LALLEMAND
BAKING UPDATE
VOLUME 1 / NUMBER 9
Yeast Production

Practical technology from Lallemand Inc., parent of American Yeast Sales, producers and distributors of Eagle® yeast, fresh and instant.

AMERICAN YEAST SALES · Eagle · fermipan

Bakers Yeast Production and Characteristics

THE WAY YEAST is grown and processed affects its composition, purity, and appearance. Information about yeast production can help bakers judge and use yeast better in their own processes.

PRODUCTION PROCESS

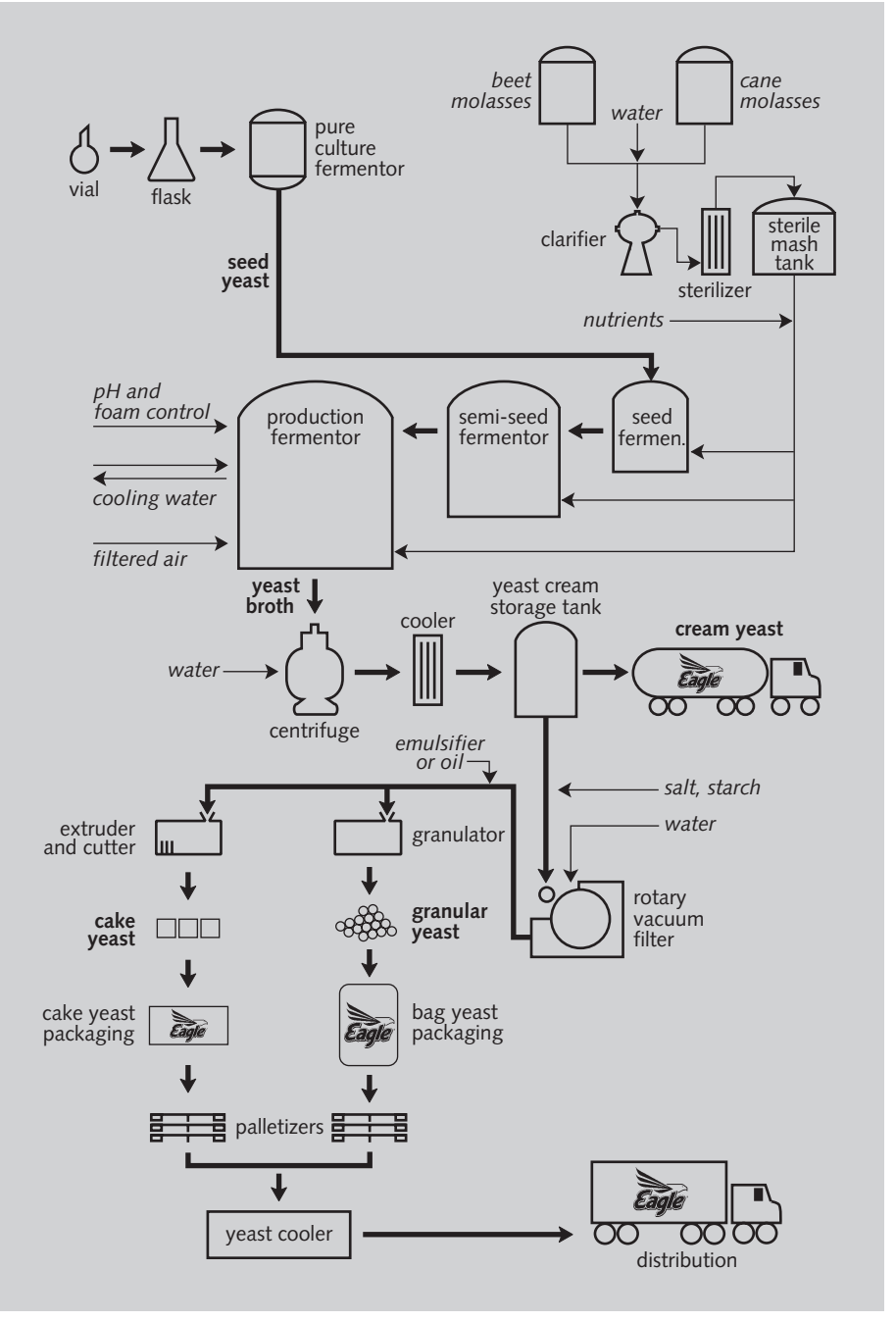
Raw Materials. Cane or beet molasses is the primary raw material for bakers yeast production. It supplies all the sugar that yeast needs for growth and energy along with part of the needed nitrogen. Before it is fed to the yeast, concentrated molasses is diluted with water, clarified, and heat sterilized. It is then supplemented with additional nitrogen, phosphate, vitamins, and minerals.

Fermentation. Bakers yeast begins as a pure culture of the desired strain, which is inoculated from a small vial into a sterile flask of broth. From the flask it is transferred into a larger vessel, then through several fermentation stages of increasing volume. The larger-scale fermentations take place in 25,000- to 50,000-gallon fermentors that are equipped for aeration, cooling, incremental molasses feeding, pH control, and anti-foam addition. Each fermentation step requires about a day, so that at the end of a week more than 500,000 pounds can be produced from a single vial.

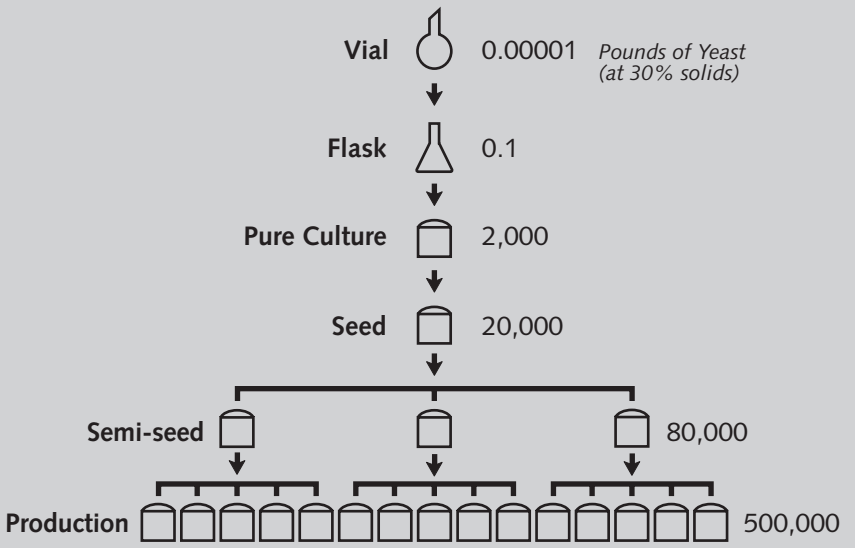
Processing. Yeast broth from the fermentor at about 5 percent solids is concentrated in a centrifuge to about 18 percent solids and washed with water. Cream yeast is simply this liquid yeast that is cooled and delivered in bulk to the bakery. To make compressed (granular and cake) yeast, cream yeast is passed through a filter, which removes water and increases the solids concentration to about 30 percent. When a rotary vacuum filter is used, the cream is first treated with salt, then sucked onto a thin layer of starch, rinsed with cold water to remove the salt, and scraped off the

Continued

YEAST PRODUCTION



YEAST PROPAGATION STAGES



Bakers Yeast Production and Characteristics

(Continued)

starch. After filtering, small amounts of emulsifiers or oils are added to assist in the extrusion and cutting of the yeast and to improve its appearance. Granular yeast is then crumbled and packed in bags; cake yeast is extruded and formed into blocks.

FINISHED PRODUCT

Composition. Compressed yeast contains about 70 percent water and 30 percent yeast solids. Of the yeast solids, about 50 percent is protein, 40 percent is carbohydrate, and the rest is fat and ash. The solids content can vary from about 27 to 33 percent, depending on how it is filtered. The higher the yeast solids, the higher the activity. The protein level can vary from about 45 to 60 percent and the carbohydrate level from 30 to 45 percent, depending mostly on how fast the yeast is grown. Higher growth rates give higher protein, higher activity, lower carbohydrate, and lower stability. Lower growth rates give lower protein, lower activity, higher carbohydrate, and higher stability.

Purity. Bakers yeast is grown under sanitary (not sterile) conditions to ensure that the strain remains true to type and that no harmful organisms are present. Better sanitation procedures, fewer fermentation stages, and lower fermentation pH give lower contamination levels. All products should be free of *Salmonella*, *Listeria*, and *E. coli*, with low levels of coliforms and other sanitation-indicator organisms. Lactic acid bacteria and "wild" (non-*Saccharomyces cerevisiae*) yeast are always present because they are common in the environment and grow under the same conditions as bakers yeast. Normal levels of these other microorganisms are not a problem because they occur naturally in flour, and the bakers yeast cells greatly outnumber them.

Appearance. Compressed yeast can range in color from dark brown to nearly white, and in texture from friable (easy to crumble) to gummy. Appearance is affected by yeast strain, molasses source, fermentation conditions, processing aids, moisture level, and age. Low fermentation pH gives higher purity but darker yeast. Emulsifiers give lighter color and frozen storage gives mushier texture, but neither affects performance. High moisture makes yeast darker but affects performance only to the extent that yeast solids are reduced. Storage time, temperature, and oxygen make yeast darker and gummier and reduce its performance. Old or damaged yeast frequently appears dark and gummy, but because there are so many other factors involved, appearance alone is not a reliable indicator of yeast quality.

Yeast Production Biochemistry

BAKERS YEAST production depends on the ability of *Saccharomyces cerevisiae* to assimilate inorganic nitrogen and grow via respiration instead of fermentation.

Assimilating inorganic nitrogen is important because it allows bakers yeast to be grown on molasses as an economical source of sugar and other nutrients. Molasses is relatively low in nitrogen and has to be supplemented so that yeast can synthesize the protein and the other cell constituents they need for growth. Because *Saccharomyces cerevisiae* can use inorganic nitrogen, a combination of ammonia and ammonium salts are added to provide economical sources of nitrogen and pH control.

Growing via respiration is important because it is about eighteen times as efficient as fermentation at converting sugar into yeast. The tendency of yeast to grow via respiration when large amounts of oxygen are present is known as the Pasteur effect. The tendency of yeast to grow via fermentation when high levels of sugar are present is known as the Crabtree effect. The combination of Pasteur and Crabtree effects in *Saccharomyces cerevisiae* is the reason commercial bakers yeast fermentations use high aeration and incremental feeding to maintain high oxygen and low sugar levels throughout the process.

LALLEMAND
BAKING UPDATE

Lallemand Baking Update is produced by Lallemand Inc. to provide bakers with a source of practical technology for solving problems. If you would like to be on our mailing list to receive future copies, or if you have questions or comments, please contact us at:

LALLEMAND Inc.
1620 Préfontaine
Montréal, QC H1W 2N8 CANADA
tel: (800) 840-4047 (514) 522-2133
fax: (514) 255-6861