Pre-gel Starch Production with Drum Dryers

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Summary

Drum drying has many applications. One of the most common, but also one of the toughest is drying of starch for both food and technical applications. Drum drying of starch requires a robust, heavy-duty machine. Royal GMF-Gouda is the leading drum dryer manufacturer and its drum dryers are in use at all major starch producing companies world-wide, as well as at many smaller companies active in this field.

Starch is widely present in nature and is the most important source of nutrition. However, starch in its native form is not optimal for use and digestibility, which is the reason why high starch containing products are being heat treated. The unique characteristic of native starch to produce a viscous paste when heat treated, provides the ability for use in a wide range of applications, both in food and for technical use. Therefore, starches are modified into forms with specific properties for the required application. A common modification is drum drying of starch slurries. Due to fast evaporation of water, cold soluble starch with a long shelf life is acquired. Drum drying is a thermal (physical) modification, often done in the final stage of a starch modification process, in which, for example, chemical modifications or fermentation are done before drying.

When a slurry of native starch is brought onto the hot surface of a drum, it will start to gelatinize (swell) almost immediately. The starch granules absorb water and their volume expands dramatically. The individual starch molecules are still held together in a greatly swollen reticulated network. However, the water will also start to evaporate at the same time, resulting in an open structure of the starch granules. When drum dried starch is being dissolved in cold water, the granules will start to swell without the solution being heated; the so-called cold swelling properties.

The gelatinizing starch slurry on the drying drum becomes very viscous and sticky. It strongly adheres to the drum surface when passing the narrow gaps between the applicator rolls and the drying drum, by which a thin film is formed from which the remaining moisture can easily be evaporated before being scraped from the drum. The narrow gaps are required for the best possible product quality, but also cause high shear forces. The shear forces vary when changing the gap distances. After a single rotation of the drying drum the product film is scraped of by a knife, which is fixed in a heavy-duty knife holder. The knife holder needs to be a very rigid construction to ensure that the strong adhering product film will be removed over the entire length of the drum. The characteristics of starch while being dried requires a very robust mechanical design of the drum dryer. In the presentation the design will be discussed step by step. Both single and double drum dryers are used to dry starch. However, the highest production output related to surface area is achieved on single drum dryers, which are capable of handling slurries with a high dry solid content. Furthermore, the end product from a single drum dryer differs from a product made on a double drum dryer. The reason hereof, as well as optimal machine and process settings, will be discussed along the above mentioned machine design. When a range of products is dried, it is best to find one single setting for the machine in terms of steam pressure and gap settings to avoid constant resetting of the machine. These settings can be determined in the GMF-Gouda pilot plant in the Netherlands, before transferring them to industrial sized machines. Furthermore, in cooperation with NIZO Food research, there is the possibility for toll manufacturing and producing marketing batches in a food grade environment.

Beamer-Presentation shown at the meeting.
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