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(81) Designated States (unless otherwise indicated, for every

kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))
- with sequence listing part of description (Rule 5.2(a))

[Continued on next page]

(54) Title: STABLE FUNGAL CEL6 ENZYME VARIANTS

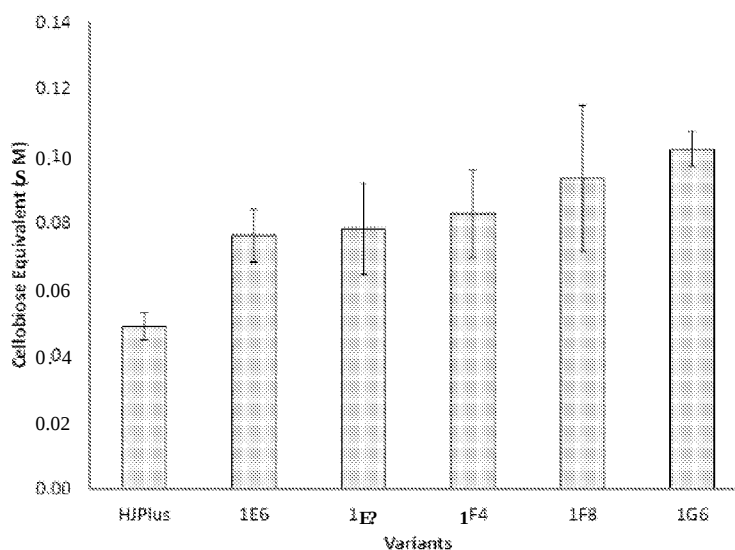


FIGURE 2

(57) Abstract: The disclosure provides variant Cel6a enzymes having increased thermostability, methods of making and using such polypeptides.



(88) Date of publication of the international search report:
6 June 2013

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/047637**A. CLASSIFICATION OF SUBJECT MATTER****C12N 9/42(2006.01)i, C12N 15/56(2006.01)1, C12N 15/63(2006.01)1**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

C12N 9/42; C07H 21/00; C12N 9/14; C12N 15/00; C12N 9/24

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

NCBI PubMed, eKOMPASS(KIPO internal) & Keywords: cel6, cellobiohydrolase 2, thermostability, cellulase activity

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2010-066411 A2 (DIREVO INDUSTRIAL BIOTECHNOLOGY GMBH et al.) 17 June 2010 See Abstract and Paragraph [0009] and SUMMARY OF THE DISCLOSURE and Figure 8	1-4, 9, 10, 27, 31-36
A	Heinzelman, P. et al. A family of thermostable fungal cellulases created by structure-guided recombination. 7 April 2009, Vol. 106, No. 14, pages 5610-5615 See Abstract	1-4, 9, 10, 27, 31-36
A	US 04894338A A (KNOWLES; JONATHAN et al.) 16 January 1990 See Claim 1 and Figure 5	1-4, 9, 10, 27, 31-36
A	US 7867744 B2 (WU WENPING et al.) 11 January 2011 See the whole document	1-4, 9, 10, 27, 31-36



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

27 March 2013 (27.03.2013)

Date of mailing of the international search report

28 March 2013 (28.03.2013)

Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/047637

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

- SEQ ID NO. 2: N14S, S30F, S30M, V128A, V131E, M135L, C246A, C246G, C246L, C246S, Q277L, S293R, S317P, S317W, S406P, S413F, S413P, S413W
- SEQ ID NO. 4: N38S, S54F, S54M, V151A, V154E, C269A, C269G, C269L, C269S, S316R, S430P, M158L, Q300L, S340P, S340W, S437F, S437P, S437W
- SEQ ID NO. 6: G37S, Q53F, Q53M, V155A, V158E, Q162L, L276A, L276G, L276S, I307L, K323R, P347W, T436P, Y443F, Y443P, Y443W
- SEQ ID NO. 8: N38S, L54F, L54M, V155A, V158E, Q162L, L276A, L276G, L276S, I307L, S347P, S347W, T436P, Y443F, Y443P, Y443W

The present set of claims refers to multiple recombinant polypeptides having one or more amino acid substitutions at residues mentioned above.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-4, 9, 10, 27, 31-36 (the first identified invention about N14S in SEQ ID NO: 2)

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☒ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2012/047637

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2010-06641 1 A2	17.06.2010	EP 2364358 A2 US 2011-300263 A1 WO 2010-06641 1 A3 WO 2010-06641 1 A3	14.09.2011 08.12.2011 16.09.2010 17.06.2010
US 04894338A A	16.01.1990	EP 0214971 A1 EP 0214971 B1 EP 0312121 A3 US 05393670A A US 05529919A A US 05766915A A WO 85-04672 A1	25.03.1987 12.04.1995 13.12.1989 28.02.1995 25.06.1996 16.06.1998 24.10.1985
US 7867744 B2	11.01.2011	AU 2003-291962 A1 AU 2003-291962 A8 CN 101555472 A CN 1729287 A CN 1729287 CO EP 1578964 A2 EP 1578964 B1 EP 2128247 A1 US 2006-0053514 A1 US 2008-0213835 A1 US 2011-0081696 A1 US 7348168 B2 WO 2004-05698 1 A2 WO 2004-05698 1 A3	14.07.2004 14.07.2004 14.10.2009 01.02.2006 01.02.2006 28.09.2005 05.08.2009 02.12.2009 09.03.2006 04.09.2008 07.04.2011 25.03.2008 08.07.2004 08.07.2004