

US008815571B2

(12) United States Patent

Abbas et al.

(54) INCREASED FIBER HYDROLYSIS BY PROTEASE ADDITION

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- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1371 days.
- (21) Appl. No.: 12/247,499
- (22) Filed: Oct. 8, 2008

(65) **Prior Publication Data**

US 2009/0098638 A1 Apr. 16, 2009

Related U.S. Application Data

- (60) Provisional application No. 60/998,818, filed on Oct. 12, 2007.
- (51) Int. Cl.

C13B 5/00	(2011.01)
C12N 9/62	(2006.01)
C12P 19/20	(2006.01)
C12P 19/02	(2006.01)
C12N 9/42	(2006.01)
C12N 9/50	(2006.01)
C12N 9/58	(2006.01)
C12P 7/10	(2006.01)

- (58) Field of Classification Search
 CPC A23K 1/06; C12P 7/10; C12P 19/02; C12P 19/20; C08L 97/02
 See application file for complete search history.

(10) Patent No.: US 8,815,571 B2

(45) **Date of Patent:** Aug. 26, 2014

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,737,365	Α	4/1988	Meyer
5,612,055	Α	3/1997	Bedford et al.
6,506,423	B2	1/2003	Drouillard et al.
7,005,128	B1	2/2006	Bedford et al.
7,494,675	B2 *	2/2009	Abbas et al 426/12
2004/0053373	A1	3/2004	Foody et al.
2004/0202697	A1	10/2004	Beauchemin et al.
2006/0154353	A1	7/2006	Duan et al.
2006/0200877	A1	9/2006	Lanahan et al.
2006/0251764	A1*	11/2006	Abbas et al 426/53
2007/0037259	A1	2/2007	Hennessey et al.
2007/0124833	A1	5/2007	Abad et al.

FOREIGN PATENT DOCUMENTS

JP 07031393 A * 2/1995

OTHER PUBLICATIONS

Nebraska Ethanol Board "Ethanol Facts: Distillers Grains (DDG) and Corn Gluten Feed.", Apr. 3, 2005, retrieved online from <URL:http://www.ne-ethanol.org/facts/ddg.htm>, 1 page.* International Preliminary Report on Patentability for PCT/US08/ 79152 (Form PCT/IB/373 and PCT/ISA/237), 7 pages.

* cited by examiner

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(57) **ABSTRACT**

Novel fiber processing methods and the products obtained therefrom are disclosed. Methods may include thermochemical and/or enzymatic hydrolysis of fiber feedstocks including distillers' dried grains, distillers' dried grains with solubles, soyhull, miscanthus and switchgrass. Enzymatic hydrolysis includes hydrolysis with cellulase, hemicellulase, and protease.

19 Claims, No Drawings

INCREASED FIBER HYDROLYSIS BY PROTEASE ADDITION

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of U.S. Patent Application Ser. No. 60/998,818 filed Oct. 12, 2007. U.S. Patent Application Ser. No. 60/998,818 is incorporated by reference as if fully rewritten herein.

SEQUENCE LISTING

Following the Abstract of the Disclosure is set forth a paper copy of the SEQUENCE LISTING having SEQ ID NO:1 through SEQ ID NO:12. The SEQUENCE LISTING is incorporated by reference into this application.

BACKGROUND OF THE INVENTION

The following includes information that may be useful in understanding the present teachings. It is not an admission that any of the information provided herein is prior art, or material, to the presently described or claimed subject matter, ²⁵ or that any publication or document that is specifically or implicitly referenced is prior art.

FIELD OF THE INVENTION

The present teachings relate to, but are not limited to, the field of agricultural product production. Embodiments relate, for example, to methods for increasing the free glucose and other organic matter available from a fiber feedstock for fermentation and other applications.

BACKGROUND OF THE ART

A large quantity and variety of fiber feedstocks are available from agricultural processing operations. These fiber ⁴⁰ feedstocks (also called cellulosic feedstocks, biomass, or lignocellulosics) may be used, for example, to produce fuel, to produce industrial chemicals, or as other value-added food and feed products. A cellulosic feedstock is largely comprised of plant cell walls with cellulose, hemicellulose, lignin, and ⁴⁵ protein polymers as the primary constituents. The hydrolysis or breakdown of these feedstocks uses singly or a combination of enzymatic and thermochemical methods that result in the production of monomers and oligomers of carbohydrates. The hydrolyzed mix can serve as feedstocks to produce fuel, ⁵⁰ chemicals, and other products. Similar hydrolysis schemes are employed with most plant fibers that facilitate the release of glucose and other carbohydrates from fiber feedstocks.

Although attention has been paid to increasing the amount of glucose available from compositions such as uncooked ⁵⁵ granular starch (see, for example, U.S. Patent Application Publication No. 2006/0154354 A1, to Duan, et al.), lately more attention has been paid to methods for increasing the amount of usable carbohydrates obtained from readily available and inexpensive fiber feedstocks that contain no starch or ⁶⁰ minimal amounts of starch.

BRIEF SUMMARY OF THE INVENTION

Embodiments of the invention are typically directed to 65 providing a method for increasing the amount of glucose and other carbohydrates obtained from hydrolysis of a low-starch

or no-starch fiber stream by hydrolyzing the fiber stream in the presence of protease and one or more of cellulase and hemicellulase.

Embodiments include a method for increasing the amount of glucose and other organic matter released from a fiber feedstock, comprising reacting a fiber feedstock with a mixture of reactants comprising at least one protease and at least one member of the group consisting of cellulase and hemicellulase; and obtaining a reaction product from the fiber feedstock and the mixture of reactants comprising glucose. The amount of glucose in the reaction product (measured as a percentage of the fiber feedstock mass) is greater than the amount of glucose obtained from reaction of the fiber feedstock under the same conditions as the reaction including protease, but with at least one member selected from the group consisting of cellulase and hemicellulase and excluding protease. In some embodiments, the mixture of reactants used to increase the amount of glucose and other organic matter released from the fiber stream does not include amy-20 lases.

Proteases are enzymes that have found a great number of uses in the industrial production of detergents, animal hide processing, meat tenderizing as well as in other food applications involving animal and plant materials. As a group they represent one of the largest classes of hydrolytic enzymes which posses a wide range of specificities towards amino acid sequences, different pH and temperature optima, and different amino acids at active sites with some (i.e. metallo-proteases) requiring cations such as zinc or iron for optimal activity. Although a variety of proteases may be suitable for use in embodiments of the invention, typically an acid fungal protease is preferred. In one embodiment, the acid fungal protease has an amino acid sequence at least 95% identical to the amino acid sequence of SEQ ID NO: 1. In a further embodiment, the protease is selected from the group consisting of Aspergillus saitoi aspartic protease, or aspartic proteases from molds that are members of the genera of the Ascomycetous fungi represented by the genera Aspergillus, Mucor, Rhizopus, and Penicillium. In a typical embodiment, the protease is Aspergillus saitoi aspartic protease, which has the amino acid sequence of SEQ ID NO: 1.

A variety of fiber feedstocks are suitable for use in embodiments of the invention. Fiber feedstocks include, but are not limited to, corn stover, corn gluten feed (CGF), distillers' dried grains (DDG), distillers' dried grains with solubles (DDGS), switchgrass, miscanthus, soyhulls, wheat chaff, and wheat straw. In a typical embodiment, the fiber feedstock includes less than 20% starch by weight, less than 10% starch by weight, less than 5% starch by weight, or less than 1% starch by weight. In another embodiment, the fiber feedstock includes no starch.

A number of cellulases are suitable for use in typical embodiments of the invention. These include, for example, but are not limited to CELLUCLAST® (a Novozyme product), which is a 1,4-(1,3:1,4)- β -D-Glucan 4-glucano-hydro-lase produced by submerged fermentation of the fungus *Trichoderma reesei*, deposited as ATCC No. 26921; or GC-220 (a Genencor product). Other useful cellulases include those from *T. reesei*, other species of *Trichoderma*, species of *Aspergillus*, species of *Crysosporium*, species of clostridium or cellulases from other bacterial and fungal species.

A variety of hemicellulases are suitable for use in typical embodiments of the invention, including, for example, but not limited to ULTRAFLO L (Novozyme), MULTIFECT XYLANASE (Genencor), VISCOZYME L (Novozyme), and VISCOSTAR L (Dyadic). The reaction products may also include one or more of arabinose, xylose, galactose,

mannose, cellobiose, xylobiose, acetyl groups, phytosterols, phenolic compounds and oligomers of these compounds.

The amount of glucose in the reaction product (measured as a percentage of the fiber feedstock mass) following protease addition is greater than the amount of glucose obtained 5 from reaction of the fiber feedstock without protease by at least 10%, at least 20%, at least 30%, at least 40%, at least 50%, at least 60%, at least 70%, at least 80%, at least 90%, or at least 100%.

A further embodiment includes a method for obtaining a solid residue from the enzyme treated fiber for the production of biooil, comprising preparing a glucose-enriched fiber feedstock reaction product as described in other embodiments of the invention, and separating said reaction product into a solid hydrolyzed fiber fraction and a liquid fraction. This solid fraction may then be used as a fuel for biooil production. The process employed in the above treatment is often referred to as hydrotreating, or HT. It can be used with fiber streams that contain a fairly high level of moisture typically greater than 20 cal hydrolysis of a fiber feedstock. This releases some pen-50% on a wt/wt basis.

DETAILED DESCRIPTION OF THE INVENTION

The present teaching describes several different features 25 and aspects of the invention with reference to various exemplary embodiments. It is understood, however, that the invention embraces numerous alternative embodiments, which may be accomplished by combining any of the different features and aspects described herein in any combination that 30 one of ordinary skill in the art would find useful.

Processing methods as described herein may offer many advantages over the prior art. Of course, the scope of the invention is defined by the claims, and whether an embodiment is within that scope should not be limited by whether the 35 method provides one or more of these advantages.

Current methods of processing corn, soy, wheat, barley, milo, canola, sunflower and other agricultural products to obtain useful commodities such as ethanol, animal feed, meals, and flours may also result in the production of a num- 40 ber of fiber byproducts. Processing methods include but are not limited to wet milling, dry milling, and modified wet milling. See Singh, et al. "Modified Dry Grind Ethanol Process," Ag. Eng. Dept., U. of Ill., UILU No. 2001-7021 (Jul. 18, 2001).

These byproducts, also referred to as fiber feedstocks, may include, for example, but are not limited to, corn stover, corn gluten feed, distillers' dried grains (DDG), distillers' dried grains with solubles (DDGS), switchgrass, soyhulls, wheat chaff, and wheat straw, palm fiber, bermuda grass, miscanthus 50 and babassu. Fiber feedstocks do not necessarily need to be byproducts of any particular process to obtain some benefit from treatment according to embodiments presented herein. Fiber feedstocks may be pretreated chemically, thermally, and/or mechanically. More detail on fiber feedstocks, particu-55 larly corn fiber feedstocks, is found in U.S. Patent Application Publication No. 20060216396A1, to Abbas, et al., entitled "Corn Fiber Hulls as a Food Additive or Animal Feed," which is incorporated by reference herein.

Fiber feedstocks often benefit from further processing to 60 produce more useful commodities, such as more readily digestible feed products, biofuel precursors, or industrial chemicals. Because typical byproducts are largely comprised of plant cell walls made of cellulose, hemicellulose, lignin, and proteins, their treatment typically includes enzymatic 65 and/or thermochemical hydrolysis, which generates carbohydrate monomers and oligomers.

In some embodiments, the hydrolysis does not include any amylases. Amylases are glycoside hydrolase enzymes that break down starch into glucose molecules. Amylase is usually not necessary because the feedstocks have little or no starch. Alkaline treatment of the fiber feedstock while useful in extracting lignin and to break down ester linkages is not always necessary in a typical embodiment.

We have found that treatment of fiber feedstocks with protease prior to or in conjunction with enzymatic and/or thermochemical hydrolysis increases the amount of carbohydrate monomers and oligomers that may be obtained from the fiber feedstock, thereby increasing the commercial value of the fiber feedstock. Typically, the fiber feedstocks will either contain no starch prior to the protease treatment, or they will have only a small amount of starch. For example, the starch content of the fiber feedstock, by weight, may be less than 10%, less than 5%, less than 4%, less than 3%, less than 2%, less than 1%, or less than 0.5%.

A typical process of the invention includes thermochemitoses from the fiber hemicellulose constituent and loosens the fiber structures, particularly that of any remaining cell wall components. Following thermochemical hydrolysis, the fiber feedstock is treated enzymatically to release glucose and other hexoses, as well as to release pentoses including D-xylose and L-arabinose. A typical enzymatic treatment is conducted using a blend of enzymes including one or more cellulases and one or more hemicellulases, though one skilled in the art will recognize that this blend may be modified depending on the initial content of the fiber feedstock and on the results of the thermochemical hydrolysis.

In addition to including cellulases and hemicellulases, an enzymatic treatment includes one or more proteases. Although applicants do not wish to be bound by theory, it is believed that the proteases degrade primarily the structural proteins that are cross-liked to other components of the fiber feedstock. In many cases the carbohydrate polymers are linked predominantly via N or O type linkages to the amino acids: asparagine, glutamine, serine, hydroxyproline or threonine that are present in the polypeptide backbone. This increases the amount of glucose and other hexoses that are released during the enzymatic treatment. This also reduces the amount of cellulase necessary in a typical hydrolysis.

As used herein, "cellulase" or "cellulase blend" include one enzyme or a mixture of enzymes that degrade cellulose. Typical cellulases include endocellulase or endoglucanase, exocellulase, exocello-biohydrolase, and cellobiase. "Hemicellulase" or "hemicellulase blend" include one enzyme or a mixture of enzymes that hydrolyze hemicellulose. Typical hemicellulases include but are not limited to β -xylanases, $\alpha\mbox{-}arabinofuranosidases,$ ferulic and acetyl esterases, α & β -mannases, $\alpha \& \beta$ -galactosidases, and β -galactomannanases.

The effective amount of cellulase, hemicellulase, and protease used in embodiments of the invention will vary with the type of enzymes used in the process, the ultrastructure and composition of the cell wall (which varies by plant type), the pretreatment or pre-processing step, and well as the as the desired yield. Commercial enzymes may be used according to their manufacturer's instructions.

Typical proteases for use in the invention include, for example, the aspartic protease from Aspergillus saitoi having the amino acid sequence give in SEQ ID NO:1. Other proteases having at least 50% or greater sequence identity with SEQ ID NO:1 may also be used, so long as the protease activity is conserved. Proteases suitable for use in embodiments of the invention may have a sequence identity with

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SEQ ID NO: 1 of greater than 50%, greater than 60%, greater than 70%, greater than 80%, greater than 90%, greater than 95%, or greater than 98%, so long as protease activity is retained.

For example, other suitable proteases include but are not limited to those given in Table 1. The Aspergillus saitoi protease protein sequence was used to blast the NCBI sequence collection and identify proteases with 47% or higher sequence identity. The T. reesei protease was not identified because of too many gaps between the two protease sequences. Sequence identity percentages are based on percentage identity with SEQ ID NO:1. Sequence identity percentages were determined by BLAST in the CGC Wisconsin Genetics Software Packages, Version 10 (available from 15 Accelrys Inc., 9685 Scranton Road, San Diego, Calif., USA). Alignments using BLAST programs can be performed using the default parameters.

TABLE 1

Sequence Identity comparison of protease from <i>Aspergillus saitoi</i> with proteases from other organisms.										
Source	Sequence identity %	E value	Sequence ID							
aspergillopepsin A precursor [<i>Aspergillus</i> niger]	99%	2e-180	SEQ ID NO: 2							
preproproctase B [Aspergillus niger]	97%	3e-147	SEQ ID NO: 3							
aspartic proteinase aspergillopepsin I pepA-Aspergillus niger	97%	5e-141	SEQ ID NO: 4							
Aspergillopepsin A precursor	96%	9e-140	SEQ ID NO: 5							
aspartic endopeptidase Pep1/aspergillopepsin F [<i>Aspergillus fumigatus</i> Af293]	71%	1e-134	SEQ ID NO: 6							
<i>Aspergillus Oryzae</i> Aspartic Proteinase	71%	4e-103	SEQ ID NO: 7							
propenicillopepsin-JT2 precursor [<i>Penicillium</i> janthinellum]	67%	1e-109	SEQ ID NO: 8							
acid proteinase [Monascus purpureus]	63%	4e-124	SEQ ID NO: 9							
aspartic proteinase [Penicillium roquefortii]	64%	5e-119	SEQ ID NO: 10							
aspartic protease [Phaeosphaeria nodorum]	53%	1e-94	SEQ ID NO: 11							
aspartyl protease [<i>Trichoderma</i> <i>asperellum</i>]	47%	5e-60	SEQ ID NO: 12							

Reaction conditions for hydrolysis including protease need not vary from those typically used for hydrolysis using cel-55 lulases or hemicellulases without proteases. For example, reaction temperatures may be, for example, but are not limited to between 25 to 80° C., 40 to 70° C. or 50 to 60° C. Reaction times may be, for example, but are not limited to between 30 minutes to 48 hours, typically between 60 min-60 utes and 24 hours. Reaction pH may be, for example, from 2.0 to 7.0, more typically from 4.0 to 5.5. Based on results obtained earlier and present knowledge of acid proteases, some of the reactions may proceed at lower pH (<5.0) and at higher temperature (>55 C). With different fiber materials, the optimum enzyme performance may occur over a wide range of temperature and pH.

EXAMPLES

The examples below are only representative of some aspects of the invention. These examples should not be interpreted as limiting the invention in any way not explicitly stated in the claims.

Example 1

Example 1 shows hydrolysis of various fiber feedstocks with and without a protease. Percentages are calculated on a V/V basis. A mixture of 250 mg fiber feedstock in 5 ml of 100 mM citrate buffer at pH 5.0, an enzyme solution of 0.2% cellulase mix (including 0.2% GC-220, a Genencor cellulase blend; 0.2% CELLUCLAST L, a Novozymes cellulase blend, and 0.1% Novozyme 28074), 0.2% hemicellulase mix (ULTRAFLO L, a Novozymes hemicellulase blend), and an aspartic protease from Aspergillus saitoi having SEQ ID NO: 20 1 were placed in a shaker at 55.degree. C. for about 48 hours. Fiber feedstocks were prepared by grinding with a Wiley mill and sieving through a 40 mesh screen. Fiber feedstocks used in the experiment were corn fiber, corn stover, corn gluten feed, distillers' dried grains, distillers' dried grains with solubles, switchgrass, soyhulls, wheat chaff, and wheat straw.

A control experiment was also conducted for each of the fiber feedstocks. The control did not include the protease, but otherwise the conditions and amounts were the same.

Samples of each reaction were spun, and the supernatant was used for glucose analysis. Glucose concentration was obtained using an analyzer from YSI, Incorporated. Results are shown in Table 2. The amount of available glucose was increased over the control by up to 130%. The corn fiber showed a negligible improvement, with only a 0.5% increase. 35 This negligible increase is believed to be due to the presence of a relatively high amount of starch in the corn fiber.

TABLE 2

40	Percent of glucose released from different feedstocks by cellulase and hemicellulases with and without the protease Glucose Released (% of total dry weight)												
	Fiber Streams	No Protease	Protease	% Improvement									
	Corn Fiber	19.8	19.9	0.5									
45	Corn Stover	15.2	17.4	14.5									
	Corn Gluten Feed	6.0	13.8	130.0									
	DDG	14	20.4	45.7									
	DDGS	6.8	12.2	79.4									
	Switchgrass	11	14	27.3									
	Soyhulls	22.0	32.4	47.3									
50	Wheat Chaff	10.8	13.8	27.7									
50	Wheat Straw	12.6	17	34.9									

Patents, patent applications, publications, scientific articles, books, web sites, and other documents and materials referenced or mentioned herein are indicative of the levels of skill of those skilled in the art to which the inventions pertain, as of the date each publication was written, and all are incorporated by reference as if fully rewritten herein. Inclusion of a document in this specification is not an admission that the document represents prior invention or is prior art for any purpose.

The terms and expressions employed herein have been used as terms of description and not of limitation, and there is no intention in the use of such terms and expressions, or any portions thereof, to exclude any equivalents now known or later developed, whether or not such equivalents are set forth or shown or described herein or whether or not such equiva-

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lents are viewed as predictable, but it is recognized that various modifications are within the scope of the invention claimed, whether or not those claims issued with or without alteration or amendment for any reason. Thus, it shall be understood that, although the present invention has been specifically disclosed by preferred embodiments and optional features, modifications and variations of the inventions embodied therein or herein disclosed can be resorted to by those skilled in the art, and such modifications and variations are considered to be within the scope of the inventions dis- 10 closed and claimed herein.

Specific methods and compositions described herein are representative of preferred embodiments and are exemplary and not intended as limitations on the scope of the invention. Other objects, aspects, and embodiments will occur to those skilled in the art upon consideration of this specification, and are encompassed within the spirit of the invention as defined

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by the scope of the claims. Where examples are given, the description shall be construed to include but not to be limited to only those examples.

It will be readily apparent to one skilled in the art that varying substitutions and modifications may be made to the invention disclosed herein without departing from the scope and spirit of the invention, and from the description of the inventions, including those illustratively set forth herein, it is manifest that various modifications and equivalents can be used to implement the concepts of the present invention without departing from its scope. A person of ordinary skill in the art will recognize that changes can be made in form and detail without departing from the spirit and the scope of the invention. The described embodiments are to be considered in all respects as illustrative and not restrictive. Thus, for example, additional embodiments are within the scope of the invention and within the following claims.

SEQUENCE LISTING

<160> NUMBER OF SEQ ID NOS: 12 <210> SEQ ID NO 1 <211> LENGTH: 394 <212> TYPE: PRT <213> ORGANISM: Aspergillus saitoi <400> SEQUENCE: 1 Met Val Val Phe Ser Lys Thr Ala Ala Leu Val Leu Gly Leu Ser Thr 10 1 Ala Val Ser Ala Ala Pro Ala Pro Thr Arg Lys Gly Phe Thr Ile Asn 20 25 30 Gln Ile Ala Arg Pro Ala Asn Lys Thr Arg Thr Val Asn Leu Pro Gly 35 40 45 Leu Tyr Ala Arg Ser Leu Ala Lys Phe Gly Gly Thr Val Pro Gln Ser 55 Val Lys Glu Ala Ala Ser Lys Gly Ser Ala Val Thr Thr Pro Gln Asn 70 75 Asn Asp Glu Glu Tyr Leu Thr Pro Val Thr Val Gly Lys Ser Thr Leu 90 His Leu Asp Phe Asp Thr Gly Ser Ala Asp Leu Trp Val Phe Ser Asp 105 100 Glu Leu Pro Ser Ser Glu Gln Thr Gly His Asp Leu Tyr Thr Pro Ser 120 115 Ser Ser Ala Thr Lys Leu Ser Gly Tyr Ser Trp Asp Ile Ser Tyr Gly 135 Asp Gly Ser Ser Ala Ser Gly Asp Val Tyr Arg Asp Thr Val Thr Val 145 150 155 160 Gly Gly Val Thr Thr Asn Lys Gln Ala Val Glu Ala Ala Ser Lys Ile 170 Ser Ser Glu Phe Val Gln Asp Thr Ala Asn Asp Gly Leu Leu Gly Leu 185 Ala Phe Ser Ser Ile Asn Thr Val Gln Pro Lys Ala Gln Thr Thr Phe 195 200 205 Phe Asp Thr Val Lys Ser Gln Leu Asp Ser Pro Leu Phe Ala Val Gln 215 220 210 Leu Lys His Asp Ala Pro Gly Val Tyr Asp Phe Gly Tyr Ile Asp Asp 225 230 235 240 Ser Lys Tyr Thr Gly Ser Ile Thr Tyr Thr Asp Ala Asp Ser Ser Gln 245 250 255

Gly Tyr Trp Gly Phe Ser Thr Asp Gly Tyr Ser Ile Gly Asp Gly Ser Ser Ser Ser S
er Gly Phe Ser Ala Ile Ala Asp \mbox{Thr} Gly Th
r \mbox{Thr} Leu Ile Leu Leu Asp Asp Glu Ile Val Ser Ala Tyr Tyr Glu Gln Val Ser Gly Ala Gln Glu Ser Tyr Glu Ala Gly Gly Tyr Val Phe Ser Cys Ser Thr Asp Leu Pro Asp Phe Thr Val Val Ile Gly Asp Tyr Lys Ala Val Val Pro Gly Lys Tyr Ile Asn Tyr Ala Pro Val Ser Thr Gly Ser Ser Thr Cys Tyr Gly Gly Ile Gln Ser Asn Ser Gly Leu Gly Leu Ser Ile Leu Gly Asp Val Phe Leu Lys Ser Gln Tyr Val Val Phe Asn Ser Glu Gly Pro Lys Leu Gly Phe Ala Ala Gln Ala <210> SEO ID NO 2 <211> LENGTH: 394 <212> TYPE: PRT <213> ORGANISM: Aspergillus niger <400> SEOUENCE: 2 Met Val Val Phe Ser Lys Thr Ala Ala Leu Val Leu Gly Leu Ser Thr Ala Val Ser Ala Ala Pro Ala Pro Thr Arg Lys Gly Phe Thr Ile Asn Gln Ile Ala Arg Pro Ala Asn Lys Thr Arg Thr Val Asn Leu Pro Gly Leu Tyr Ala Arg Ser Leu Ala Lys Phe Gly Gly Thr Val Pro Gln Ser Val Lys Glu Ala Ala Ser Lys Gly Ser Ala Val Thr Thr Pro Gln Asn Asn Asp Glu Glu Tyr Leu Thr Pro Val Thr Val Gly Lys Ser Thr Leu His Leu Asp Phe Asp Thr Gly Ser Ala Asp Leu Trp Gly Phe Ser Asp Glu Leu Pro Ser Ser Glu Gln Thr Gly His Asp Leu Tyr Thr Pro Ser Ser Ser Ala Thr Lys Leu Ser Gly Tyr Ser Trp Asp Ile Ser Tyr Gly Asp Gly Ser Ser Ala Ser Gly Asp Val Tyr Arg Asp Thr Val Thr Val Gly Gly Val Thr Thr Asn Lys Gln Ala Val Glu Ala Ala Ser Lys Ile Ser Ser Glu Phe Val Gln Asp Thr Ala Asn Asp Gly Leu Leu Gly Leu Ala Phe Ser Ser Ile Asn Thr Val Gln Pro Lys Ala Gln Thr Thr Phe Phe Asp Thr Val Lys Ser Gln Leu Asp Ser Pro Leu Phe Ala Val Gln Leu Lys His Asp Ala Pro Gly Val Tyr Asp Phe Gly Tyr Ile Asp Asp

225					230					235					240
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Glu	Leu	Pro 115	Ser	Ser	Glu	Gln	Thr 120	Gly	His	Asp	Leu	Tyr 125	Thr	Pro	Ser
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Gly	Tyr	Trp	Gly 260	Phe	Ser	Thr	Aab	Gly 265	Tyr	Ser	Ile	Gly	Asp 270	Gly	Ser
Ser	Ser	Ser 275	Ser	Gly	Phe	Ser	Ala 280	Ile	Ala	Asp	Thr	Gly 285	Thr	Thr	Leu
Ile	Leu 290	Leu	Asp	Asp	Glu	Ile 295	Val	Ser	Ala	Tyr	Tyr 300	Glu	Gln	Val	Ser
Gly 305	Ala	Gln	Glu	Ser	Glu 310	Glu	Ala	Gly	Gly	Tyr 315	Val	Phe	Ser	Cys	Ser 320
Thr	Asn	Pro	Pro	Asp 325	Phe	Thr	Val	Val	Ile 330	Gly	Asp	Tyr	Lys	Ala 335	Val
Val	Pro	Gly	Arg 340	Tyr	Ile	Asn	Tyr	Ala 345	Pro	Ile	Ser	Thr	Gly 350	Ser	Ser
Thr	Суз	Phe 355	Gly	Gly	Ile	Gln	Ser 360	Asn	Ser	Gly	Leu	Gly 365	Leu	Ser	Ile
Leu	Gly 370	Asp	Val	Phe	Leu	Lys 375	Ser	Gln	Tyr	Val	Val 380	Phe	Asn	Ser	Glu
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<213 <400 Met 1 Ala Gln Met Val 65 Asn His Glu Ser	<pre>3> OF Val Val Ile Tyr 50 Lys Leu Leu Ser 130</pre>	CQUEN Val Ser Ala Glu Glu Asp Pro 115 Ala	ISM: NCE: Phe Ala 20 Arg Arg Ala Glu Ser Thr	Aspe 4 Ser 5 Ala Pro Ser Ala Tyr 85 Asp Ser Lys	ergil Lys Pro Ala Leu Ser 70 Leu Thr Glu Leu	llus Thr Ala Asn Ala 55 Lys Thr Gly Gln Ser 135	nige Ala Pro Lys 40 Lys Gly Pro Ser Thr 120 Gly	Ala Thr 25 Thr Phe Ser Val Ala 105 Gly Tyr	Leu 10 Arg Gly Ala Thr 90 Asp His Thr	Val Lys Thr Gly Val Val Leu Asp Trp	Leu Gly Ile Thr Gly Trp Leu Asp 140	Gly Phe Asn 45 Val Thr Lys Val Tyr 125 Ile	Leu Thr 30 Leu Pro Ser Pro Ser 110 Thr Ser	Ser 15 Ile Pro Gln Gln Thr 95 Ser Pro Tyr	Ser Asn Gly Ser Asn Leu Asp Ser Gly
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<213 <400 Met 1 Ala Gln Met Val 65 Asn His Glu Ser Asp 145 Gly	<pre>3> OF Val Val Ile Lys Leu Leu Leu Gly Gly</pre>	CANI CQUEN Val Ser Ala Glu Glu Glu Asp Pro 115 Ala Ser Val	ISM: ICE: Phe Ala 20 Arg Arg Arg Ala Glu Phe 100 Ser Thr Ser Thr	Aspe 4 Ser 5 Ala Pro Ser Ala Tyr 85 Ser Lys Ala Thr 165	ergil Lys Pro Ala Leu Ser 70 Leu Thr Glu Leu Ser 150 Asn	llus Thr Ala Asn Asn Lys Clys Gly Gln Ser 135 Gly Lys	nige Ala Pro Lys Gly Pro Ser Thr 120 Gly Asp Gln	Ala Thr 25 Thr Phe Ser Val Ala 105 Gly Tyr Val Ala	Leu 10 Arg Gly Ala Thr 90 Asp His Thr Tyr Val	Val Lys Thr Gly Val Leu Asp Trp Arg 155 Glu	Leu Gly Ile Thr Gly Trp Leu Asp 140 Asp	Gly Phe Asn 45 Val Thr Lys Val Tyr 125 Ile Thr Ala	Leu Thr 30 Leu Pro Ser Pho 110 Thr Ser Val Ser	Ser 15 Ile Pro Gln Gln Gln Thr 95 Ser Pro Tyr Thr Lys 175	Ser Asn Gly Ser Asn Ser Gly Val 160 Ile

Ala	Phe	Ser 195	Ser	Ile	Asn	Thr	Val 200	Gln	Pro	Lys	Ala	Gln 205	Thr	Thr	Phe	
Phe	Asp 210	Thr	Val	Lys	Ser	Gln 215	Leu	Aap	Ser	Pro	Leu 220	Phe	Ala	Val	Gln	
Leu 225	Lys	His	Asp	Ala	Pro 230	Gly	Val	Tyr	Asp	Phe 235	Gly	Tyr	Ile	Asp	Asp 240	
Ser	Lys	Tyr	Thr	Gly 245	Ser	Ile	Thr	Tyr	Thr 250	Asp	Ala	Asp	Ser	Ser 255	Gln	
Gly	Tyr	Trp	Gly 260	Phe	Ser	Thr	Asp	Gly 265	Tyr	Ser	Ile	Gly	Asp 270	Gly	Ser	
Ser	Ser	Ser 275	Ser	Gly	Phe	Ser	Ala 280	Ile	Ala	Asp	Thr	Gly 285	Thr	Thr	Leu	
Ile	Leu 290	Leu	Asp	Asp	Glu	Ile 295	Val	Ser	Ala	Tyr	Tyr 300	Glu	Gln	Val	Ser	
Gly 305	Ala	Gln	Glu	Ser	Glu 310	Glu	Ala	Gly	Gly	Tyr 315	Val	Phe	Ser	Cys	Ser 320	
Thr	Asn	Pro	Pro	Asp 325	Phe	Thr	Val	Val	Ile 330	Gly	Asp	Tyr	Lys	Ala 335	Val	
Val	Pro	Gly	Lys 340	Tyr	Ile	Asn	Tyr	Ala 345	Pro	Ile	Ser	Thr	Gly 350	Ser	Ser	
Thr	Суз	Phe 355	Gly	Gly	Ile	Gln	Ser 360	Asn	Ser	Gly	Leu	Gly 365	Leu	Ser	Ile	
Leu	Gly 370	Asp	Val	Phe	Leu	Lys 375	Ser	Gln	Tyr	Val	Val 380	Phe	Asn	Ser	Glu	
Gly	Pro	Lys	Leu	Gly	Phe	Ala	Ala	Gln	Ala							
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3385 <210 <211 <212 <213 <220 <223 <400 Ser 1 Leu Thr Glu Leu 65 Ser	<pre>>> SEE >> LF >> TY >> OF >> NZ >> CT >> NZ >> CT D>> SE Lys Thr Gly Ser Gly</pre>	2Q III ENGTH PFE: CANJ EATUF MECA MECA HER GQUEN Gly Ser 35 Thr Gly Asp) NO I: 32 PRT SM: 22 CEY: CON: INFC ICE: Ser Val 20 Ala Gly Tyr Val	5 Aspe (257) RMAN 5 Ala 5 Thr Asp His Thr Thr Tyr 85	ergil 2_fea 7) Val Val Leu Asn Trp 70 Arg	llus (257) : Xaa Thr Gly Trp Val 55 Asn Asp	awan a car Thr Lys Val 40 Tyr Ile Thr	nori Pro Ser 25 Phe Thr Ser Val	any Gln 10 Thr Ser Pro Tyr Thr 90	natu Asn Leu Asp Ser Gly 75 Val	Asn His Glu Ser 60 Asn Gly	y oc Asp Leu Leu 45 Ser Gly Gly	Glu Asp 30 Pro Ala Ser Val	ing Glu 15 Phe Ser Thr Ser Thr 95	amino Tyr Asp Ser Lys Ala 80 Asn	acid
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Ser 145	Gln	Leu	Asn	Ser	Pro 150	Leu	Phe	Ala	Val	Gln 155	Leu	Lys	His	Asp	Ala 160
Pro	Gly	Val	Tyr	Asp 165	Phe	Gly	Tyr	Ile	Asx 170	Asx	Ser	Lys	Tyr	Thr 175	Gly
Ser	Ile	Thr	Tyr 180	Thr	Asp	Ala	Asp	Ser 185	Ser	Glu	Gly	Tyr	Trp 190	Gly	Phe
Asn	Pro	Asn 195	Gly	Tyr	Ser	Ile	Gly 200	Aab	Ser	Ser	Ser	Ser 205	Gly	Phe	Ser
Ala	Ile 210	Ala	Asp	Thr	Gly	Thr 215	Thr	Leu	Ile	Leu	Leu 220	Asp	Asp	Glu	Ile
Val 225	Leu	Asn	Gly	Ser	Glx 230	Val	Ser	Gly	Gln	Ala 235	Asn	Gln	Glu	Ala	Asp 240
Gly	Gly	Tyr	Val	Phe 245	Asx	Суз	Ser	Thr	Thr 250	Pro	Pro	Asp	Phe	Thr 255	Gly
Хаа	Ile	Gly	Asp 260	Tyr	Lys	Ala	Val	Gly 265	Pro	Lys	Tyr	Ile	Asn 270	Tyr	Ala
Pro	Ser	Asx 275	Thr	Pro	Ser	Thr	Cys 280	Phe	Gly	Gly	Ile	Gln 285	Ser	Asn	Ser
Gly	Leu 290	Gly	Leu	Ser	Ile	Leu 295	Gly	Asp	Val	Phe	Leu 300	Lys	Ser	Gln	Tyr
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M	17-7		Dl	<i></i>		17-7	m1	77-	17-7	17-7	17-7	a]		<i></i>	mla ac
Met 1	vai	vai	Pne	ser 5	гла	vai	Thr	AIA	vai 10	vai	vai	GIŶ	Leu	ser 15	Inr
Ile	Val	Ser	Ala 20	Val	Pro	Val	Val	Gln 25	Pro	Arg	Lys	Gly	Phe 30	Thr	Ile
Asn	Gln	Val 35	Ala	Arg	Pro	Val	Thr 40	Asn	Lys	Lys	Thr	Val 45	Asn	Leu	Pro
Ala	Val 50	Tyr	Ala	Asn	Ala	Leu 55	Thr	Lys	Tyr	Gly	Gly 60	Thr	Val	Pro	Asp
Ser 65	Val	Lys	Ala	Ala	Ala 70	Ser	Ser	Gly	Ser	Ala 75	Val	Thr	Thr	Pro	Glu 80
Gln	Tyr	Aab	Ser	Glu 85	Tyr	Leu	Thr	Pro	Val 90	Lys	Val	Gly	Gly	Thr 95	Thr
Leu	Asn	Leu	Asp 100	Phe	Asp	Thr	Gly	Ser 105	Ala	Asp	Leu	Trp	Val 110	Phe	Ser
Ser	Glu	Leu 115	Ser	Ala	Ser	Gln	Ser 120	Ser	Gly	His	Ala	Ile 125	Tyr	Lys	Pro
Ser	Ala 130	Asn	Ala	Gln	Lys	Leu 135	Asn	Gly	Tyr	Thr	Trp 140	Lys	Ile	Gln	Tyr
Gly 145	Asp	Gly	Ser	Ser	Ala 150	Ser	Gly	Asp	Val	Tyr 155	Lys	Asp	Thr	Val	Thr 160
Val	Gly	Gly	Val	Thr 165	Ala	Gln	Ser	Gln	Ala 170	Val	Glu	Ala	Ala	Ser 175	His
Ile	Ser	Ser	Gln 180	Phe	Val	Gln	Asp	Lys 185	Asp	Asn	Asp	Gly	Leu 190	Leu	Gly

Phe	Phe 210	Asp	Thr	Val	ГЛЗ	Ser 215	Gln	Leu	Asp	Ser	Pro 220	Leu	Phe	Ala	Val
Thr 225	Leu	Lys	Tyr	His	Ala 230	Pro	Gly	Thr	Tyr	Asp 235	Phe	Gly	Tyr	Ile	Asp 240
Asn	Ser	Lys	Phe	Gln 245	Gly	Glu	Leu	Thr	Tyr 250	Thr	Asp	Val	Asp	Ser 255	Ser
Gln	Gly	Phe	Trp 260	Met	Phe	Thr	Ala	Asp 265	Gly	Tyr	Gly	Val	Gly 270	Asn	Gly
Ala	Pro	Asn 275	Ser	Asn	Ser	Ile	Ser 280	Gly	Ile	Ala	Asp	Thr 285	Gly	Thr	Thr
Leu	Leu 290	Leu	Leu	Asp	Asp	Ser 295	Val	Val	Ala	Asp	Tyr 300	Tyr	Arg	Gln	Val
Ser 305	Gly	Ala	Lys	Asn	Ser 310	Asn	Gln	Tyr	Gly	Gly 315	Tyr	Val	Phe	Pro	Суз 320
Ser	Thr	Lys	Leu	Pro 325	Ser	Phe	Thr	Thr	Val 330	Ile	Gly	Gly	Tyr	Asn 335	Ala
Val	Val	Pro	Gly 340	Glu	Tyr	Ile	Asn	Tyr 345	Ala	Pro	Val	Thr	Asp 350	Gly	Ser
Ser	Thr	Сув 355	Tyr	Gly	Gly	Ile	Gln 360	Ser	Asn	Ser	Gly	Leu 365	Gly	Phe	Ser
Ile	Phe 370	Gly	Asp	Ile	Phe	Leu 375	ГЛа	Ser	Gln	Tyr	Val 380	Val	Phe	Asp	Ser
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Ser Glu Phe Thr Gln Asp Thr Ala Asn Asp Gly Leu Leu Gly Leu Ala

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Phe	Ser	Ser 195	Ile	Asn	Thr	Val	Gln 200	Pro	Thr	Pro	Gln	Lys 205	Thr	Phe	Phe
Asp	Asn 210	Val	Гла	Ser	Ser	Leu 215	Ser	Glu	Pro	Ile	Phe 220	Ala	Val	Ala	Leu
Lys 225	His	Asn	Ala	Pro	Gly 230	Val	Tyr	Asp	Phe	Gly 235	Tyr	Thr	Asp	Ser	Ser 240
Lys	Tyr	Thr	Gly	Ser 245	Ile	Thr	Tyr	Thr	Asp 250	Val	Asp	Asn	Ser	Gln 255	Gly
Phe	Trp	Gly	Phe 260	Thr	Ala	Asp	Gly	Tyr 265	Ser	Ile	Gly	Ser	Asp 270	Ser	Ser
Ser	Asp	Ser 275	Ile	Thr	Gly	Ile	Ala 280	Asp	Thr	Gly	Thr	Thr 285	Leu	Leu	Leu
Leu	Asp 290	Asp	Ser	Ile	Val	Asp 295	Ala	Tyr	Tyr	Glu	Gln 300	Val	Asn	Gly	Ala
Ser 305	Tyr	Asp	Ser	Ser	Gln 310	Gly	Gly	Tyr	Val	Phe 315	Pro	Ser	Ser	Ala	Ser 320
Leu	Pro	Asp	Phe	Ser 325	Val	Thr	Ile	Gly	Asp 330	Tyr	Thr	Ala	Thr	Val 335	Pro
Gly	Glu	Tyr	Ile 340	Ser	Phe	Ala	Asp	Val 345	Gly	Asn	Gly	Gln	Thr 350	Phe	Gly
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Gly 385	Phe	Ala	Ala	Gln	Ala 390										
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Val	Asn	Gln	20 Lys	Ala	Ara	Pro	Val	25 Ala	Gln	Ala	Lvs	Ala	30 Ile	Asn	Leu
Pro	Glv	35 Met	-1-2 Tvr	Ala	Ser	Ala	40 Leu	Ser	Lvs	Tvr	Glv	45 Ala	Ala	Val	Pro
×10	50	100	-y-	A1-	NI-	55		Cor.	C1	-y-	60 81-	Wol	nia Th~	741 Th	Pro
ата 65	ser	vai	гуз	лта	лта 70	AIA	στα	ser	GTÀ	75	лта	vai	inr	mr	80 71-1-1
GIu	Ala	Asn	Asp	Val 85	Glu	Tyr	Leu	Thr	Pro 90	Val	Asn	Val	Gly	G1Y 95	Tnr
Thr	Leu	Asn	Leu 100	Asp	Phe	Asp	Thr	Gly 105	Ser	Ala	Asp	Leu	Trp 110	Val	Phe
Ser	Ser	Glu 115	Leu	Ser	Ser	Ser	Glu 120	Ser	Thr	Gly	His	Ser 125	Leu	Tyr	Lys
Pro	Ser 130	Ser	Asn	Ala	Thr	Lys 135	Leu	Ala	Gly	Tyr	Ser 140	Trp	Ser	Ile	Thr

		-	-	165	1				170					175	501
Gln	Ile	Ser	Gln 180	Gln	Phe	Val	Asn	Asp 185	Lys	Asn	Asn	Asp	Gly 190	Leu	Leu
Gly	Leu	Ala 195	Phe	Ser	Ser	Ile	Asn 200	Thr	Val	Lys	Pro	Lys 205	Ser	Gln	Thr
Thr	Phe 210	Phe	Asp	Thr	Val	Lys 215	Gly	Gln	Leu	Asp	Ser 220	Pro	Leu	Phe	Ala
Val 225	Thr	Leu	Lys	His	Asn 230	Ala	Pro	Gly	Thr	Tyr 235	Asp	Phe	Gly	Phe	Val 240
Asp	Lys	Asn	Lys	Tyr 245	Thr	Gly	Ser	Leu	Thr 250	Tyr	Ala	Gln	Val	Asp 255	Ser
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Lys	Ser	Gly 275	Gly	Ser	Ile	Gln	Gly 280	Ile	Ala	Asp	Thr	Gly 285	Thr	Thr	Leu
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Gly 305	Ala	Gln	Gln	Aab	Ser 310	Ser	Ala	Gly	Gly	Tyr 315	Thr	Val	Pro	Сүз	Ser 320
Ala	Gln	Leu	Pro	Asp 325	Phe	Thr	Val	Thr	Ile 330	Gly	Ser	Tyr	Asn	Ala 335	Val
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Tyr 145	Gly	Asp	Gly	Ser	Ser 150	Ala	Ser	Gly	Aab	Val 155	Tyr	Lys	Asp	Thr	Val 160
Thr	Val	Ala	Gly	Ile 165	Thr	Ala	Pro	Arg	Gln 170	Ala	Val	Glu	Ala	Ala 175	Ser
Thr	Ile	Ser	Ser 180	Glu	Phe	Thr	Gln	Asp 185	Lys	Asn	Asn	Asp	Gly 190	Leu	Leu
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Val	Asn	Gln 35	Val	Gln	LÀa	Ala	Val 40	Pro	Gly	Thr	Arg	Thr 45	Val	Asn	Leu
Pro	Gly 50	Leu	Tyr	Ala	Asn	Ala 55	Leu	Val	Lys	Tyr	Gly 60	Ala	Thr	Val	Pro
Ala 65	Thr	Val	His	Ala	Ala 70	Ala	Val	Ser	Gly	Ser 75	Ala	Ile	Thr	Thr	Pro 80
Glu	Ala	Asp	Asp	Val 85	Glu	Tyr	Leu	Thr	Pro 90	Val	Thr	Ile	Gly	Ser 95	Ser
Thr	Leu	Asn	Leu 100	Asp	Phe	Asp	Thr	Gly 105	Ser	Ala	Asp	Leu	Trp 110	Val	Phe
Ser	Ser	Glu	Leu	Thr	Ser	Ser	Gln	Gln	Ser	Gly	His	Asp	Val	Tyr	Asn

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Ту 14	r Gly 5	Asp	Gly	Ser	Ser 150	Ala	Ser	Gly	Asp	Val 155	Tyr	ГЛа	Asp	Thr	Val 160
Th	r Val	Gly	Gly	Val 165	Lys	Ala	Thr	Gly	Gln 170	Ala	Val	Glu	Ala	Ala 175	Lys
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Gl	y Met	Ala 195	Phe	Ser	Ser	Ile	Asn 200	Thr	Val	Ser	Pro	Thr 205	Pro	Gln	Lys
Th	r Phe 210	Phe	Asp	Thr	Val	Lys 215	Ser	Ser	Leu	Gly	Glu 220	Pro	Leu	Phe	Ala
Va 22	l Thr 5	Leu	Gln	Gly	Thr 230	Gly	Arg	Pro	Trp	His 235	Leu	Arg	Phe	Gly	Tyr 240
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Th	r Leu 290	Leu	Leu	Leu	Asp	Ser 295	Ser	Ile	Val	Thr	Gly 300	Leu	Leu	Gln	Glu
G1 [.] 30	y Tyr 5	Pro	Gly	Ser	Gln 310	Asn	Ser	Ser	Ser	Ala 315	Gly	Gly	Tyr	Ile	Phe 320
Pr	o Cys	Ser	Ala	Thr 325	Leu	Pro	Asp	Phe	Thr 330	Val	Thr	Ile	Asn	Gly 335	Tyr
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Va	l Val	Ala	Ser 20	Pro	Val	Glu	ГЛа	Arg 25	Asp	Ala	Phe	Glu	Val 30	ГЛа	Gln
Va	l Ala	His 35	Gly	Leu	His	Arg	Lys 40	Asn	Gly	Pro	Ala	Gln 45	Ile	Ala	Lys
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A1 65	a Asp	Asn	Asn	Ala	Val 70	Val	Gln	Ala	Asp	Ala 75	Asn	Thr	Gly	Ser	Asp 80
Pr	o Ala	Val	Pro	Ser 85	Asp	Gln	Tyr	Asp	Ser 90	Ser	Tyr	Leu	Ser	Pro 95	Val

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Asj	p Leu	1 Trp 115	Val	Phe	Ser	Asp	Leu 120	Gln	Ala	Lys	Ser	Ser 125	Leu	Ser	Gly
Hi	a Asp 130) Tyr	Tyr	Lys	Thr	Asp 135	Ala	Ser	Lys	Arg	Lys 140	Ser	Gly	Tyr	Thr
Tr] 14!	p Lya 5	; Ile	Ser	Tyr	Gly 150	Asp	Gly	Ser	Gly	Ala 155	Ser	Gly	Gln	Val	Tyr 160
Th:	r Asp	b Lys	Val	Thr 165	Val	Gly	Gln	Val	Thr 170	Ala	Thr	Ala	Gln	Ala 175	Val
Glı	ı Ala	a Ala	Thr 180	Ser	Val	Ser	Ala	Gln 185	Phe	Ser	Gln	Asp	Val 190	Asp	Thr
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Glı	n Glr 210	n Gln)	Thr	Thr	Trp	Phe 215	Asp	Thr	Val	Lys	Ser 220	Gln	Leu	Ala	Lys
Pro 22!	o Leu 5	ı Phe	Ala	Val	Thr 230	Leu	Lys	Tyr	His	Ala 235	Ala	Gly	Thr	Tyr	Asp 240
Phe	e Glչ	/ Tyr	Ile	Asp 245	Ser	Ala	Lys	Tyr	Thr 250	Gly	Ala	Ile	Thr	Tyr 255	Val
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Ту:	r Val	. Phe	Pro	Cys 325	Ser	Ala	Thr	Leu	Pro 330	Asn	Phe	Ser	Ile	Thr 335	Val
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Ile	e Thi	: Asp 355	Gly	Ser	Ser	Thr	Суз 360	Phe	Gly	Gly	Met	Gln 365	Pro	Asp	Thr
Asj	p Ile 370	e Gly	Gln	Ser	Ile	Phe 375	Gly	Asp	Ile	Phe	Leu 380	Lys	Ser	Lys	Tyr
I10 38!	e Val	. His	Asp	Met	Ser 390	Asn	Gly	Thr	Pro	Arg 395	Leu	Gly	Phe	Ala	Gln 400
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Pro	o Val	. Ile 35	Tyr	Asn	Ala	Asn	His 40	Ala	Pro	His	Gly	Pro 45	Ser	Ala	Leu
Ту:	r Lys 50	8 Ala	Lys	Lys	Lys	Phe 55	Gly	Ala	Pro	Ile	Ser 60	Glu	Ser	Leu	Lys

30

Asn 65	Asn	Val	Ala	Gln	His 70	Lys	Ala	Ala	Lys	Leu 75	Ala	Arg	Arg	Gln	Thr 80
Gly	Ser	Ala	Pro	Asn 85	His	Pro	Ser	Asp	Ser 90	Glu	Asp	Asp	Glu	Tyr 95	Ile
Thr	Asn	Val	Ser 100	Ile	Gly	Thr	Pro	Ala 105	Gln	Val	Leu	Pro	Leu 110	Asp	Phe
Asp	Thr	Gly 115	Ser	Ser	Asp	Leu	Trp 120	Val	Phe	Ser	Ser	Glu 125	Thr	Pro	Ser
Ser	Gln 130	Ala	Lys	Gly	His	Thr 135	Leu	Tyr	Asn	Pro	Thr 140	Lys	Ser	Ser	Thr
Ser 145	Lys	Lys	Leu	Ser	Gly 150	Tyr	Ser	Trp	Thr	Ile 155	Ser	Tyr	Gly	Asp	Gly 160
Ser	Ser	Ser	Ser	Gly 165	Asp	Val	Tyr	Thr	Asp 170	Thr	Val	Ser	Val	Gly 175	Gly
Phe	Ser	Val	Thr 180	Gly	Gln	Ala	Val	Glu 185	Ser	Ala	Thr	Lys	Val 190	Ser	Ser
Glu	Phe	Val 195	Ser	Asp	Thr	Ser	Asn 200	Ser	Gly	Leu	Leu	Gly 205	Leu	Ala	Leu
Asp	Ser 210	Ile	Asn	Thr	Val	Ser 215	Pro	Lys	Gln	Gln	Lys 220	Thr	Trp	Phe	Ser
Asn 225	Ala	Ser	Ser	Lys	Leu 230	Ala	Gln	Pro	Val	Phe 235	Thr	Ala	Asp	Leu	Asn 240
His	Gln	Ala	Ser	Gly 245	Ser	Tyr	Asn	Phe	Gly 250	Tyr	Ile	Asp	Thr	Ser 255	Leu
Ala	Ser	Gly	Pro 260	Ile	Ser	Tyr	Val	Pro 265	Ile	Ser	Thr	Ala	Asn 270	Gly	Phe
Trp	Glu	Phe 275	Thr	Ser	Ala	Ser	Tyr 280	Ala	Ile	Gly	Ser	Gly 285	Ser	Thr	Lys
Lys	His 290	Ser	Thr	Asp	Gly	Ile 295	Ala	Asp	Thr	Gly	Thr 300	Thr	Leu	Leu	Leu
Leu 305	Aab	Asp	Thr	Ile	Val 310	Asp	Ala	His	Tyr	Gly 315	Gln	Val	Ser	Ser	Ala 320
Gln	Tyr	Asp	Asn	Ser 325	Gln	Glu	Gly	Tyr	Thr 330	Phe	Aab	Сүз	Asp	Glu 335	Asn
Leu	Pro	Ser	Phe 340	Thr	Phe	Ala	Val	Gly 345	Ser	Ser	Lys	Ile	Thr 350	Val	Pro
Gly	Ser	Leu 355	Ile	Asn	Phe	Ala	Pro 360	Val	Ser	Gly	Asn	Thr 365	Сүз	Phe	Gly
Gly	Leu 370	Gln	Ser	Asn	Asp	Gly 375	Ile	Gly	Ile	Asn	Ile 380	Phe	Gly	Asp	Val
Ala 385	Ile	ГЛа	Ala	Ala	Leu 390	Val	Val	Phe	Aap	Leu 395	Gly	Asn	Lys	Arg	Leu 400
Gly	Trp	Ala	Gln	Lys 405											

We claim:

1. A method for increasing the amount of glucose and other sugar and peptides released from a fiber containing corn or soy bean byproduct comprising:

(a) reacting a fiber containing corn or soy bean byproduct selected from the group consisting of corn gluten feed (CGF), distillers dried grains (DDG), distillers dried 65 grains with solubles (DDGS), and soy hulls with a mixture of reactants comprising at least one protease and at least one member of the group consisting of cellulase and hemicellulase; and

- (b) obtaining a reaction product from said fiber containing corn or soy byproduct and said mixture of reactants, wherein a wt/wt ratio of glucose/fiber is greater in the reaction product than the wt/wt ratio of glucose/fiber obtained from reaction of the fiber containing corn or soy processing byproduct under the same conditions as the reaction of step (a), but excluding protease, and
- (c) forming an animal feed from the reaction product.

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2. The method of claim 1, wherein said mixture does not include amylase.

3. The method of claim 1, wherein said protease is an acid fungal protease.

4. The method of claim **1**, wherein said protease has an ⁵ amino acid sequence at least 95% identical to the amino acid sequence of SEQ ID NO: 1.

5. The method of claim **1**, wherein said protease is selected from the group consisting of *Aspergillus saitoi* aspartic protease, *Penicillium* acid protease, *Mucor* acid protease, *Monascus* acid protease, *Trichoderma* acid protease, *Phaeosphaeria* acid protease, and *Rhizopus* acid protease.

6. The method of claim **4**, wherein said protease is *Aspergillus saitoi* aspartic protease, said *Aspergillus saitoi* aspartic protease having the amino acid sequence of SEQ ID NO: 1.

7. The method of claim 1, wherein said corn or soy bean byproduct is selected from the group consisting of CGF, DDG, and DDGS.

8. The method of claim **1**, wherein said fiber feedstock comprises less than 20% starch by weight.

9. The method of claim **1**, wherein said fiber feedstock comprises less than 10% starch by weight.

10. The method of claim **1**, wherein said fiber feedstock ²⁵ comprises less than 5% starch by weight.

11. The method of claim **1**, wherein said fiber feedstock comprises 0% starch by weight.

12. The method of claim 1, wherein said mixture of reactants comprises cellulase, and wherein said cellulase comprises one or more of endo- β -1,4 glucanases, exo-cellobiohydrolases, β -glucosidase, and exoglucanases.

13. The method of claim 1, wherein said mixture of reactants comprises hemicellulase, and wherein said hemicellulase comprises one or more of endo-1,4- β -xylanase, β -xylosidase, β -endomannanase, β -mannosidase, pectin lyase,

pectate lyase, α -L-arabinofuransidase, α -glucuronidases, α/β -galactosidases, and several esterases.

14. The method of claim 1, wherein said reaction product further comprises arabinose, xylose, galactose, mannose, cellulobiose, maltose, and maltotriose.

15. The method of claim **1**, wherein the wt/wt ratio of glucose/fiber is greater in the reaction product than the wt/wt ratio of glucose/fiber amount of glucose obtained from reaction of the fiber containing corn or soy byproduct under the same conditions as the reaction of step (a), but excluding protease by at least 10%.

16. The method of claim 15, wherein the wt/wt ratio of glucose/fiber is greater in the reaction product than the wt/wt ratio of glucose/fiber amount of glucose obtained from reaction of the fiber containing corn or soy byproduct under the same conditions as the reaction of step (a), but excluding protease by at least 20%.

17. The method of claim 16, wherein the wt/wt ratio of glucose/fiber is greater in the reaction product than the wt/wt $_{20}$ ratio of glucose/fiber amount of glucose obtained from reaction of the fiber containing corn or soy byproduct under the same conditions as the reaction of step (a), but excluding protease by at least 100%.

18. The method of claim **1**, wherein said protease has an amino acid sequence selected from the group consisting of SEQ ID NO: 1, SEQ ID NO:2, SEQ ID NO: 3, SEQ ID NO: 4, SEQ ID NO: 5, SEQ ID NO: 6, SEQ ID NO: 7, SEQ ID NO: 8, SEQ ID NO: 9, SEQ ID NO: 10, SEQ ID NO: 11, and SEQ ID NO: 12.

19. A method for obtaining a solid hydrolyzed fiber, comprising: (a) preparing a reaction product according to claim **1**; and (b) separating said reaction product into a solid hydrolyzed fiber fraction and a liquid fraction, wherein at least one of the hydrolyzed fiber fraction the liquid fraction are used to form the animal feed.

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