

19



LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère de l'Économie

11

N° de publication :

LU508360

12

BREVET D'INVENTION

B1

21

N° de dépôt: LU508360

51

Int. Cl.:
A23K 10/00, A23L 11/00, A23J 1/00

22

Date de dépôt: 25/09/2024

30

Priorité:

72

Inventeur(s):
YANG Lijie – China, JIANG Shuzhen – China, YANG
Weiren – China, GE Jinshan – China

43

Date de mise à disposition du public: 25/03/2025

74

Mandataire(s):
Patent42 SA – 4081 Esch-sur-Alzette (Luxembourg)

47

Date de délivrance: 25/03/2025

73

Titulaire(s):
SHANDONG AGRICULTURAL UNIVERSITY –
271099 Tai'an City (China), SHANDONG ZHONGCHENG
FEED TECHNOLOGY CO.,LTD. – 271699 Tai'an
City (China)

54

GARLIC STRAW FERMENTED FEED AND PREPARATION METHOD AND APPLICATION THEREOF.

57

The invention belongs to the technical field of feed preparation, and relates to a garlic straw fermented feed and a preparation method and application thereof. According to the invention, garlic straw is firstly subjected to freeze-thaw treatment, then crushed, then evenly mixed with compound enzyme, compound bacteria and wheat bran, and subjected to anaerobic fermentation, so that the garlic straw fermented feed is obtained. The nutrient components in garlic straw can be protected from being destroyed to the greatest extent, and the digestibility and absorption of the feed are improved. Under the action of enzymes, bacteria, bran and other raw materials, the pungent smell of garlic straw is improved, the palatability and nutritional value of the feed are increased, and its utilization rate is improved. No harmful substances such as chemical preservatives and artificial pigments are added in the preparation process.

DESCRIPTION

LU508360

GARLIC STRAW FERMENTED FEED AND PREPARATION METHOD AND APPLICATION THEREOF**TECHNICAL FIELD**

The invention belongs to the technical field of feed preparation, in particular to a garlic straw fermented feed and a preparation method and application thereof.

BACKGROUND

Feed is an important source of nutrition in aquaculture and plays a decisive role in the growth and health of cultured animals. Traditional feed raw materials mainly include grain and soybean meal, but due to the limitation of planting area and yield, the prices of these raw materials are rising, which seriously affects the breeding cost. Therefore, finding new, environmentally friendly and sustainable feed raw materials has become an important demand in the industry.

Garlic is an *Allium* plant in Liliaceae, which is rich in protein, volatile oil, various amino acids, vitamins, sugars, minerals and trace elements. It has antibacterial, antiviral, anti-tumor, hypolipidemic, hypoglycemic, detoxicating, and immune function improvement effects. According to the determination, its chemical composition and effective substance content are almost comparable to those of garlic, and it has research and development value. The harvested garlic straw has high nutritional value, low crude fiber content and rich allicin, so it has high utilization value.

Because garlic straw is not resistant to long-term storage, easy to mildew and low utilization rate, it is often abandoned and burned by farmers at will, polluting the environment and air. At present, the utilization of garlic straw is generally to return the crushed straw to the field or to feed fattening pigs such as cattle and sheep after drying. These methods have low utilization rate of garlic straw and it is difficult to effectively utilize the nutrients in garlic straw.

Therefore, how to prepare a pig feed with garlic straw as the main raw material and improve the utilization rate and economic value of garlic straw is an urgent problem for technicians in this field.

SUMMARY

The purpose of the invention is to provide a preparation method of a garlic straw fermented feed, so as to solve the problems existing in the prior art, improve the utilization rate of garlic straw, and realize the cost reduction and efficiency increase of cultivation.

To achieve the above objectives, the present invention provides the following scheme:

One of the technical schemes of the invention is to provide a preparation method of a garlic straw fermented feed, which includes the following steps:

freezing-thawing garlic straw and crush them to obtain pretreated garlic straw;

adding compound enzyme, compound bacteria and wheat bran into the pretreated garlic straw, mixing uniformly, and performing anaerobic fermentation to obtain the fermented garlic straw feed.

Further, the garlic straw is fresh garlic straw.

Further, the step of freezing-thawing treatment includes:

garlic straw are frozen at -30--20 °C for 24-48h, then thawed at room temperature, and the freezing-thawing process is repeated at least twice to complete the freezing-thawing treatment.

The beneficial effects of the above further and optimized scheme are as follows: the freeze-thaw treatment has three main purposes: firstly, the cellulose structure in garlic straw is destroyed, which is beneficial to subsequent fermentation and improves the utilization rate of garlic straw fermented feed; secondly, it can promote the cell rupture of garlic straw in the process of freeze-thaw treatment, so that the nutrition of garlic straw can be dissolved more easily in the following steps; the third is to kill the potential pathogenic bacteria and eggs that may be carried on the surface of fresh garlic straw. Furthermore, garlic straw is rich in allicin, which is easy to decompose in the process of high-temperature sterilization, resulting in the loss of nutrition of garlic straw. By adopting the freeze-thaw treatment in the invention as a sterilization method, the allicin in garlic straw can be guaranteed not to be damaged by high temperature, resulting in the reduction of content.

Further, the particle size of the crushed garlic straw is 1 mm-10 mm.

Further, the compound enzyme includes pectinase and cellulase in a mass ratio of 1-3: 3-6.

Preferably, the compound enzyme is a commercially available product provided by Shandong Longkete Enzyme Preparation Co., Ltd., where the enzyme activity of pectinase is not less than 4×10^7 U/kg, and that of cellulase is not less than 2×10^7 U/kg.

Complex enzyme can destroy the fiber structure in garlic straw, thus improving the digestibility of feed. LU508360

Further, the compound bacteria include lactic acid bacteria and yeast in a mass ratio of 1-5: 1-5.

Preferably, the compound bacteria is a commercial product, which is provided by Shandong Taishan Shengliyuan Group Co., Ltd., where the viable count of lactic acid bacteria liquid is not less than 5.0×10^9 CFU/g, and the viable count of yeast is not less than 2.0×10^{11} CFU/g.

Complex bacteria can further decompose and release the nutrients in garlic straw during anaerobic fermentation.

Further, the mass ratio of the compound enzyme, the compound bacteria and the wheat bran is 4-9: 3-5: 20-30, preferably 9:4:10.

Further, the mass ratio of the pretreated straw to the wheat bran is 10:2-3, preferably 10: 2.

Further, during the anaerobic fermentation, the temperature of the environment is kept between 20-30 °C.

Further, the anaerobic fermentation time is 14-21 days.

Preferably, the water content of the material before anaerobic fermentation is kept at 60-70%.

Preferably, the anaerobic fermentation is carried out by using a fermentation bag with a one-way air valve, and only the air is discharged but not the air is introduced.

The second technical scheme of the present invention is to provide a garlic straw fermented feed prepared by the above method.

The third technical scheme of the invention is to provide an application of the garlic straw fermented feed in the feeding of fattening pigs.

The invention discloses the following technical effects:

under the condition of effectively killing germs, eggs and other effects, the invention can also ensure the nutritional integrity of garlic straw from loss, and improve the digestibility and absorption of feed.

Under the action of enzymes, bacteria, bran and other raw materials, the invention improves the pungent smell of garlic straw, increases the palatability and nutritional value of feed, and improves its utilization rate. No harmful substances such as chemical preservatives and artificial pigments are added in the preparation process, and the prepared feed has the characteristics of environmental protection, health and the like.

Through microbial fermentation, the cellulose and lignin in the straw are decomposed into easily digestible nutrients such as sugars and amino acids, thus improving the palatability and nutritional value of the feed; microbial enzymes produced during fermentation can promote the secretion and activity of digestive enzymes in animals, thus improving the digestibility and absorption rate of feed; organic acids and antibacterial substances produced by microbial fermentation can inhibit the growth and reproduction of intestinal pathogens, improve intestinal health and reduce the occurrence of intestinal diseases such as animal diarrhea. Microbial fermentation products are rich in vitamins, immune polysaccharides and other nutrients, which can enhance animal immunity and improve disease resistance; using crop straw to feed animals instead of some concentrate can reduce the consumption of concentrate, thus reducing the generation of waste and environmental pollution.

DESCRIPTION OF THE INVENTION

A number of exemplary embodiments of the present invention will now be described in detail, and this detailed description should not be considered as a limitation of the present invention, but should be understood as a more detailed description of certain aspects, characteristics and embodiments of the present invention.

It should be understood that the terminology described in the present invention is only for describing specific embodiments and is not used to limit the present invention. In addition, for the numerical range in the present invention, it should be understood that each intermediate value between the upper limit and the lower limit of the range is also specifically disclosed. Intermediate values within any stated value or stated range, as well as each smaller range between any other stated value or intermediate values within the stated range are also included in the present invention. The upper and lower limits of these smaller ranges can be independently included or excluded from the range.

Unless otherwise specified, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention relates. Although the present invention only describes the preferred methods and materials, any methods and materials similar or equivalent to those described herein can also be used in the practice or testing of the present invention. All documents mentioned in this specification are incorporated by reference to disclose and describe methods and/or materials related to the documents. In case of conflict with any incorporated document, the contents of this specification shall prevail.

It is obvious to those skilled in the art that many improvements and changes can be made to the specific embodiments of the present invention without departing from the scope or spirit of the present invention. Other embodiments will be apparent to the skilled person from the description of the invention. The description and Embodiment of that present invention are exemplary only.

The terms "including", "comprising", "having" and "containing" used in this article are all open terms, which means including but not limited to.

Wheat bran is provided by Shandong Taishan Shengliyuan Group Co., Ltd.

The compound enzyme is a commercial product provided by Shandong Longkete Enzyme Preparation Co., Ltd., in which the enzyme activity of pectinase is not less than 4×10^7 U/kg and the enzyme activity of cellulase is not less than 2×10^7 U/kg.

Compound bacteria are commercial products, provided by Shandong Taishan Shengliyuan Group Co., Ltd., in which the number of live bacteria in lactic acid bacteria liquid is not less than 5.0×10^9 CFU/g, and the number of live bacteria in yeast is not less than 2.0×10^{11} CFU/g.

In the specific embodiment of the invention, the particle size of the crushed garlic straw is between 1-10 mm.

Embodiment 1

Preparation of garlic straw fermented feed:

S1, freezing fresh garlic straw at $-30\text{ }^{\circ}\text{C}$ for 24 hours, then thawing at room temperature, repeating the freezing-thawing process for three times, and crushing the frozen and thawed garlic straw to obtain pretreated garlic straw;

S2, uniformly mixing the pretreated garlic straw with compound enzyme (pectinase and cellulase in a mass ratio of 1:1), compound bacteria (lactic acid bacteria and yeast in a mass ratio of 1:1) and wheat bran to obtain a mixed material, where the mass ratio of compound enzyme, compound bacteria and wheat bran is 9:4:20, and the mass ratio of pretreated straw to wheat bran is 10: 2;

S3, detecting the water content of the mixed material, supplementing water until the water content is 60-70%, and then filling the mixture into a fermentation bag with a one-way air valve, and performing anaerobic fermentation, where the temperature of the anaerobic fermentation environment is controlled at $20\text{-}30\text{ }^{\circ}\text{C}$, and the garlic straw fermented feed is obtained after 21 days of anaerobic fermentation.

Embodiment 2

Preparation of garlic straw fermented feed:

S1, freezing fresh garlic straw at -30 °C for 24 hours, then thawing at room temperature, repeating the freezing-thawing process for three times, and crushing the frozen and thawed garlic straw to obtain pretreated garlic straw; LU508360

S2, uniformly mixing the pretreated garlic straw with compound enzyme (pectinase and cellulase in a mass ratio of 1:1), compound bacteria (lactic acid bacteria and yeast in a mass ratio of 1:1) and wheat bran to obtain a mixed material, where the mass ratio of compound enzyme, compound bacteria and wheat bran is 9:3:25, and the mass ratio of pretreated straw to wheat bran is 10: 2.5;

S3, detecting the water content of the mixed material, supplementing water until the water content is 60-70%, and then filling the mixture into a fermentation bag with a one-way air valve, and performing anaerobic fermentation, where the temperature of the anaerobic fermentation environment is controlled at 20-30 °C, and the garlic straw fermented feed is obtained after 14 days of anaerobic fermentation.

Embodiment 3

Preparation of garlic straw fermented feed:

S1, freezing fresh garlic straw at -30 °C for 24 hours, then thawing at room temperature, repeating the freezing-thawing process for three times, and crushing the frozen and thawed garlic straw to obtain pretreated garlic straw;

S2, uniformly mixing the pretreated garlic straw with compound enzyme (pectinase and cellulase in a mass ratio of 1:1), compound bacteria (lactic acid bacteria and yeast in a mass ratio of 1:1) and wheat bran to obtain a mixed material, where the mass ratio of compound enzyme, compound bacteria and wheat bran is 9:5:30, and the mass ratio of pretreated straw to wheat bran is 10: 3;

S3, detecting the water content of the mixed material, supplementing water until the water content is 60-70%, and then filling the mixture into a fermentation bag with a one-way air valve, and performing anaerobic fermentation, where the temperature of the anaerobic fermentation environment is controlled at 20-30 °C, and the garlic straw fermented feed is obtained after 14 days of anaerobic fermentation.

Embodiment 4

Preparation of garlic straw fermented feed:

S1, freezing fresh garlic straw at -30 °C for 24 hours, then thawing at room temperature, repeating the freezing-thawing process for three times, and crushing the frozen and thawed garlic straw to obtain pretreated garlic straw;

S2, uniformly mixing the pretreated garlic straw with compound enzyme (pectinase and cellulase in a mass ratio of 1:1), compound bacteria (lactic acid bacteria and yeast in

a mass ratio of 1:1) and wheat bran to obtain a mixed material, where the mass ratio of compound enzyme, compound bacteria and wheat bran is 7:3:30, and the mass ratio of pretreated straw to wheat bran is 10: 3;

S3, detecting the water content of the mixed material, supplementing water until the water content is 60-70%, and then filling the mixture into a fermentation bag with a one-way air valve, and performing anaerobic fermentation, where the temperature of the anaerobic fermentation environment is controlled at 20-30 °C, and the garlic straw fermented feed is obtained after 21 days of anaerobic fermentation.

Embodiment 5

Preparation of garlic straw fermented feed:

S1, freezing fresh garlic straw at -30 °C for 24 hours, then thawing at room temperature, repeating the freezing-thawing process for three times, and crushing the frozen and thawed garlic straw to obtain pretreated garlic straw;

S2, uniformly mixing the pretreated garlic straw with compound enzyme (pectinase and cellulase in a mass ratio of 1:1), compound bacteria (lactic acid bacteria and yeast in a mass ratio of 1:1) and wheat bran to obtain a mixed material, where the mass ratio of compound enzyme, compound bacteria and wheat bran is 7:4:20, and the mass ratio of pretreated straw to wheat bran is 10: 2;

S3, detecting the water content of the mixed material, supplementing water until the water content is 60-70%, and then filling the mixture into a fermentation bag with a one-way air valve, and performing anaerobic fermentation, where the temperature of the anaerobic fermentation environment is controlled at 20-30 °C, and the garlic straw fermented feed is obtained after 21 days of anaerobic fermentation.

Comparative embodiment 1

Preparation of garlic straw fermented feed:

Compared with Embodiment 1, the difference is only that the mass ratio of compound enzyme, compound bacteria and wheat bran is 9:2:20.

Comparative embodiment 2

Preparation of garlic straw fermented feed:

Compared with Embodiment 2, the difference is only that the mass ratio of pretreated straw, compound enzyme, compound bacteria and wheat bran is 100:5:1:10.

Comparative embodiment 3

Preparation of garlic straw fermented feed:

Compared with Embodiment 2, the difference is only that the mass ratio of pretreated straw, compound enzyme, compound bacteria and wheat bran is 100:4:2:30.

Comparative embodiment 4

LU508360

Preparation of garlic straw fermented feed:

Compared with Embodiment 4, the difference is only that the anaerobic fermentation days are 7 days.

Comparative embodiment 5

Preparation of garlic straw fermented feed:

Compared with Embodiment 1, the only difference is that the freeze-thaw treatment is changed to steam sterilization.

Comparative embodiment 6

Preparation of garlic straw fermented feed:

Compared with Embodiment 1, the only difference is that garlic straw is not frozen and thawed, and the steps are as follows:

S1, crushing fresh garlic straw, and uniformly mixing with compound enzyme (pectinase and cellulase in a mass ratio of 1:1), compound bacteria (lactic acid bacteria and yeast in a mass ratio of 1:1) and wheat bran to obtain a mixed material, where the mass ratio of compound enzyme, compound bacteria and wheat bran is 9:4:20, and the mass ratio of crushed straw to wheat bran is 10: 2;

S2, detecting the water content of the mixed material, supplementing water until the water content is 60-70%, and then filling the mixture into a fermentation bag with a one-way air valve, and performing anaerobic fermentation, where the temperature of the anaerobic fermentation environment is controlled at 20-30 °C, and the garlic straw fermented feed is obtained after 21 days of anaerobic fermentation.

Test embodiment 1

Dry matter (DM) content (GB/T 6435-2014) is determined by drying method (103±2 °C). The crude fiber (CF) content (GB/T 6434-2022) is determined by filter bag method. By comparing the data between mixed materials and feed, the DM degradation rate and CF degradation rate are obtained. The results are shown in Table 1.

Table 1

LU508360

Sample	DM degradation rate (%)	CF degradation rate (%)
Embodiment 1	6.33	54.95
Embodiment 2	7.52	48.35
Embodiment 3	8.99	43.85
Embodiment 4	10.35	39.97
Embodiment 5	11.25	35.66
Comparative embodiment 1	21.54	27.28
Comparative embodiment 2	16.33	30.77
Comparative embodiment 3	16.56	20.95
Comparative embodiment 4	18.52	25.49

As can be seen from the data in Table 1, in the scheme of the embodiment of the present invention, the degradation rate of crude fiber is higher than that of the comparative embodiment, and the degradation rate of dry matter is lower than that of the comparative embodiment. It can be shown that the feed of the present invention degrades crude fiber to preserve dry matter and improves the palatability and nutritional value of the feed.

Test embodiment 2

Pretreated garlic straw (CK) and the mixture of pretreated garlic straw and wheat bran (CK₁) according to the mass ratio of 5:1 are used as the control group, and the digestibility of the feed prepared in embodiment 1 is tested in vitro. The method is as follows:

The in vitro digestibility of pigs is determined by the method of "SDS- II monogastric animal bionic digestion system" developed by Institute of Animal Sciences of CAAS. The

energy of samples before and after digestion is analyzed according to ISO 9831: 1998, using PARR 1281 automatic oxygen bomb energy analyzer (USA), and the nitrogen content is analyzed by DUMAS method (AOAC, 990.03) and Rapid N III combustion rapid nitrogen determination (Germany).

Table 2

	CK	CK ₁	Embodiment 1
Dry matter digestibility/%	21.41	32.07	45.42
Protein digestibility/%	45.89	47.62	49.21
Total energy/(kcal/kg)	3577.82	3721.45	3539.76
Energy value of enzymatic hydrolysate/(kcal/kg)	966.34	1483.86	1429.71

It can be seen from Table 2 that the digestibility of dry matter in Embodiment 1 is significantly higher than that in CK group and CK₁ group, and the energy value of enzymatic hydrolysate in Embodiment 1 is significantly higher than that in CK group, indicating that the feed prepared by the invention has higher digestion, absorption and utilization rate.

Test embodiment 3

200 weaned piglets with good health and average weight of (14±0.15) kg are randomly divided into four groups, of which three groups are fed with the feed prepared in embodiment 1 and comparative embodiments 5-6 respectively, and the remaining group is fed with the commercially available pig feed for 45 days. All piglets are free to eat and drink water, and the pigsty adopted the same management method, and the growth data, daily gain, daily intake and diarrhea rate are recorded. Calculate the average value, and the results are shown in Table 3.

Table 3

LU508360

	Daily intake	Average daily gain	Diarrhea rate
Embodiment 1	2.15	937	2%
Comparative embodiment 5	2.33	813	4%
Comparative embodiment 6	2.41	824	8%
Commercial pig feed	2.21	635	8%

It can be seen from Table 3 that the daily intake of comparative embodiment 5 after steam sterilization is higher than that of embodiment 1, but the average daily gain is lower than that of embodiment 1, indicating that freeze-thaw treatment destroys the microstructure of straw, which is beneficial to the nutrient absorption of subsequent feed, and freeze-thaw treatment will not destroy the effective components of straw. From the diarrhea rate of comparative embodiment 6, comparative embodiment 5 and embodiment 1, it can be seen that the diarrhea rate of unsterilized straw is significantly improved after being prepared into feed. The average daily intake of embodiment 1 of the present invention is the lowest, but the average daily gain is the highest, indicating that the digestion, absorption and utilization rate of the feed prepared by embodiment 1 of the present invention is higher than that of comparative embodiments 5-6 and commercial pig feed.

Each embodiment in this specification is described in a progressive way, and each embodiment focuses on the differences from other embodiments, so it is only necessary to refer to the same and similar parts between each embodiment.

The above description of the disclosed embodiments enables those skilled in the art to make or use the invention. Many modifications to these embodiments will be obvious to those skilled in the art, and the general principles defined herein can be implemented in other embodiments without departing from the spirit or scope of the invention. Therefore, the present invention is not to be limited to the embodiments shown herein, but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

CLAIMS

LU508360

1. A preparation method of a garlic straw fermented feed, characterized by comprising the following steps:

freezing-thawing garlic straw and pulverizing to obtain pretreated garlic s;

adding compound enzyme, compound bacteria and wheat bran into the pretreated garlic straw, uniformly mixing, and performing anaerobic fermentation to obtain the garlic straw fermented feed;

the compound enzyme comprises pectinase and cellulase;

the compound bacteria comprise lactic acid bacteria and yeast.

2. The preparation method according to claim 1, characterized in that the step of freezing-thawing treatment comprises:

freezing garlic straw at -30--20 °C for 24-48h, then thawing at room temperature, and repeating the freezing-thawing process at least twice to complete the freezing-thawing treatment.

3. The preparation method according to claim 1, characterized in that the particle size of the crushed garlic straw is 1-10 mm.

4. The preparation method according to claim 1, characterized in that the mass ratio of the compound enzyme, the compound bacteria and the wheat bran is 4-9: 3-5: 20-30; the mass ratio of the pretreated garlic straw to the wheat bran is 10: 2-3.

5. The preparation method according to claim 1, characterized in that the mass ratio of pectinase to cellulase in the composite enzyme is 1-3: 3-6; the mass ratio of lactic acid bacteria to yeast in the compound bacteria is 1-5: 1-5.

6. The preparation method according to claim 1, characterized in that the temperature of the environment is kept between 20-30 °C during the anaerobic fermentation; the time of anaerobic fermentation is 14-21 days.

7. A garlic straw fermented feed prepared by the preparation method according to any one of claims 1-6.

8. An application of garlic straw fermented feed in fattening pig feeding according to claim 7.

1. Herstellungsverfahren eines fermentierten Futtermittels aus Knoblauchstroh, dadurch gekennzeichnet, dass es die folgenden Schritte umfasst:

Einfrieren und Auftauen von Knoblauchstroh und Pulverisieren, um vorbehandelten Knoblauchstroh zu erhalten;

Hinzufügen eines zusammengesetzten Enzyms, zusammengesetzter Bakterien und Weizenkleie zu dem vorbehandelten Knoblauchstroh, gleichmäßiges Mischen und Durchführen einer anaeroben Fermentation, um das fermentierte Knoblauchstrohfutter zu erhalten;

das zusammengesetzte Enzym umfasst Pektinase und Cellulase; und

die zusammengesetzten Bakterien umfassen Milchsäurebakterien und Hefe.

2. Herstellungsverfahren nach Anspruch 1, dadurch gekennzeichnet, dass der Schritt der Behandlung vom Einfrieren und Auftauen umfasst:

Einfrieren des Knoblauchstrohs bei -30-20°C für 24-48 Stunden, dann Auftauen bei Raumtemperatur und Wiederholen des Vorgangs vom Einfrieren und Auftauen mindestens zweimal, um die Behandlung vom Einfrieren und Auftauen abzuschließen.

3. Zubereitungsverfahren nach Anspruch 1, dadurch gekennzeichnet, dass die Partikelgröße des zerkleinerten Knoblauchstrohs 1-10 mm beträgt.

4. Herstellungsverfahren nach Anspruch 1, dadurch gekennzeichnet, dass das Massenverhältnis des zusammengesetzten Enzyms, der zusammengesetzten Bakterien und der Weizenkleie 4-9: 3-5: 20-30 ist; das Massenverhältnis des vorbehandelten Knoblauchstrohs zur Weizenkleie 10: 2-3 beträgt.

5. Herstellungsverfahren nach Anspruch 1, dadurch gekennzeichnet, dass das Massenverhältnis von Pektinase zu Cellulase in dem zusammengesetzten Enzym 1-3:

3-6 beträgt; das Massenverhältnis von Milchsäurebakterien zu Hefe in den zusammengesetzten Bakterien 1-5: 1-5 beträgt.

6. Herstellungsverfahren nach Anspruch 1, dadurch gekennzeichnet, dass die Temperatur der Umgebung während der anaeroben Fermentation zwischen 20-30°C gehalten wird; und die Dauer der anaeroben Fermentation beträgt 14-21 Tage.

7. Fermentiertes Futtermittel aus Knoblauchstroh, hergestellt durch das Herstellungsverfahren nach einem der Ansprüche 1 bis 6.

8. Anwendung vom fermentierten Futtermittel aus Knoblauchstroh in der Mastschweinefütterung nach Anspruch 7.