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**Datasheet for the decision  
of 23 August 2016**

**Case Number:** T 0823/12 - 3.3.02  
**Application Number:** 08756561.0  
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A01K67/027, C12N5/10  
**Language of the proceedings:** EN

**Title of invention:**

POLYPEPTIDES HAVING CELLULOLYTIC ENHANCING ACTIVITY AND  
POLYNUCLEOTIDES ENCODING SAME

**Applicant:**

Novozymes, Inc.

**Headword:**

Glycosyl hydrolase/NOVOZYMES

**Relevant legal provisions:**

EPC Art. 56

**Keyword:**

Inventive step - obvious alternative

**Decisions cited:**

**Catchword:**



**Beschwerdekammern**  
**Boards of Appeal**  
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Case Number: T 0823/12 - 3.3.02

**D E C I S I O N**  
**of Technical Board of Appeal 3.3.02**  
**of 23 August 2016**

**Appellant:** Novozymes, Inc.  
(Applicant) 1445 Drew Avenue  
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**Representative:** Potter Clarkson LLP  
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**Decision under appeal:** Decision of the Examining Division of the  
European Patent Office posted on 14 November  
2011 refusing European patent application No.  
08756561.0 pursuant to Article 97(2) EPC.

**Composition of the Board:**

**Chairman** U. Oswald  
**Members:** T. Sommerfeld  
M. Blasi

## Summary of Facts and Submissions

- I. The appeal lies from the decision of the examining division according to which European patent application 08756561.0, based on an international application published as WO 2008/148131, was refused under Article 97(2) EPC.

The examining division decided that none of the requests on file fulfilled the requirements of Article 56 EPC.

- II. The applicant (hereinafter the appellant) lodged an appeal against the decision of the examining division, requesting that the decision be set aside and that a patent be granted according to the main claim request or, alternatively, according to auxiliary requests 1, 2 or 3, all filed with the grounds of appeal. New documents D3 to D12 and Annexes 1 and 2 were also filed at the same time.

The **main request** comprises 12 claims. Claim 1 reads as follows:

"1. An isolated polypeptide having cellulolytic enhancing activity, selected from the group consisting of:

(a) a polypeptide comprising an amino acid sequence having at least **80%** identity to the mature polypeptide of SEQ ID NO: 2;

(b) a polypeptide encoded by a polynucleotide that hybridizes under at least high stringency conditions with (i) the mature polypeptide coding sequence of SEQ ID NO: 1 or (ii) a full-length complementary strand of (i);

(c) a polypeptide encoded by a polynucleotide comprising a nucleotide sequence having at least **80%** identity to the mature polypeptide coding sequence of SEQ ID NO: 1." [emphasis added by the board]

Claim 1 of **auxiliary requests 1 and 2** differs from claim 1 of the main request in that the percentage identities read, respectively, "at least **90%** identity" and "at least **95%** identity". [emphasis added by the board].

**Auxiliary request 3** consists of two claims which derive from claims 11 and 12 of the main request:

"1. A method for degrading or converting a cellulose-containing material, comprising: treating the cellulose-containing material with a cellulolytic enzyme composition in the presence of the polypeptide having cellulolytic enhancing activity selected from the group consisting of ...[*definition according to claim 1 of the main request*], wherein the presence of the polypeptide having cellulolytic enhancing activity increases the degradation of cellulose-containing material compared to the absence of the polypeptide having cellulolytic enhancing activity.

2. A method for producing a fermentation product, comprising:

(a) saccharifying a cellulose-containing material with a cellulolytic enzyme composition in the presence of the polypeptide having cellulolytic enhancing activity selected from the group consisting of ...[*definition according to claim 1 of the main request*], wherein the presence of the polypeptide having cellulolytic enhancing activity increases the degradation of cellulose-containing material compared to the absence

of the polypeptide having cellulolytic enhancing activity;

(b) fermenting the saccharified cellulose-containing material of step (a) with one or more fermentating microorganisms to produce the fermentation product; and  
(c) recovering the fermentation product from the fermentation."

- III. The board sent a communication pursuant to Rule 100(2) EPC and Article 17(1) RPBA, wherein it expressed a preliminary non-binding negative opinion as regards inventive step.
- IV. The appellant filed a reply to the board's communication setting out its arguments and maintaining its requests; a new document numbered D13 was also filed.
- V. The board issued a summons to oral proceedings, without an accompanying communication.
- VI. The oral proceedings took place as scheduled. At the end of the oral proceedings, the chairman announced the decision of the board.
- VII. The documents cited in the examination and appeal proceedings include the following:
- D1 WO 2005/074647
  - D3 Din et al. 1991, Biotechnol. 9, 1096-1099
  - D4 Baker et al. 2000, Applied Biochem. and Biotechn. 217-223
  - D5 Saloheimo et al. 2002, Eur.J.Biochem. 269, 4202-4211
  - D6 WO 2005/067531
  - D7 Mosier et al. 2005, Bioresource Technol. 96,

673-686

D9 Henrissat and Davies 1997, *Curr. Opin. Struct. Biol.* 7, 637-644

D10 Lev and Horwitz 2003, *The Plant Cell* 15, 835-844

D11 Amino acid sequence corresponding to D10

D12 WO 2004/031378

D13 Witness Statement of Paul Harris, dated 19.05.15

VIII. The appellant's arguments, in so far as relevant to the present decision, may be summarised as follows:

Glycosyl hydrolase family 61 (GH61) was one of 60 different families of glycosyl hydrolases (D9), and not all its members - even from the same organism - possessed a cellulolytic enhancing activity (D13, paragraphs 7 and 8, and figure in-between). The technical problem in view of D1 could be formulated as the provision of a polypeptide with cellulolytic enhancing activity which was at least as good as that of D1: an alternative to the GH61B polypeptide disclosed in D1 but not in relation to other polypeptides of D1 which performed worse (Annex 2, Figure 2). The technical problem was solved by the claimed solution (Example 16 of the application). The solution was not obvious from D1, which disclosed many other organisms as possible sources: page 22, from line 7 on. Moreover, D1 disclosed different approaches to identification of the GH61 polypeptides in *Thielavia terrestris* (Example 1, page 84, line 12; Examples 8 to 11), and was thus an exhaustive investigation. Even if one expected that more glycosyl hydrolase genes could be found, these would not necessarily be members of the GH61 family, let alone have a cellulolytic enhancing activity comparable to the one of D1's GH61B. Furthermore, D1 disclosed protein motives (page 13) which were also common to other enzymes, such as e.g.

the endoglucanase of D10/D11. In fact, several endoglucanases and other proteins had sequence similarity to the SEQ ID NO:2 of the application (Annex 1).

As regards auxiliary requests 1 and 2, the higher degree of sequence identity served to take the claimed subject-matter even further away from the sequences of D1 and to narrow the scope. Claim 1 of auxiliary request 3, on the other hand, was directed to a method for conversion of cellulose material, thus focusing more narrowly on the effect of the polypeptide (shown in Annex 2).

- IX. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the claims of the main request or, alternatively, on the basis of auxiliary requests 1, 2 or 3, all filed together with the statement of the grounds of appeal.

### **Reasons for the Decision**

1. The appeal is admissible.
2. Main request - Inventive step
  - 2.1 The present application is directed to polypeptides (and corresponding polynucleotides) having cellulolytic enhancing activity which can be used in methods for conversion of cellulose into ethanol. It provides a polypeptide with the amino acid sequence displayed in SEQ ID NO:2 and which is encoded by a polynucleotide with the nucleotide sequence displayed in SEQ ID NO:1.



Such polypeptide, designated GH61F, was identified and cloned from the filamentous fungus *Thielavia terrestris* NRRL 8126 (Examples 1 to 6) and shown to possess cellulolytic enhancing activity (Example 16, in particular Table 1 on page 98 and the following paragraphs, i.e. page 98, line 17 to page 99, line 7).

- 2.2 Document D1 is directed to the same purpose as the patent application, namely it is also directed to polypeptides (and corresponding polynucleotides) having cellulolytic enhancing activity which are to be used in methods for conversion of cellulose into ethanol. Document D1 is thus a suitable starting point for the assessment of inventive step.
- 2.3 The difference with respect to the present application is that other polypeptides (with different structural features, as evidenced by their amino acid sequence) are disclosed in D1. From the application it is not apparent that the polypeptide claimed has any enhanced properties or any unexpected properties in relation to the polypeptides of the closest prior art D1. Also, the post-published evidence submitted as Annex 2 (Figures 1 and 2) shows that while GH61F performs better than D1's GH61D, its activity is similar to that of D1's GH61B. As such, the technical problem has to be formulated as the provision of an alternative polypeptide with cellulolytic enhancing activity. The solution proposed by the application is the polypeptide as claimed. In view of the experimental data of the application (in particular Example 16 starting on page 96), it is plausible that the problem has been solved.
- 2.4 It has next to be assessed whether or not the skilled person would arrive at the claimed solution in an obvious way.

2.5 When attempting to solve the problem of providing alternative polypeptides with cellulolytic enhancing activity, the skilled person would *a priori* know that several alternative solutions were possible. Starting from D1, which had already disclosed the identification and cloning of five such polypeptides from the fungus *Thielavia terrestris* (Examples 1 to 12, starting on page 80; Example 24 starting on page 119) and their successful use in methods for cellulose conversion (Examples 25 to 28, starting on page 123), the skilled person would be motivated to use this fungus as a potential source for further polypeptides with cellulolytic enhancing activity, thereby having a reasonable expectation of success of arriving at a solution to the objective technical problem. For this, the skilled person would just have to repeat the experimental procedure of D1, namely the production of an EST cDNA library, then analysis of sequence homology of the assembled EST sequences against various databases and finally identification of those genes which had hits against known glycosyl hydrolase genes encoding for polypeptides with cellulolytic enhancing activity. This is what the inventors have done (application, Examples 1 to 4, which are in fact almost completely identical to Examples 1, 8, 9 and 10, respectively, of D1). While there was no guarantee that new genes would be identified, the fact that D1 had already disclosed that 13 genes from the assembled EST sequences had hits against known glycosyl hydrolase genes (Example 10 on page 97, second paragraph) justified the reasonable expectation that there were more glycosyl hydrolase genes in *Thielavia terrestris* than the five which were cloned in D1.

2.6 The board thus comes to the conclusion that claim 1 does not involve an inventive step (Article 56 EPC).

2.7 The appellant argued that a number of other prior art documents were available (e.g. D3 to D7) which indicated that several different possibilities to improve cellulolytic activity were known which did not even necessarily involve enzymes, let alone glycosyl hydrolases.

The board notes however that, while documents D3 to D7 are in fact directed to different methods for cellulose conversion, none of them is directed to the same purpose as the application, since they do not disclose or teach to use polypeptides that enhance cellulolytic conversion. Hence they are certainly further away from the claimed subject-matter than D1 and do not constitute the most suitable starting points for the discussion of inventive step.

2.8 The appellant further argued that, even if starting from D1 as the closest prior art, it was known that glycosyl hydrolases were found in a multitude of different sources and belonging to many different families, as further evidenced by D9. In view of D1's exhaustive disclosure of the identification of GH61 family members from *Thielavia terrestris*, the skilled person would not have expected that more GH61 polypeptides with the desired cellulolytic enhancing activity could still be found in the same organism. Instead, the skilled person would consider searching in one of the numerous other possible sources listed in D1 (page 22).

The board agrees that the skilled person would be aware of the existence of glycosyl hydrolases in many

different organisms. However, there is nothing in D1 or in the remaining prior art which teaches or even suggests that no more polypeptides with the desired activity could be found in *Thielavia terrestris*. In fact the contrary is true (page 97, second paragraph; see also section 2.5 above). Although there was a *priori* no guarantee that any of the remaining hits would correspond to polypeptides with the desired activity, nothing more than routine experimentation, already disclosed in D1, was required in order to test them. Finally, the fact that there were eventually several potential, equally suitable, alternative solutions to the technical problem does not render one such alternative inventive.

- 2.9 A further argument concerned the teaching of D1 as regards protein motives found in the polypeptides of D1 (page 13, lines 10 to 26). Such motives were not present in the amino acid sequence of the claimed polypeptide (SEQ ID NO:2), but rather in unrelated polypeptides such as the endoglucanase of D10 (amino acid sequence displayed in D11). Also, a sequence homology search showed sequence similarity of SEQ ID NO:2 to a number of many functionally different proteins, such as endoglucanases among others (Annex 1). A sequence homology search based on the sequences of D1 would thus not lead to the claimed polypeptide.

The board does not find these arguments convincing and notes that the claimed polypeptide was not identified by homology search based on the polypeptides of D1 but rather by the same method as was used in D1, i.e. identification of positive hits in a genomic cDNA library tested against well characterised homologues of glycosyl hydrolase genes that were known to have the desired properties. D1 also identified the polypeptides

designated GH61E and GH61G by their identity at protein level to a known homologue of the GH61 protein from *Volvariella volvacea*, which was, respectively, 41% and 38% (page 97, lines 19 to 23). Similarly, the GH61F polypeptide of the application was identified using the same method, by its identity at protein level to GH61F from *Neurospora crassa*, which was 57.67% (application, page 80, lines 15 to 19). It is also to be noted that the remaining GH61 polypeptides of D1, namely GH61B, GH61C and GH61D, were also shown to have a high level of identity to a number of different GH61 proteins from *Neurospora crassa* (D1, Example 12, in particular page 101, lines 9 to 13 and 22 to 26, and page 102, lines 1 to 5).

2.10 Since claim 1 of the main request does not comply with Article 56 EPC, the main request is not allowable.

3. Auxiliary requests 1 and 2 - Inventive step

3.1 Claim 1 of these requests differs from claim 1 of the main request solely in that the degree of required amino acid identity to SEQ ID NO:2 for the claimed polypeptides is higher, namely 90% and 95%, respectively, thus resulting in a narrower scope of the claim.

3.2 The board notes that the inventive step analysis made above for the main request concerns the polypeptides comprising the amino acid sequence of SEQ ID NO:2. Such polypeptides are still encompassed in claim 1 of auxiliary requests 1 and 2. Thus claim 1 of auxiliary requests 1 and 2 is also considered to relate to subject-matter which does not involve an inventive step, for the reasons given above (Article 56 EPC).

3.3 It follows that auxiliary requests 1 and 2 are also not allowable.

4. Auxiliary request 3 - Inventive step

4.1 The sole two claims of this request are directed to methods for degrading or converting a cellulose-containing material (claim 1) or for producing a fermentation product from a cellulose-containing material (claim 2) using a polypeptide as defined in claim 1 of the main request.

4.2 Document D1 also discloses such methods (e.g. claims 48 and 60) making use of the polypeptides disclosed in D1, which, like the GH61F polypeptide of the present application, also have cellulolytic enhancing activity. Hence it would be obvious for the skilled person to replace the polypeptides of D1 in the methods as claimed with an alternative polypeptide with cellulolytic enhancing activity such as the polypeptide of the application.

4.3 Claims 1 and 2 of auxiliary request 3 are thus also considered to lack inventive step (Article 56 EPC).

**Order**

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

The appeal is dismissed.

The Registrar:

The Chairman:



N. Maslin

U. Oswald

Decision electronically authenticated