

(19)



(11) Patent Number: KE 7

(45) Date of grant: 26/01/1996

(12) PATENT

(51) Int.Cl.7:
A 23L 1/221, 1/23, 1/238

(21) Application Number:
1993/000118

(22) Filing Date:
22/10/1993

(30) Priority data:
P42359279 23/10/1992 DE

(54) Title:
A PROCESS FOR PRODUCTION OF A SEASONING SAUCE BASED ON OAT

(57) Abstract:
The invention relates to a process for the preparation of a spiced sauce similar to the known soy sauce, whereby a fungus-covered, enzyme-containing substrate is first mashed with common salt-containing water, the mash is subjected to a fermentation for a longer period for time, and finally treated by pressing, pasteurizing and filtering, characterized in that
(A) despelled, softened oat kernels are used as the substrate,
(B) mashing is carried out with salt water, so that the salt content of the mash comes to 4 to 12% by weight, preferably to 7 to 8% by weight, and
(C) the fermentation is carried out in several stages at temperatures decreasing from 40 to 45 degree centigrade in the first stage to room temperatures in the final stage, for 8 to 12 weeks.

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PROCESS FOR THE PREPARATION OF A
SPICED SAUCE BASED ON OAT

The invention relates to a process for the preparation of a spiced sauce similar to the known soya sauce.

It is known to prepare soya sauce by a fermentation process, whereby soybeans are used in different proportions as whole beans or as degreased coarse soybean meal, as well as wheat, if need be, mostly as roasted wheatmeal and salt, and on the basis of a type of malt, an enzyme-containing substrate covered with fungi, which is referred to as koji, is prepared first. Said substrate is subsequently mashed with salt water and subjected to a multi-stage fermentation, in which a combined hydrolytic process takes place with lactic acid and alcoholic fermentation, and to a maturation phase. The hyphal fungi of the *Aspergillus oryzae* or *Asp. soyae* genus are used for the preparation of the koji, and the

salt-tolerating lactococci *pediococcus halophilus* and the yeast *Zygosaccharomyces rouxii* are used in the fermentation phase. As opposed to earlier days, when fermentation was effected by the natural attendant flora, modern processes make use of defined starter cultures. With sauces fermented the natural way, no mineral acid is used for accelerating the degradation of the raw vegetable substances; this is accomplished exclusively by means of enzymatic hydrolysis of the fungal enzymes formed during the koji phase. More recent developments make use of immobilized enzymes or immobilized microorganisms for the fermentation. However, with a reduced fermentation time as well as reduced salt contents during mashing, the quality of the flavor of the sauces so obtained is not as good as with the process used heretofore. Following a longer maturing phase (3 to 6 months) the mash is refined to a stable, ready-to-eat sauce by pressing, heating, sludge sedimentation and layer filtration. The traditionally produced soysauce has a dark color and a salty, roasty-malty flavor that is slightly foreign to western taste.

The problem of the invention was to prepare a soysauce-like spiced sauce which, however, has a lighter color as compared to the known soysauce, a less roasty and more neutral yet well-balanced flavor, and is consequently more adapted to

western taste. Another problem was to reduced the time of the manufacturing process and to make do with a process time of less than 3 months.

JP-A-52-76488 specifies a process for the preparation of a spiced sauce based on protein-containing substances such as, for example, soya beans, soya protein, wheat, barley, wheat gluten, corn gluten, fish protein, milk protein etc., and carbohydrate-containing raw materials such as, for example, sorghum, rice bran, wheat bran, potatoes, molasses, starch residues etc., from which a koji is prepared with the use of suitable koji organisms such as, in particular *Aspergillus soyae* and *Aspergillus oryzae*, which is fermented in a common salt solution at temperatures between 30° and 55°C.

US-PS 4,115,591 specifies a process for the preparation of a koji, whereby a koji fungus is cultivated in a modified koji substrate for 30 to 100 hours at a temperature of 20° to 40°C, in the presence of 0.05 to 8% of a salt of an aliphatic carbonic acid with up to 4 carbon atoms. The koji substrate is selected from the group comprising soya beans, degreased soya beans, gluten, rice, wheat, wheat gluten, barley, oat, corn, fish meal and others. The koji so obtained is used for preparing fermented food products such as, for example,

soysauce, miso and sake, for example by fermentation in a 22% salt solution at 30°C for 150 days.

EP-A-417 481 specifies a process for the preparation of a soysauce by fermentation on the basis of a koji that has been prepared by fermenting a mixture of coarse soybean meal and wheat by means of a koji culture, whereupon the koji is hydrolyzed in aqueous suspension for 3 to 8 hours at 45° to 60°C with the enzymes obtained during the fermentation with the koji culture, whereupon the mixture is subjected to 4 to 8 weeks of fermentation after sodium chloride was added for obtaining a salt content of 15 to 19% by weight.

With respect to the state of the art, reference is made, furthermore, to US-PS 3,912,822, which specifies a process for the preparation of a protein hydrolysate with a high glutamic acid content, with the help of proteolytic enzymes.

Now, surprisingly, it has been found that the problems according to the invention can be solved by controlling the process in a certain way with the use of raw materials which are traditionally not used for the fermentation of soysauce, i.e., by using an enzyme-containing substrate covered with fungi (koji) consisting of despelted and softened oat kernels. According to the invention, such a koji is mashed with salt

water with a relatively low salt content and the fermentation is subsequently carried out in a number of stages.

Thus the process according to the invention for the preparation of a spiced sauce, whereby an enzyme-containing substrate covered with fungi is first mashed with common salt-containing water, the mash is subjected for a longer time to fermentation, and finally treated by pressing, pasteurizing and filtering, is characterized in that

(A) despelted, softened oat kernels are used as substrate;

(B) mashing is carried out with salt water, so that the salt content in the mash comes to 4 to 12% by weight, preferably to 7 to 8% by weight; and

(C) fermentation is carried out in several stages for 8 to 12 weeks at temperatures decreasing from 40 to 45°C in the first stage to room temperature in the final stage.

The enzyme-containing substrate covered with fungi, which is referred to as koji in the trade language and used as the starting material, is prepared in the traditional way, however, with the use of despelted, softened oat kernels as the carbohydrate-containing raw material. In this connection, the

procedure can be as described, for example, in EP-A1-417 481. It is useful in this connection to use a starter culture, preferably *Aspergillus oryzae*. A dense mycelium forms on the substrate, and this fungus-covered, enzyme-containing substrate, which is briefly referred to as koji, is subsequently mashed with water containing common salt, and subjected to fermentation, whereby a yeast, preferably *Zygosaccharomyces rouxii* can be added in the mash fermentation stage.

The koji enzymes are activated by the higher starting temperature in the mash fermentation phase, so that no further addition of enzyme is required for accelerating the process.

According to the invention, oat kernels are used as the starting material; however, it may be useful to admix up to 20% of other raw materials such as, for example, wheat, coarse soybean meal, barley, rice and/or corn.

According to the invention, mashing is carried out with salt water, whereby a weight ratio of koji to salt water of about 1:1 is maintained in general. The salt content of the mash generally comes to 4 to 12, preferably to 7 to 8% by weight.

According to the invention, the alcoholic fermentation of the starch - which is first saccharified enzymatically - is controlled during the fermentation phase in a defined way.

It is advantageous in the process of the invention to remove from the mash the fermentation alcohol formed in the course of fermentation, and the CO₂ fermentation gas formed. Such separation of ethanol and carbon dioxide from the fermenting mash has not been carried out heretofore in the production of soysauce. Such separation is generally not required for the complete fermentation of the mash because when the usual raw materials (soybeans, roasted wheat) are used, the alcohol content of the mash will not increase to the range in which the yeast is inhibited. However, it has been found that a greater amount of sugar is released when oat is used, so that it is useful to prevent the fermentation from stopping when the content of residual sugar in the mash is still high on account of said fermentation products that have an inhibiting effect on the yeast. In this way, a desirable degree of final fermentation is obtained, on the one hand; on the other hand, this process step makes it possible to obtain new types of spiced liquids that have a desirable content of residual sugar and a corresponding flavor profile.

The fermentation gas and fermentation alcohol can be removed by means of vacuum evaporation in the manner known per se.

According to a particularly preferred execution of the process of the invention, the fermentation of the mash is carried out in a first stage C1 for 4 to 21 days at a temperature from 40 to 45°C, in a second stage C2 for 2 to 4 weeks at a temperature from 28 to 32°C, and in a third stage C3 for 2 to 6 weeks at room temperature from 18 to 25°C.

The matured mash is treated in the normal way by press filtration, heating and, if need be, clarifying by diaphragm filtration. The clear spiced liquid can be preconcentrated by drying, then mixed with salt and other carrier substances, and subsequently vacuum dried or spray dried.

Example

1000 g oat kernel (despelted) is softened for 2 hours in water and subsequently autoclaved for 15 minutes at 120°C. The sterile substrate is subsequently inoculated with 0.5% of a spore suspension of *Aspergillus oryzae* (culture obtained from the German Strain Collection for Microorganisms, Braunschweig). The fermentation of the substrate in a bioreactor requires a constant temperature of 30°C at high air humidity and with good ventilation. It takes about 50 hours until a white mycelium has grown on the kernels and a typical pungent fungal odor

of the koji is noticeable. The koji is mixed with the same amount of salt water, so that 7% salt is present in the mash, and the latter is fermented for 12 days in a fermentation vessel at 42 to 45°C with occasional mixing. Subsequently, the preparation is inoculated with the yeast *Zygosaccharomyces rouxii* (salt-adapted, culture obtained from the German Strain Collection for Microorganisms). Following further fermentation of the preparation at 30°C, which is attended by the release of fruity odors, the alcohol content rises to 4% within 12 days.

Subsequently, the fermentation alcohol is removed from this mash under vacuum at 48°C in a rotation evaporizer, and after yeast has been added, the mash is permitted to ferment further at 30°C. After 12 days, the alcohol content of the mash rises again to 2.5%, and the pH has dropped from 5.8 initially to 4.5 to 4.6.

For maturation, the preparation is stored at room temperature for 4 weeks and then treated.

For such treatment, the liquid of the mash is pressed off under pressure, pasteurized, and subsequently clarified by diaphragm filtration (micro- or ultrafiltration). The resulting spiced fluid has a light color and neutral flavor.

Claims

1. Process for the preparation of a spiced sauce, whereby a fungus-covered, enzyme-containing substrate is first mashed with common salt-containing water, the mash is subjected to a fermentation over a longer period of time, and finally treated by pressing, pasteurizing and filtering, characterized in that

(A) despelted, softened oat kernels are used as the substrate;

(B) mashing is carried out with salt water, so that the salt content in the mash amounts to 4 to 12% by weight, preferably to 7 to 8% by weight; and

(C) the fermentation is carried out in several stages for 8 to 12 hours at temperatures decreasing from 40 to 45°C in the first stage to room temperature in the final stage.

2. Process according to claim 1, characterized in that the fermentation is carried out in a first stage C1 for 4 to 21 days at a temperature of 40 to 45°C, preferably for 8 to 14 days, in a second stage C2 for 2 to 4 weeks at a temperature of 28 to 32°C, and in a third stage C3 for 2 to 6 weeks at a room temperature of 18 to 25°C.

3. Process according to claim 1 or 2, characterized in that during the fermentation, the fermentation gas CO₂ formed and the fermentation alcohol are removed from the mash.

4. Process according to claim 3, characterized in that the fermentation gas and the fermentation alcohol are removed by means of vacuum evaporation.

5. Process according to any one of claims 1 to 4, characterized in that despelted, softened and sterilized oat kernels together with up to 20% wheat, coarse soybean meal, barley, rice and/or corn are used as the substrate A.

6. Process according to any one of the preceding claims, characterized in that during the process, one or several micro-organisms from the group *Aspergillus oryzae* and *Zygosaccharomyces rouxii* are added.

7. Process according to claim 6, characterized in that prior to mashing, a starter fungus, preferably *Aspergillus oryzae* is added to the substrate, and permitted to grow until a dense mycelium has formed, and that a yeast, preferably *Zygosaccharomyces rouxii* is added in the mash fermentation stage.

Abstract

The invention relates to a process for the preparation of a spiced sauce similar to the known soysauce, whereby a fungus-covered, enzyme-containing substrate is first mashed with common salt-containing water, the mash is subjected to a fermentation for a longer period of time, and finally treated by pressing, pasteurizing and filtering, characterized in that

(A) despelted, softened oat kernels are used as the substrate,

(B) mashing is carried out with salt water, so that the salt content of the mash comes to 4 to 12% by weight, preferably to 7 to 8% by weight, and

(C) the fermentation is carried out in several stages at temperatures decreasing from 40 to 45°C in the first stage to room temperature in the final stage, for 8 to 12 weeks.