove lactase from the mozzarella cheese. Thus, the claimed process differs from the disclosure of D4 only in the definition of the enzyme which is required to be capable of oxidising the reducing group of the disaccharide lactose.

- 6.2 The board concurs with the appellant that the technical problem to be solved in the light of D4 has to be seen in the provision of an alternative process for the prevention and/or reduction of Maillard reaction in a dairy foodstuff containing lactose. The alternative solution provided in auxiliary request 1 is the replacement of the enzyme preparation of formula 8 of example 7 of D4 by hexose oxidase. The examples in the patent in suit provide evidence that the technical problem posed is indeed solved by the use of hexose oxidase. The mozzarella cheese used in the examples typically contains lactose (patent in suit, paragraph [0008]) and the cheese processed with hexose oxidase shows reduced browning (examples 1-4, 6,7 and 9-11).
- 6.3 The skilled person starting from formula 8 of example 7 of D4 and aiming at the provision of an alternative process for the prevention and/or reduction of Maillard reaction in a dairy foodstuff containing lactose would find in D17 the motivation to use the enzyme hexose oxidase as an alternative to the enzyme preparation of formula 8 of D4 (see in this context point 4.3.1 above). Despite its low specificity for lactose, it is explicitly stated in D17 (page 1, line 11; page 22, lines 7-30) that hexose oxidase oxidises the disaccharide lactose.
- 6.4 Contrary to the argument of the appellant, D11, D14 and D17 do not dissuade the skilled person from using hexose oxidase in view of its lower specificity for lactose in comparison to its higher specificity for other mono- and disaccharides (D11: page 55, left-hand column, lines 1-9; D14: page 700, middle column, first full paragraph; D17: page 22, lines 7-25 and page 71,

point 4.4.1). D11, for example, relates to dough and bread as substrate and is irrelevant for the claimed process which concerns dairy foodstuffs. Both D14 and D17 stress the promising characteristics of hexose oxidase which would motivate the skilled person to use this enzyme. D14 (page 701, left-hand column, lines 15-18) discloses that hexose oxidase was thought to be one of the more promising enzymes for the direct conversion of lactose to lactobionic acid in milk (i.e. a dairy foodstuff). D17 (page 2, lines 4-11) discloses that hexose oxidase is a more interesting enzyme in the case of a milk product (i.e. dairy foodstuff) than the lactose-degrading enzyme lactase, whereby the lactose is degraded to glucose and galactose. The reference to milk products in general is a clear hint for the skilled person towards the use of hexose oxidase in the mozzarella cheese of D4.

- 6.5 In view of the above considerations the board concludes that the subject-matter of claim 1 of auxiliary request 1 does not involve an inventive step. The same conclusion applies *mutatis mutandis* to the subject-matter of claim 11 which relates to the use of an enzyme, defined in the same manner as in claim 1, for the prevention and/or reduction of Maillard reaction in a heated dairy foodstuff containing lactose.

Auxiliary request 2

7. The subject-matter of claims 1 and 14 of auxiliary request 2 is admittedly broader in scope than the subject-matter of claims 1 and 12 of the main request, because the foodstuff is no longer limited to a dairy foodstuff but also includes a milk-based or milk-

containing foodstuff, a gratin, an egg-based foodstuff, an egg-containing foodstuff, a shallow or deep-fried foodstuff, or potato.

For the reasons given in point 4 above, the subject-matter of claims 1 and 14 of auxiliary request 2 does not involve an inventive step.

8. Admittance of auxiliary requests 3 to 10

8.1 Auxiliary requests 3 to 10 were originally filed before the opposition division with a letter dated 17 February 2012, i.e. two months before the oral proceedings held before the opposition division. The opposition division did not admit these request into the proceedings because these late-filed requests could not be considered as a reaction to a fresh piece of evidence or to an argument submitted earlier by the opponent and were not considered *prima facie* relevant for the purpose of overcoming the objections raised against the subject-matter of the hierarchically higher requests.

8.2 Auxiliary requests 3 to 10 were part of the appellant's submissions presented with the grounds of appeal and in accordance with Article 12(1) RPBA must be taken into account by the board. It is undisputed that Article 12(4) RPBA gives the board the power to hold inadmissible requests which were not admitted in the first-instance proceedings, as is the case in the present appeal, but that is a matter for the board's discretion. Under the present circumstances the board does not consider it appropriate to exercise this discretionary power since the non-admittance of auxiliary requests 3 to 10 by the opposition division

was based on the evaluation of whether the subject-matter of those requests fulfilled the requirements of patentability, in particular novelty and inventive step. As the appellant is normally entitled to a review of this evaluation at the appeal stage, auxiliary requests 3 to 10 were admitted into the proceedings.

Auxiliary request 3

9. The subject-matter of claim 1 of auxiliary request 3 is identical to the subject-matter of claim 14 of auxiliary request 2, which as set out in point 7 above lacks an inventive step.

Auxiliary request 4

10. The subject-matter of claim 1 of auxiliary request 4 is identical to the subject-matter of claim 12 of the main request, which as set out in point 4 above lacks an inventive step.

Auxiliary request 5

11. The subject-matter of claim 1 of auxiliary request 5 is identical to the subject-matter of claim 11 of auxiliary request 1, which as set out in point 6 above lacks an inventive step.

Auxiliary request 6

12. The subject-matter of claim 1 of auxiliary request 6 corresponds to the subject-matter of claim 1 of auxiliary request 5, with the further limitation that the foodstuff is cheese. Cheese is a well-known dairy

foodstuff, and is the foodstuff used in the closest state of the art, i.e. D4, example 7. Accordingly, the claimed subject-matter of auxiliary request 6 lacks an inventive step for the same reasons given in point 11 above in relation to auxiliary request 5.

Auxiliary request 7

13. The subject-matter of claim 1 of this request corresponds to the subject-matter of claim 1 of auxiliary request 6, further amended to specify that that the foodstuff is mozzarella cheese. Mozzarella cheese is a well-known type of cheese and its selection is not associated with an inventive step over D4 (example 7, formula 8, relates to mozzarella cheese) combined with D17. Therefore auxiliary request 7 lacks an inventive step for the same reasons as auxiliary request 6, as discussed above.

The appellant contested the relevance of D17 for mozzarella cheese and in consequence its consideration by the skilled person for the issue of inventive step. Nevertheless this document discloses the use of hexose oxidase in the manufacture of dairy products (abstract) and milk products (page 2, line 9), which implicitly comprise cheese such as mozzarella cheese. Thus, D17 would certainly be considered by the person skilled in the art.

The appellant argued that the skilled person would not consider the teaching of D17 because it does not disclose that hexose oxidase has high specificity for lactose, necessary in view of the well-known low concentration of lactose in mozzarella cheese (see D21,

abstract). The board does not accept this argument since D17 explicitly states on page 22, lines 20-25, that

"... the hexose oxidase in addition to a high specificity to hexoses and other monosaccharides also has substantial specificity for disaccharides, in particular lactose present in milk ..." (emphasis added by the board).

It is immaterial for the specificity of hexose oxidase whether the lactose is to be found in milk or in mozzarella cheese. What matters and what would be taken into consideration by the skilled person is the disclosure of the substantial specificity of hexose oxidase for lactose. Therefore in view of the above disclosure the skilled person would certainly consider D17 when looking for an alternative enzyme to the enzymatic preparation of formula 8 of example 7 of D4.

Auxiliary request 8

14. The subject-matter of claims 1 and 13 of auxiliary request 8 corresponds to the subject-matter of claims 1 and 14 of auxiliary request 2, further amended to specify that the enzyme is hexose oxidase (EC1.1.3.5). The specification of the enzyme does not result in any inventive step over the combination of documents D4 and D17, because D17 relates to this specific enzyme.

Auxiliary request 9

15. The subject-matter of claim 1 of auxiliary request 9 corresponds to the subject-matter of claim 13 of

auxiliary request 8, which for the reasons given in point 14 above fails to comply with the requirements of Article 56 EPC.

Auxiliary request 10

16. The subject-matter of claim 1 of auxiliary request 10 corresponds to the subject-matter of claim 12 of the main request, with the further limitations that the enzyme is hexose oxidase and that the foodstuff is cheese. As discussed above, cheese is a well-known foodstuff, and is the foodstuff used in the closest prior-art document D4, example 7. Furthermore the specification of the enzyme is not inventive because hexose oxidase is the enzyme mentioned in D17. Accordingly, the subject-matter of this request does not result in any inventive step over the obvious combination of documents D4 and D17, for the reasons discussed in point 15 above in relation to auxiliary request 9.

Auxiliary request 11

17. The subject-matter of claim 1 of auxiliary request 11 differs from the subject-matter of claim 1 of auxiliary request 1 in that it specifies that the enzyme is sprayed onto the foodstuff as a solution or a dispersion. As the opposition division correctly noted, the step of spraying an enzyme solution or dispersion onto a foodstuff is not associated with any technical effect. At least, no such effect has ever been mentioned, let alone demonstrated. Accordingly, auxiliary request 11 is not inventive for the same

reasons as discussed in point 5 above in relation to auxiliary request 1.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

M. Canueto Carbajo

W. Sieber