classification to obtain a fraction enriched in beta-glucans. The fraction of finer particles obtained at the end of the first air-classification step is also subjected to another air-classification step to obtain a fraction enriched in proteins and a fraction enriched in starch.

Furthermore, the cereal beta-glucan extraction processes currently used may lead to certain negative effects that can alter their properties and their functionality. For example, they may alter their native structure, which can reduce their ability to form a viscous gel in the intestinal tract. This loss of structure may result in a reduction of their beneficial effects, such as cholesterol reduction and blood-glucose regulation.

There is therefore a real need to develop a process for obtaining fractions enriched in oil (or lipids), starch, protein and beta-glucan from cereal, respectively, leading to low denaturation of the components to be isolated and in particular of beta-glucans and proteins, and having reduced greenhouse gas emissions.

Summary

The disclosure relates first to a method for separating a cereal material, comprising the following steps:

- providing at least one cereal material comprising starch, proteins, lipids and beta-glucans;
- treating the cereal material by solid/liquid extraction with an alcohol solution comprising at least 50% by volume of alcohol, so as to obtain a solid fraction depleted in lipids and a liquid fraction enriched in lipids;
- grinding the solid fraction depleted in lipids;
- separating the particles of the ground lipid-depleted fraction according to their size, so as to obtain a fraction enriched in beta-glucans and a fraction depleted in beta-glucans;
- grinding the fraction depleted in beta-glucans; and
- treating the ground fraction depleted in beta-glucans by air classification, so as to obtain a fraction enriched in proteins and a fraction enriched in starch.

In one aspect, the disclosure refers to a method for separating a cereal material, comprising the following steps:

- providing at least one cereal material (1) comprising starch, proteins, lipids and beta-glucans;
- treating the cereal material by solid/liquid extraction (4) with an alcohol solution comprising at least 50% by volume of alcohol, so as to obtain a solid fraction depleted in lipids (6) and a liquid fraction enriched in lipids (5);
- grinding (7) the solid fraction depleted in lipids (6);

- separating (9) the particles of the ground lipid-depleted fraction (8) according to their size, so as to obtain a fraction enriched in beta-glucans (10) and a fraction depleted in beta-glucans (11);
- grinding (12) the fraction depleted in beta-glucans (11); and

treating the ground fraction depleted in beta-glucans by air classification (13), so as to obtain a fraction enriched in proteins (14) and a fraction enriched in starch (15).

In examples, the cereal material is an oat and/or barley cereal material.

In examples, the cereal material is at least one cereal grain and/or at least one product from the malting, malt-extract manufacturing, brewing, cereal distillation, plant-based dairy and/or milling industries.

In examples, the alcohol solution is a mixture of alcohol and at least one solvent, the solvent preferably being chosen from the group consisting of water, 2-methyloxolane and mixtures thereof, more preferably the alcohol solution consists of a mixture of alcohol and water.

In examples, the alcohol solution comprises from 50 to 90% by volume of alcohol.

In examples, the alcohol of the alcohol solution is recycled alcohol.

In examples, the alcohol of the alcohol solution is ethanol.

In examples, grinding the fraction depleted in beta-glucans comprises micronizing the fraction depleted in beta-glucans.

In examples, separating the particles of the ground lipid-depleted fraction according to their size is carried out by sieving.

In examples, the method further comprises a step of separating the alcohol from the liquid fraction enriched in lipids, preferably by distillation, the method preferably further comprising a step of recycling the separated alcohol for the solid/liquid extraction step.

In examples, the method further comprises, before the step of treating the cereal material by solid/liquid extraction, a step of grinding and/or flattening the cereal material so as to obtain a ground and/or flattened fraction, the provided cereal material being preferably a cereal grain.

In examples, the cereal material is a cereal grain comprising a hull, the method further comprising a step of dehulling the grain prior to the step of grinding and/or flattening the cereal material.

In examples, the fraction enriched in beta-glucans comprises a beta-glucan amount greater than or equal to 10% by weight, preferably from 10 to 40% by weight, more preferably from 15 to 25% by weight, relative to the total dry matter weight of the fraction.

In examples, the starch-enriched fraction comprises a carbohydrate amount greater than or equal to 40% by weight, preferably from 40 to 90% by weight, more preferably from 50 to 85% by weight, relative to the total dry matter weight of the fraction.

In examples, the protein-enriched fraction comprises a protein amount greater than or equal to 15% by weight, preferably from 15 to 35% by weight, more preferably from 15 to 30% by weight, even more preferably from 20 to 30% by weight, relative to the total dry matter weight of the fraction.

The present disclosure makes it possible to meet the need expressed above. More particularly, it provides an improved method for separating a cereal material, making possible the fractionation of four components of interest (oil, beta-glucans, starch, proteins) that is simple, effective, more economical, that leads to low denaturation (transformation) of the fractionated components, notably beta-glucans and proteins, that is

environmentally friendly, with lower water consumption and reduced greenhouse gas emissions, and generating a minimum of effluents that are easy to recycle.

This is achieved by using the combination of a de-oiling step by extraction using a specific solvent, namely an alcohol solution comprising at least 50% by volume of alcohol,

and a dry fractionation process, using one or more grinding steps, and an air classification step.

In particularly advantageous examples in which the alcohol used for the de-oiling, in particular ethanol, is recycled to be reused in the extraction step, the method according to the disclosure makes it possible to further reduce greenhouse gas emissions as well as solvent consumption and effluent generation.

Brief description of the figures

Figure 1 shows a flowchart of an example method according to the invention.

Detailed description

The invention is now described in more detail and in a non-limiting manner in the description that follows.

Unless indicated otherwise, all percentages are by weight.

In the present text, the quantities indicated for a given species can apply to that species according to all its definitions (as mentioned in the present text), including the narrower definitions.

In the present text, “fraction enriched in a substance X” obtained after a certain treatment means a fraction in which the ratio of molar proportions of substance X to total dry matter is greater than that of the fraction before treatment.

In the present text, the terms “lipids”, “oil” and “fats” have the same meaning and are used interchangeably.

The invention relates to a method for separating a cereal material, in particular to obtain a lipid-enriched fraction, a beta-glucan enriched fraction, a starch-enriched fraction and a protein-enriched fraction. In the context of the present invention, “cereal material” means any material based on or derived from at least one cereal, in any possible form (such as whole, ground, powdery, flattened, etc.). More particularly, it may be the cereal itself (raw), any part thereof, or any material obtained after processing, transformation or use of the cereal.

The method according to the invention involves a step of de-oiling grains by extraction using an alcohol solution comprising at least 50% by volume of alcohol, followed by fractionation of the cereal material by dry process. “Dry process” means any operation, such as grinding or air classification, carried out without using water.

Cereals belong to the Poaceae family. They produce grains, which comprise starch, proteins, lipids and soluble fibers, in particular beta-glucans. In general, cereal grains