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(54) Titre : PROCEDE DE CONDITIONNEMENT DES GRAINS ENTIERS DE CEREALES DE BRASSERIE, APPLIQUE A LA PRODUCTION DE LA BIERE

(54) Title: PROCESS FOR WHOLEGRAIN-CONDITIONING OF BREWER'S CEREAL GRAINS USED IN BEER PRODUCTION

(57) Abrégé/Abstract:
The invention relates to a process for whole-grain conditioning, in particular of native and malted brewing cereals. To improve the mashing process and to increase the number of brews and product quality, the brewing cereals are conditioned and subsequently fed to a hulling and/or mechanical comminution process.

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Erklärungen gemäß Regel 4.17:
— *hinsichtlich der Identität des Erfinders (Regel 4.17 Ziffer i)*
— *hinsichtlich der Berechtigung des Anmelders, ein Patent zu beantragen und zu erhalten (Regel 4.17 Ziffer ii)*
— *hinsichtlich der Berechtigung des Anmelders, die Priorität einer früheren Anmeldung zu beanspruchen (Regel 4.17 Ziffer iii)*
— *Erfindererklärung (Regel 4.17 Ziffer iv)*

Veröffentlicht:
— *mit internationalem Recherchenbericht*

Zur Erklärung der Zweibuchstaben-Codes und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

(54) **Title:** PROCESS FOR WHOLE-GRAIN CONDITIONING OF BREWING CEREALS USED IN BREWING BEER

(54) **Bezeichnung:** VERFAHREN ZUR GANZKORNKONDITIONIERUNG VON ZUR BIERBEREITUNG EINGESETZTEM BRAUGETREIDE

(57) **Abstract:** The invention relates to a process for whole-grain conditioning, in particular of native and malted brewing cereals. To improve the mashing process and to increase the number of brews and product quality, the brewing cereals are conditioned and subsequently fed to a hulling and/or mechanical comminution process.

(57) **Zusammenfassung:** Die Erfindung betrifft ein Verfahren zur Ganzkornkonditionierung, insbesondere von nativem und vermälztem Braugetreide. Zur Verbesserung des Maischenprozesses und zur Erhöhung der Sudzahl und der Produktqualität wird das Braugetreide konditioniert und anschliessend einem Schäl- und/oder mechanischen Zerkleinerungsprozess zugeführt.

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Process for Wholegrain-Conditioning of Brewer's Cereal Grains Used in Beer production

The invention relates to a process for wholegrain conditioning, especially of brewer's grains, such as malted barley, and the processing of these wholegrain-conditioned cereal grains in the brewing technology.

Brewer's grains are mechanically broken up, e.g. by crushing in roller, hammer or corundum-disk mills or in rotor-stator systems, prior to further processing in the brewing process. Where roller mills are used, a wetting of the brewer's grains in conditioning screw conveyors to a max. of 2% moisture content, for improving the milling result, is likewise known to prior art; while in the case of so-called 'soft conditioning' mills (*Weichkonditionierung*), a water component of up to 16% is introduced to the malt in a so-called softening shaft. In both systems the holding time of the malt in the wetting zone is somewhere around 60 sec. This holding time is not sufficient to allow the malt to fully absorb the water, and at least part of the introduced water is left still clinging to the husk in its free state. Because of this short holding time, and also the naturally occurring dissimilar grain sizes of the cereal grain, a homogenous water uptake in the charge is not ensured.

As the proportion of introduced water increases, there is an increased danger of the rollers of the mills sticking and/or of problems arising in connection with hygiene.

In the subsequent mashing process, there takes place the enzymatic conversion of water-insoluble, large molecular weight constituents such as starches and proteins to smaller molecular weight, water-soluble substances, e.g. sugar and amino acids. In

order to convert and extract these from the cereal grains, the mechanical preparation of the brewer's grains has have been done sufficiently.

In the subsequent lautering process, the resulting solution (mash) is separated into the liquid phase (wort) and the solid substances (draff).

In the brewing technology generally a lauter tun or a mash filter is used for the separation of solid/liquid.

In the lauter tun, the solid, water-insoluble parts of the cereal grain, the husks, form a filter layer, through which the liquid (wort) is drawn downwards and filtered. If due to insufficient elasticity the husks and germ are broken up into too small a size in the coarse grinding, then firstly, an increased dissolution can lead to unwanted constituents such as polyphenols, lipids etc. getting into the wort, and furthermore it results in a pronounced negative effect on the structure of the filter layer, leading to a slowing down of the lautering of the wort.

In the mash filter, the effect that unbroken whole husks have on the speed of lautering is of little importance due to the low height of the filter layer.

In DE-A4440481 the suggestion was therefore made to first wet the malt, then subject it to a pressure treatment in the milling gap, and also to separate the husks and endosperm by sieving. For this the malt mill used is fitted with at least one sieve. The separated husks are then subjected to an impact treatment so that any extract still adhering to them can be removed.

By impacting, not only can a gain in extract be obtained, it also increases the volume of the husk fraction. This increased fraction produces an optimised filter bed in the lauter tun which in turn ensures an improved lautering; or conversely it is possible to use a smaller portion of the husks as filter material, by which means the possible entry of polyphenols is reduced.

Also known are a coarse grinding mill for malt with a continuous monitoring of the grinding (DE-A-10218424), a wet coarse grinding (DE-A-10255504 among others), an enclosed, airless coarse grinding (DE-A-19740036), or an extrusion of malt grist (DE-A-3212390).

The invention is based on the intended aim of developing a process for wholegrain conditioning of brewer's grain used in beer production, such as virgin brewer's grains or malted brewer's grains, which improves the standard of the wetting of the brewer's grain, as preparation for the coarse grinding process, and therefore by a homogenous wetting of each individual grain of up to 20% water content, without free surface water, there is a very good tender crumbliness of the endosperm and at the same time the elasticity of husks and germ is increased to such an extent that the husks and germ emerge from the coarse grinding process almost without any mechanical damage, and thus the subsequent stages in the brewing process, the mashing, the lautering, the boiling of the wort and the fermentation, can be configured with optimal raw material and process parameters.

The copious bulk of the coarse meal produced by the inventive process allows a c. 10 to 15% higher volume throughput in the solid/liquid separation stage of the process as compared to coarse meal produced by the described methods of prior art, and this means shorter cycle times. A further technological advan-

tage results from the great number of germs retained whole and therefore fully separable, if required, as this means the harmful constituents in the germ, such as lipids and others, are less likely to get extracted in the mash.

If one desires to completely eliminate the extraction of these unwanted constituents, the high portion of whole germs allows a fractioning of the coarse meal into husks, germ and endosperm by the known mechanical processes, where all or some portion of the husks can be fed back into the process at a later stage. If the unfractioned coarse meal is mashed in, then at the time of the mashing in one can already observe how the germs kept unbroken, swim on the mash as a surface layer and can be separated from there.

A further process advantage due to the optimised homogenous wetting of the endosperm is an accelerated reaction kinetics in the enzymatic metabolism during the mashing process.

The wetting of the brewer's grain according to the invention is carried out in at least one stage, by using moist air, or in two stages by a pre-wetting with small quantities of water of 1 - 3%, then letting it stand for a while (resting phase), followed by a second wetting and where needed a second resting phase, until the desired final humidity is achieved. By the pre-wetting and the resting phase, it is ensured that the entire quantity of water is taken up by the husks and their permeability is decisively increased for the second wetting. By this means, in the second wetting the quantities of water necessary for the required tender crumbliness of the endosperm and also for the required elasticity of husk and germ can be very rapidly taken up by the grain, so that no free surface water, which would have a negative effect on the process, is left remaining.

According to an embodiment of the invention, the time of the resting phase amounts to max. 30 minutes per stage.

It is also possible to wetten the cereal grains by means of an air-moistening, i.e. by a variable relative humidity of the air, where the relative (initial) humidity of the air should be at least 95%.

According to an embodiment of the invention, the brewer's grain may be shelled prior to wetting.

The brewer's grains which are optimally prepared in this way for the mechanical crushing process are then led to a mechanical crushing. This can be done using the mills known from prior art in the brewing technology, and here the wholegrain-conditioned brewer's grains can be either dry-milled or wet-milled.

According to an embodiment of the invention, the homogenous conditioned brewer's grain may be crushed twice without an intermediate sifting.

The brewer's grains wetted by the inventive process can, however, also be crushed and mashed in-line, using dry crushing mills with high throughput rates which are specially adapted to the requirements of this malt.

An additional advantage of the inventive process in the milling of the wholegrain-conditioned malt, lies in the field of explosion protection, for the degree of wetting of the malt markedly reduces the risk of a dust explosion and therefore it is possible to use rollermills as found in bread grain mills.

As a result it should be possible to achieve an increase in the number of brews to about 20.

What is claimed is:

1. Process for wholegrain-conditioning of brewer's grains used in beer production, by homogenous wetting of the brewer's grains for up to 20% effective moisture content and a related resting phase, as well as a subsequent milling of the wholegrain-conditioned brewer's grains, wherein the time of the resting phase amounts to max. 30 minutes per stage.

2. Process according to Claim 1, wherein the brewer's grain is shelled prior to wetting.

3. Process according to Claim 1 or 2, wherein the moistening/wetting and the resting phase are carried out in at least one stage.

4. Process according to Claim 3, wherein the wetting and the resting phase are carried out in two stages.

5. Process according to any one of the Claims 1 to 4, wherein the homogenous conditioned brewer's grain is crushed twice without an intermediate sifting.

6. Process according to Claim 1, wherein the brewer's grain is moistened slowly by means of moist air, with it being possible to vary the relative humidity of the air.

7. Process according to any one of Claims 1-6, wherein the processed brewer's grains is malted barley.

8. Process according to any one of Claims 1-7, wherein the subsequent milling is a dry milling.

9. Process according to any one of Claims 1-8, wherein the subsequent milling is a wet milling.

10. Process according to any one of Claims 1-9, wherein the subsequent milling comprises dry and wet milling.

11. Process according to any one of Claims 1-10, wherein the brewer's grains are virgin brewer's grains.

12. Process according to any one of Claims 1-11, wherein the brewer's grains are malted brewer's grains.