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**Datasheet for the decision of 19 September 2024**

**Case Number:** T 2650/22 - 3.3.09

**Application Number:** 12810110.2

**Publication Number:** 2775857

**IPC:** A23K10/30, A23K10/33, A23K20/189, A23K40/10, A23K40/20, A23K50/30, A23K50/75, A23K50/80, C12N9/24

**Language of the proceedings:** EN

**Title of invention:**
A FEED COMPOSITION SUPPLEMENTED WITH A XYLANASE

**Patent Proprietor:**
EW Nutrition GmbH

**Opponent:**
Novozymes A/S

**Headword:**
Feed composition with a xylanase/EW NUTRITION

**Relevant legal provisions:**
EPC Art. 100(b), 100(a), 56

**Keyword:**
Grounds for opposition - insufficiency of disclosure (no)
Inventive step - (yes)

Europäisches Patentamt
European Patent Office
Office européen des brevets

**Beschwerdekammern**

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**Case Number: T 2650/22 - 3.3.09**

# D E C I S I O N
# of Technical Board of Appeal 3.3.09
# of 19 September 2024

| | |
|---|---|
| **Appellant:** (Patent Proprietor) | EW Nutrition GmbH<br>Hogenbögen 1<br>49429 Visbek (DE) |
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| **Appellant:** (Opponent) | Novozymes A/S<br>Krogshoejvej 36<br>2880 Bagsvaerd (DK) |
| **Representative:** | Potter Clarkson<br>Chapel Quarter<br>Mount Street<br>Nottingham NG1 6HQ (GB) |
| **Decision under appeal:** | **Interlocutory decision of the Opposition Division of the European Patent Office posted on 21 October 2022 concerning maintenance of the European Patent No. 2775857 in amended form.** |

**Composition of the Board:**

| | |
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| **Chairman** | A. Haderlein |
| **Members:** | F. Rinaldi |
| | A. Jimenez |

## Summary of Facts and Submissions

I. This decision concerns the appeals filed by the patent proprietor and the opponent against the opposition division's interlocutory decision that European patent as amended met the requirements of the EPC.

II. With the notice of opposition, the opponent had requested that the patent be revoked under Article 100(a) (lack of inventive step) and (b) EPC.

III. The documents submitted during the opposition proceedings included:

D1: C. Winterhalter *et al.*, "Two extremely thermostable xylanases of the hyperthermophilic bacterium Thermotoga maritima MSB8", Applied and environmental microbiology 61(5), 1995, 1810-5

D2a: F. Robb *et al.*, "Thermophiles: Biology and Technology at High Temperatures", Chapter 8, Boca Raton: CRC Press, 1st edn., 2007, 113-60

D4: DE 195 31 944 A1

D5: WO 2010/083518 A2

D6: T. V. Velikodvorskaya *et al.*, "Purification and some properties of *Thermotoga neapolitana* thermostable xylanase B expressed in *E. coli* cells", Biochemistry (Moscow) 62(1), 1997, 66-70

D7: WO 02/38746 A2

D2 is an excerpt of chapter 8 of D2a and consists of pages 113 to 120.

IV. In the decision under appeal, the main request (patent as granted) was found to be sufficiently disclosed, and the subject-matter of claim 1 was found to lack inventive step starting from the enzyme TH4 of D5 as the closest prior art.

V. On appeal, the patent proprietor filed several auxiliary requests. Relevant for this decision are only claims 1, 10, 11 and 13 of the patent as granted (main request), which have the following wording:

"1. *An animal feed being selected from the group consisting of silage, pelletized feed and mash feed, the said animal feed being supplemented with a composition comprising a xylanase, wherein the said xylanase is hyperthermophilic and hyperthermostable, wherein the optimum temperature of the xylanolytic activity present in the said composition is higher than 80°C, wherein more than 70% of the xylanolytic activity present in the said composition is resistant to 30 minutes of heating at 90°C and wherein the ratio of activity of the xylanolytic activity present in the said composition at optimal temperature and at 40°C is higher than 10*."

"10. *Use of a hyperthermophilic and hyperthermostable xylanase for improving the body weight gain and/or the feed conversion ratio in an animal, wherein the said hyperthermophilic and hyperthermostable xylanase has a temperature optimum higher than 80°C, wherein more than 70% of the xylanolytic activity of the said hyperthermophilic and hyperthermostable xylanase is resistant to 30 minutes of heating at 90°C and wherein the ratio of activity at optimal temperature and at 40°C of the said*

*hyperthermophilic and hyperthermostable xylanase is higher than 10, wherein the use is a non-therapeutical use.*"

"11. *Use of the animal feed according to any of the preceding claims 1 to 9 in improving the body weight gain and/or the feed conversion ratio in an animal, wherein the use is a non-therapeutical use.*"

"13. *A method to produce the animal feed according to any of the preceding claims 1 to 9 comprising the steps of*

*a) selecting a feed comprising hemicellulose;*
*b) adding a composition comprising hyperthermophilic and hyperthermostable xylanase, wherein more than 30 70% of the xylanolytic activity present in the said composition is resistant to 30 minutes of heating the said composition at 90°C, wherein the optimum temperature of the xylanolytic activity present in the said composition is higher than 80°C, and wherein the ratio of activity of the xylanolytic activity present in the said composition at optimal temperature and at 40°C is higher than 10.*"

VI. The opponent's arguments relevant to the present decision are summarised as follows.

- The invention was not sufficiently disclosed over the entire scope of the claims. There were enzymes similar to or identical with the ones disclosed in the patent which did not exhibit the xylanolytic activities required by claim 1.
- The subject-matter of claims 1, 10, 11 and 13 lacked an inventive step starting from the enzyme TH4 of D5 as the closest prior art. The technical

problem was to provide a further enzyme with xylanolic activity, and the solution would have been obvious to the skilled person. In addition, D2, D4 and the enzyme TH1 of D5 could be used as starting points for assessing inventive step and also led to the conclusion that the invention was obvious.

VII. The patent proprietor's arguments relevant to the present decision are summarised as follows.

- The invention was sufficiently disclosed. The patent showed that an enzyme according to claim 1 achieved the effects described in the patent.
- The subject-matter of claims 1, 10, 11 and 13 involved an inventive step. Supplementing an animal feed with an enzyme with the xylanolytic activities required by claim 1 caused a higher body weight gain and an improved feed conversion ratio in the animal fed with it. This measure was not suggested by the prior art and would not have been expected by the skilled person.

VIII. Final requests

The patent proprietor requested that the decision under appeal be set aside and that the patent be maintained as granted (main request) or, alternatively, that the patent be maintained on the basis of one of auxiliary requests AR1 to AR9 filed with the statement setting out the grounds of appeal.

The opponent requested that the decision under appeal be set aside and that the European patent be revoked.

## Reasons for the Decision

1. *Patent and features of the claims*

1.1 The patent in suit relates to an animal feed composition supplemented with a hyperthermostable and hyperthermophilic xylanase (paragraph [0001]).

1.2 Claims 1, 10 and 13 of the patent in suit concern a xylanase having the following three xylanolytic properties which can be regarded as definitions of the terms hyperthermostable and hyperthermophilic.

(a) The optimum temperature of the xylanolytic activity is higher than 80°C.

(b) More than 70% of the xylanolytic activity is resistant to 30 minutes of heating at 90°C.

(c) The ratio of xylanolytic activity present at optimum temperature to that present at 40°C is higher than 10.

The designations (a), (b) and (c) will be used in the following when referring to the characteristics (or features) of the xylanolytic activity required by claim 1.

1.3 In the patent, xylanolytic activity refers to an enzyme's ability to hydrolyse internal glycosyl bonds linking xylose residues in xylose-containing polysaccharides, in particular beta-1,4-glycosyl bonds in beta-D-xylopyranosyl-1,4-beta-D-xylopyranosyl units of such polysaccharides (see paragraph [0030]).

2. *Main request - sufficiency of disclosure*

2.1 In the decision under appeal, the opposition division concluded that the invention as set out in the claims as granted was sufficiently disclosed. The patent described how the enzymatic activity and stability was to be measured using routine experiments. The xylanases from D4 and D5 allegedly showing that the invention was not enabled did in fact not correspond to xylanases as defined in claim 1. The experiments in Tables 2 and 4 of the patent demonstrated the improvements in body weight gain and feed conversion ratio in the animal receiving the feed with the xylanase.

2.2 The opponent contested this conclusion. In its view, the invention was not sufficiently disclosed over the entire scope of the claim. The reasons were as follows.

2.2.1 One of the xylanases of D4 (amino acid sequence of claim 9 of D4) exhibited 100% identity in amino acids 29 to 345 with one of the preferred xylanases of the patent in suit (SEQ.ID.NO:4). But the xylanase of D4 did not fulfil feature (c) of claim 1. This was derivable from the scientific publication D6 (page 67, right column and Figure 3b), in which properties of a xylanase identical to that of D4 were examined. It was not relevant that claim 9 of D4 did not disclose the first 28 amino acids of the xylanase because this part of the sequence was not responsible for the enzyme's catalytic activity.

2.2.2 Xylanase TH1 of D5 was structurally very similar to the only xylanase tested and exemplified in the opposed patent (98.6% sequence identity to SEQ.ID.NO:1 of the

patent in suit). Nevertheless, TH1 did not fulfil all features of claim 1.

2.2.3 The only exemplified xylanase of the patent had parameters far remote from the features of claim 1, in particular from feature (c). Thus, the scope of the claim was not commensurate with the purported contribution to the art.

2.2.4 Finally, considering that the xylanase of D4 was very similar to that of the patent and yet did not fulfil feature (c), undue experimentation was required to carry out the invention over the whole scope.

2.3 However, the opponent's arguments are not convincing.

2.4 The patent discloses the amino acid sequence of a xylanase XynB (derived from *Thermotoga maritima* MSB8, i.e. SEQ.ID.NO:1) which exhibits the xylanolytic activity with the characteristics (a), (b) and (c) required by claim 1. Thus, the skilled person is provided with one working embodiment of the invention. The patent demonstrates in Examples 2 and 3 that when this xylanase is added to animal feed, chickens fed with this enzyme show a higher body weight gain and an improved feed conversion ratio compared to those fed with a xylanase that does not exhibit features (a), (b) and (c).

2.5 Therefore, the central aspect of the patent's invention is enabled. This is also not contested. The question is in how far the generalisation of the invention is justified.

2.6 As to the argument that the xylanase of SEQ.ID.NO:4 of the patent did not exhibit feature (c), it is

uncontested that the xylanase with the amino acid sequence of claim 9 of D4 exhibits 100% identity in amino acids 29 to 345 with the one of SEQ.ID.NO:4 of the patent in suit. However, while the sequence in the patent discloses the N-terminal domain of the enzyme (in particular, the first 28 amino acids), the sequence in claim 9 of D4 does not.

2.7 D4 relates to two different xylanases and their uses. D4 teaches that there are endo-xylanases with an optimum temperature of at least 100°C which are used for cooking processes and endo-xylanases with a lower optimum temperature which are used in animal feeding. The thermostability of the xylanase enzymes investigated is stated to be determined by the N-terminal domain of the enzyme (D4, page 3).

2.8 The opponent argued that the first 19 of the 28 amino acids of the sequence SEQ.ID.NO:4 concerned a signal peptide that is cleaved when the enzyme is exported. However, this does not apply to the remaining amino acids of the first 28 amino acids. Thus, claim 9 of D4 does not disclose the N-terminal domain of the enzyme. This domain is responsible for the thermostability of the enzyme.

2.9 A central statement in the opponent's line of argument, which was repeated at the oral proceedings, is that the xylanase with the amino acid sequence of claim 9 of D4 and the xylanase investigated in D6 were the same. The opponent based its statement on an affirmation made by the patent proprietor on D4 and D6 during the examination proceedings before the examining division of the application leading to the patent in suit.

2.10 However, as the xylanase with the amino acid sequence of claim 9 of D4 on the one hand and the enzyme with SEQ.ID.NO:4 of the patent on the other hand do not have the same N-terminal domain, they are not the same enzymes.

2.11 Therefore, the fact that the xylanase with the amino acid sequence of claim 9 of D4 allegedly does not exhibit the xylanolytic activity's characteristic (c), as allegedly demonstrated by D6, does not allow concluding whether the enzyme with SEQ.ID.NO:4 of the patent achieves this activity. On the contrary, given the teaching of D4, it may be assumed that the N-terminal domain has an influence on the xylanolic activity's characteristics required by claim 1; all these characteristics concern aspects of thermostability.

2.12 To conclude, the board is not convinced that the enzyme with SEQ.ID.NO:4 of the patent does not exhibit feature (c) of claim 1.

2.13 With respect to the remaining arguments of the opponent that the claimed scope was too broad, the following observations are made.

2.14 Apart from the working example discussed above, the patent discloses further suitable variants of the enzyme that the skilled person may use to identify xylanases according to claim 1. It is true that the skilled person would have to perform experiments to confirm that the enzyme selected indeed exhibits the xylanolytic activity's characteristics (a), (b) and (c) required by claim 1. The skilled person may even encounter failure. However, the board agrees with the opposition division's assessment that testing whether

an enzyme exhibits the xylanolytic activity's characteristics (a), (b) and (c) would be a routine experiment for the skilled person. Documents D1, D5 and D6 confirm this. Therefore, no undue burden can be identified.

2.15 By the same token, the fact that xylanase TH1 of D5 is structurally very similar to xylanase XynB of the patent in suit does not prove the opponent's point that there is "something fundamentally flawed with the disclosure in the opposed patent, especially in the context of the breadth of the claims". Nor is it relevant in this context that the xylanolytic activity's characteristics (a), (b) and (c) found for XynB, while covered by claim 1, was allegedly far remote from the boundaries of the ranges of xylanolytic activity required by claim 1.

2.16 In sum, the claims of the invention directed at adding a hyperthermophilic and hyperthermostable xylanase to an animal feed to achieve the feeding effects demonstrated are not considered to be overly broad.

2.17 Therefore, as the opposition division correctly concluded, the ground for opposition under Article 100(b) EPC does not prejudice the maintenance of the patent as granted.

3. *Main request - inventive step*

3.1 The opposition division concluded that the subject-matter of claim 1 lacked inventive step. The reasoning can be summarised as follows.

- The example using enzyme TH4 of D5 was the most suitable starting point for examining inventive

step. It disclosed a xylan-degrading enzyme for animal feed which was hyperthermophilic and hyperthermostable.

- The subject-matter of claim 1 differed from TH4 of D5 only in that the optimum temperature of the xylanolytic activity was higher than 80°C.
- No technical effect was apparent for this difference. The problem was therefore regarded as providing an alternative animal feed supplemented with xylanase.
- The solution of choosing a xylanase with an optimum temperature of xylanolytic activity higher than 80°C was obvious in view of D5 alone.

3.2 The patent proprietor contested this finding. In its view, the opposition division erred specifically in that it did not correctly construe the content of D5. The opponent agreed with the opposition division that the enzyme TH4 of D5 was the closest prior art and that the invention lacked an inventive step. In addition, the opponent considered documents D2 and D4 and enzyme TH1 of D5 a suitable starting point for assessing inventive step.

3.3 Selection of the closest prior art

3.3.1 D5 relates to hemicellulase enzymes which degrade (i.e. cleave chemical bonds of) hemicellulose. This term denotes a group of various polysaccharides. In D5, hemicellulase enzymes are also referred to by the generic term xylanase enzymes. The hemicellulase enzymes of D5 belong to the following five different classes of enzymes: xylanase (within its conventional, specific meaning of an enzyme that digests xylan), laminarase, mannanase, arabinase and

arabinofuranosidase. Each enzyme cleaves a different chemical bond present in a specific polysaccharide.

3.3.2 The opponent argued that all enzymes disclosed in D5 were suitable for use in animal feed and referred to the following passage in support:

"*In addition, a variety of non-pulp applications exist for the enzymes. For example, the thermostable xylanase molecules of the present invention have a physiological temperature and pH optima such that they are useful as animal feeds additives since they can withstand the heat associated with feed sterilization and pellet formation*." (D5, page 5, lines 13 to 17)

3.3.3 The disclosure of this passage has to be read in context. The term "xylanase molecules" in this passage refers to the enzymes of the invention, i.e. the hemicellulase enzymes belonging to the several groups described in D5.

3.3.4 When the disclosure of D5 turns to describing each enzyme mentioned in it individually, xylanase (within its conventional, specific meaning of an enzyme that digests xylan) is described as being used in paper bleaching to remove hemicellulose and cross-linked lignin (page 6, lines 19 to 21). The xylanase exemplified is TH1, which is described as an enzyme that digests wheat arabinoxylan.

3.3.5 Arabinase is described starting on page 5, line 25. This enzyme is disclosed to be used in the treatment of plant material for use in animal feed, among other applications. The arabinase exemplified is TH4, which is described to digest L-arabinose containing

polysaccharides such as sugar beet arabinan, debranched arabinan and wheat arabinoxylan.

3.3.6 Among the enzymes disclosed in D5, the suitable starting point for addressing the problem of the patent in suit must be an enzyme that is disclosed to be used in animal feed applications and ideally is included in an animal feed. TH4 at least mentions the suitability of the enzyme for treating plant material for use in animal feed. It follows from this that TH4, not TH1, is the suitable starting point.

3.3.7 Turning to D4, the opponent considered a hyperthermophilic xylanase disclosed in D4 to be a starting point. As explained above in section 2.7, D4 discloses endo-xylanases with low temperature stability for use in animal nutrition. If the skilled person were to use this document as a starting point, they would not use the endo-xylanases with a high temperature optimum. Doing this would be contrary to the teaching of the alleged closest prior-art document itself. In view of this, D4 - and in particular the hyperthermophilic xylanase disclosed in it - is not a suitable starting point for assessing inventive step.

3.3.8 D2 is a chapter from a handbook on thermophile enzymes. It summarises information collected from a multitude of scientific publications. Although D2 suggests using robust xylanases for various biochemical applications, including as a food additive for poultry, it discloses no specific xylanase, let alone the one from *Dictyoglomus thermophilum*. In this respect, D2 is even more generic and remote from the subject-matter of claim 1 than D4. Therefore, D2 is not a suitable starting point for assessing inventive step.

3.3.9 To conclude, as the opposition division correctly assessed, enzyme TH4 of D5 is the closest prior art.

3.4 Distinguishing features, effect and problem

3.4.1 It was in dispute whether TH4 is a xylanolic enzyme and whether it exhibits the xylanolytic activity's characteristics (a), (b) and (c) called for in claim 1.

3.4.2 The opponent based its assessment that TH4 was a xylanolytic enzyme on two separate facts. Firstly, the patent in suit (paragraph [0007]) as adapted at the grant stage acknowledged that the enzyme TH4 in the document now cited as D5 had xylanase activity. Secondly, in view of Table II of D5, the enzyme TH4 performed a strong enzymatic activity (mM reducing sugar/mg protein/hour at 80°C, pH 6; 0.2% of specific substrate) on wheat arabinoxylan. This was the same polysaccharide digested by xylanase TH1. The specific activity for wheat arabinoxylan disclosed in Table II for TH1 and TH4 was similar. Therefore, TH4 had to be regarded as an enzyme with xylanolytic activity.

3.4.3 As to the first line of argument, the board's view is that the disclosure of an original document (in this case D5) prevails over the summary of the document added to a patent description at the grant stage. There is no reason to stick to an imprecise summary if evidence is provided that an error exists. As the patent proprietor explained, the information that TH4 was a xylanase was made in error during the adaptation of the description of application. In view of the following considerations, it is not expedient to conclude on how such an error impinges on the interpretation of the prior-art document D5.

3.4.4 The second line of argument was developed by the opponent in a letter filed after the notification of the board's communication under Article 15(1) RPBA. The proprietor objected to the admittance of this line of argument. However, the board sees in the explanation given by the opponent nothing more than a further development of its view that TH4 was a xylanase. This argument is based on data disclosed in Table II and Table III of D5. These tables have been discussed throughout the appeal proceedings in the context of the activity that TH1 and TH4 exhibit. Thus, there is no reason to disregard this argument.

3.4.5 On the substance of the objection, the board agrees with the patent proprietor that it is not unequivocal whether TH1 and TH4 cleave the same chemical bonds of wheat arabinoxylan. It is not unlikely that the xylanase TH1 cleaves the xylan backbone of this polysaccharide, whereas the arabinase TH4 cleaves the arabinose moiety on the side chain of this polysaccharide. Although TH1 and TH4 digest the same polysaccharide and release reducing sugars from it, it is entirely conceivable that the enzymatic activity measured and shown in Table II concerns the ability of these two enzymes to cleave different chemical bonds.

3.4.6 Be that as it may, the relevant question for identifying the distinguishing features of claim 1 is whether D5 directly and unambiguously discloses that TH4 exhibits the xylanolytic activity's characteristics (a), (b) and (c).

3.4.7 Table II of D5 shows that TH4 digests three different polysaccharides, namely sugar beet arabinan, debranched arabinan and wheat arabinoxylan. Instead, TH1 digests

only wheat arabinoxylan and none of the other polysaccharides tested.

3.4.8 Table III of D5 discloses for all enzymes examined only one specific enzymatic activity (mM reducing sugar/mg protein/hour at pH 6; 0.2% of specific substrate), measured at the enzyme's temperature optimum and at 25°C, 42°C and 55°C.

3.4.9 Given that TH4 digests three different substrates, there is no unambiguous disclosure as to what polysaccharide substrate was used for establishing the values of Table III relative to TH4. In view of the fact that enzyme TH4 is described as an arabinase, there is no reason to assume that the specific activities were measured for wheat arabinoxylan, let alone that they refer to a possible xylanolytic activity of the enzyme.

3.4.10 The same consideration apply to Figure C1 of D5, which in the opponent's view disclosed the resistance to heating at 90°C of the enzyme TH4 (i.e. feature (b) of claim 1). Here again, there is no reason to believe that the specific activity concerns a possible xylanolytic activity of the enzyme TH4 defined as an arabinase.

3.4.11 Therefore, there is no evidence that TH4 exhibits the xylanolytic activity's characteristics (a), (b) and (c) required by claim 1. In other words, the distinguishing features of claim 1 over TH4 are at least the aforementioned characteristics.

3.4.12 As explained above under sufficiency of disclosure (see section 2.4), the patent demonstrates that when a xylanase according to claim 1 is added to an animal

feed, chickens fed with this enzyme have a higher body weight gain and an improved feed conversion ratio. A xylanase that does not exhibit the xylanolytic activity's characteristics (a), (b) and (c) does not perform as well.

3.4.13 Whether features (a), (b) and (c) are directly responsible for causing a higher body weight gain and feed conversion rate is not the crucial point. It suffices that if a xylanase complies with features (a), (b) and (c), the effect of higher body weight gain and feed conversion rate is observed. There is no proof to the contrary. Under these circumstances, the board is satisfied that the effects discussed are obtained and can be taken into account in formulating the problem.

3.4.14 Therefore, the problem to be solved is considered to be to provide an animal feed for improving the body weight gain and/or the feed conversion ratio in an animal (see also patent in suit, paragraph [0014]).

3.5 Non-obviousness

3.5.1 Based on the teaching of the prior art, the skilled person would not have expected that a hyperthermophilic and hyperthermostable xylanase exhibiting features (a), (b) and (c) provides the effects identified in the patent.

3.5.2 The opponent argued that the skilled person would have arrived at the subject-matter of claim 1 using the teaching of the prior art, in particular D2 or D7. However, no convincing arguments were presented as to why the skilled person starting from TH4 would have been prompted to select a xylanase as defined in claim 1 with the aim to solve the problem. No link can

be seen that would have led the skilled person to use a xylanase disclosed in D7 (on page 32, within a long list of xylanases) or the *Thermotoga* xylanases listed in Table 8.1 of D2. These xylanases are disclosed in D2 for pulp bleaching, as is clear from the references 189, 190 and 3, i.e. the scientific publications that describe these *Thermotoga* xylanases.

3.5.3 To conclude, the subject-matter of claim 1 would not have been obvious to the skilled person. The same applies to the subject-matter of claims 10, 11 and 13, which also encompass the features (a), (b) and (c) of claim 1.

3.6 Thus, the ground for opposition under Articles 100(a) and 56 EPC does not prejudice the maintenance of the patent as granted.

**Order**

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

1. The decision under appeal is set aside.

2. The patent is maintained as granted.

The Registrar: The Chairman:

K. Götz-Wein A. Haderlein

Decision electronically authenticated