Hydrolysis of cereal-based baby food
A tasty and easily digestible porridge
ANDRITZ Gouda has developed a state-of-the-art hydrolysis process to further improve the taste and digestibility of cereal-based baby food. At the heart of this process is the Dynamic Jet Cooker, to activate the process, and the Static Jet Cooker, to deactivate the process, using of steam injection before the treated product is dried on the drum dryer.

ANDRITZ Gouda, known for its drum dryers, has extensive experience in supplying equipment for the production of high-quality cereal-based baby food. Single units or complete process lines can be supplied, comprising slurry preparation, heat treatment for sterilization of the slurry, drying, milling to determine the final particle size and bulk density, intermediate storage, and dry mixing.

For over a century, cereal-based baby food has been manufactured on drum dryers to obtain the well-known, small flakes. The drum drying process not only provides the desired residual moisture content (important in view of the shelf life of the product), but also creates the characteristic flavor and product-specific properties, such as high solubility, good water absorption, and proper swelling ability.

These properties are essential for simple and rapid preparation of a tasty, homogenous porridge. In view of the increasing interest and demand from the market for a technical solution to achieve hydrolysis of the wet product before drying in order to further improve the digestibility and taste of the end product, ANDRITZ Gouda has developed recipes and meet this demand.

The ANDRITZ Gouda Drum Dryer process includes the following steps:

1. **Slurry Preparation**: Mixing of ingredients (water, flour, etc.) to form a slurry.
2. **Hydrolysis**: The slurry is heated to a high temperature (around 125-135 °C) to activate the enzymes, which catalyze the hydrolysis of the starch chains into shorter molecules. This hydrolysis process is crucial for increasing the digestibility of the cereal-based baby food.
3. **Deactivation**: After hydrolysis, the slurry is cooled and the enzymes are deactivated to prevent further breakdown of the starch chains.
4. **Sterilization**: The slurry is sterilized at a high temperature to ensure the safety of the final product.
5. **Drying**: The sterilized slurry is then dried on a drum dryer, resulting in small, crispy flakes with a well-known texture.
6. **Milling and Mixing**: The dry product is milled to achieve a consistent particle size and mixed with other ingredients to form a ready-to-use baby food.

**ENZYMES**

Hydrolysis is the cleaving of a chemical compound into molecules by adding water. For cereals, this involves splitting long starch chains into shorter molecules. In order to achieve this goal, two different methods can be applied. Both methods make use of enzymes - proteins that catalyze (accelerate) a biochemical reaction. Each and every enzyme, however, catalyzes a specific reaction and has its own optimum operating temperature.

**Mobility**

As soon as the slurry begins to gelatinize as a result of the starch component in the flour being heated to between 51 and 65 °C, depending on the type of flour, its viscosity increases drastically. As a result, the mobility of the enzymes is greatly reduced. This slows down the hydrolysis reaction immensely. In addition, the enzyme activity is still not optimal at the gelation temperature. However, with the ANDRITZ Gouda process, the mobility of the enzymes during gelation is maintained.

**Viscosity Reduction**

The first hydrolysis method causes a shortening of the starch chains, resulting in a viscosity reduction that, in the end, helps make the porridge more digestible. The enzyme for viscosity reduction has an optimal effect at a temperature between 80 °C and 95 °C. The challenge lies in the fact that this temperature is well above the gelation temperature of the starch component in the flour and below 100 °C (the boiling point of water in the slurry).

**Saccharification**

The second hydrolysis method makes use of a different enzyme, making the porridge taste sweeter without having to add sugar. The enzyme for saccharification is active at around 60 °C, thus at a lower temperature than the enzyme for viscosity reduction. However, saccharification needs suitably low-viscosity slurry so is not always applied in the industry.

**Dynamic Jet Cooker (DJC)**

The ANDRITZ Gouda Dynamic Jet Cooker (DJC) has been designed based on the principle of direct steam injection, while maintaining the mobility of the enzymes upon activation during gelatinization of the product and realizing a fast and stable hydrolysis process with full hydrolysis effect. The stability of this hydrolysis process lacks the vulnerability of temperature and gelling variations often experienced with static, direct steam injection in a static mixer. The advantage of the DJC process is that only a smaller portion of the total flow of slurry to be dried needs to be hydrolyzed.

**Static Jet Cooker (SJC)**

After mixing with a non-hydrolyzed portion of the slurry, just in front of the Static Jet Cooker (SJC), sterile steam is injected into the slurry again to instantly increase the temperature at which the enzymes are deactivated. At the same time, the starch component in the non-hydrolyzed portion is gelatinized. The slurry is also sterilized during a controlled holding time at the high temperature thus obtained. After the Static Jet Cooker, the slurry is processed on the drum dryer to form a dry film that is scraped off the drum. After milling and mixing with the dry ingredients, the final product is then ready for sale as a tasty and nutritious porridge.

**Pilot Plant trials**

ANDRITZ Gouda has a well-equipped pilot plant for testing all the required process steps for treatment of the various recipes in order to ensure that the desired final results are obtained.
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