

Beverage Alcohol

Application Sheet



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Enhanced liquefaction

Native starch is only slowly degradable by means of alpha-amylases, which is why gelatinization and liquefaction of a 30-40% dry matter suspension are needed for enzymatic starch break down.

A good liquefaction system is vital for successful pre-saccharification. In liquefaction, an efficient temperature stable α -amylase is added to the starch milk. Mechanical liquefaction may be achieved using stirred tank reactors, continuous stirred tank reactors (CSTR) or a jet cooker.

Benefits

- Reduced processing costs
- Increased plant profitability
- Greater starch conversion
- Higher alcohol output
- More “forgiving” liquefaction process
- Termamyl SC is a remarkable new liquefaction enzyme which can operate at lower pH and calcium levels than conventional thermostable alpha-amylases

Products

Termamyl SC is a liquid enzyme preparation containing an outstandingly heatstable alpha-amylase expressed in and produced by a genetically modified strain of a Bacillus microorganism.

The systematic name for the enzyme is 1,4-alpha-D-glucan glucohydrolase (EC 3.2.1.1).

Termamyl Classic is a liquid enzyme preparation containing an outstandingly heat-stable alpha-amylase produced by a strain of Bacillus licheniformis that has not been genetically modified.

The systematic name for the enzyme is 1,4-alpha-D-glucan glucohydrolase (EC 3.2.1.1).

BAN 480 L is an alpha-amylase produced by submerged fermentation of a selected strain of *Bacillus amyloliquefaciens*. The systematic name is 1,4-alpha-D-glucan glucano-hydrolase (EC 3.2.1.1).

Fungamyl 800 L is a fungal alpha-amylase obtained from a selected strain of *Aspergillus oryzae*. The systematic name for the enzyme is 1,4-alpha-D-glucan glucano-hydrolase (EC 3.2.1.1).

Performance

Termamyl S Performance

Calcium Requirement:

- No additional calcium required (~5 ppm)
- Decreases calcium oxalate formation, called beer stone, in many unit operations.
- Results in reduced scaling in post liquefaction heat exchangers and coolers
- Calcium available in grain and well-water usually is sufficient

pH Tolerance:

- Broad pH Tolerance (5.0-6.0)
- Permits increased usage of backset in the pre-cook mash or starch slurry
- Less acid is needed to reduce the liquefaction pH prior to saccharification/fermentation
- A pH of 5.4-5.8 optimizes enzyme dose!

Viscosity Reduction:

- Unsurpassed viscosity reduction
- Ability to operate with increased levels of dry solids
- Improves jet cooker performance
- Improves heat exchanger efficiency
- Processing "Forgiveness" - Ability to withstand process variations

BAN 800 L performance

BAN also hydrolyzes 1,4-alpha-linkages in starch. At a pH of 5-7.5, it is stable at 70°C and active up to 80°C. BAN also contains 1,4-β-glucanase activity, making this product an ideal liquefaction enzyme for raw materials containing high amounts of 1,4-β-glucans, e.g. Barley.

Usage

A split enzyme dose provides the best process performance and optimum economy. In order to process with higher solids (~35% grain w/w) and obtain higher plant throughputs, we recommend a split enzyme dose process. This means adding about one-third of the Termamyl SC dose prior to jet-cooking and the remainder during secondary liquefaction. We also recommend keeping the temperature for secondary liquefaction at 85°C.

When switching to Termamyl SC, most plants can eliminate the addition of lime or calcium chloride. Sufficient calcium exists in most mashes to meet the requirements of this extremely stable enzyme.

A dosage of Termamyl SC equivalent to the previously used alpha-amylase, will result in a dramatic increase in DE and a rapid reduction in mash viscosity. This affords you the option of reducing pH or the enzyme dose and/or increasing dry solids.

While processors previously had to run at pH values around 6.0, Termamyl SC will allow you to operate at a lower pH. At pH values between 5.8- 5.4 you can expect at least a 50% total dose reduction relative to other amylases. The dose reduction will be less at pH values below 5.4. While Termamyl SC has been successfully used in commercial plants at a pH of 5.2, we have seen good liquefaction in laboratory trials on whole-ground corn at a pH of 4.8.

Dosage

| | |
|------------------|----------------------------------|
| Termamyl SC: | 0.15 - 0.45 kg per ton of starch |
| Termamyl Classic | 0.20 - 0.50 kg per ton of starch |
| BAN 480 L | 0.10 - 0.25 kg per ton of starch |
| Fungamyl 800 L | 0.10 - 0.20 kg per ton of starch |

Safety in use

Novozymes A/S' products for the ethanol industry are backed by experienced technical service professionals who can assist you in conducting a trial of this remarkable liquefaction amylase for whole grains. They are also able to make more specific recommendations for the use of this and other Novozymes' products based on your plant's design.

Safety, handling and storage

Safety, handling and storage guidelines are provided with all products.