

Fermentation control and FAN optimization

Neutrase® 0.8 L BrewQ, FAN Boost™

In wort, the main nitrogen sources for yeast metabolism are individual amino acids, small peptides and ammonium ions. These amino acids and peptides are collectively known as FAN (free amino nitrogen). FAN is formed during the malting process and during the proteolysis-rest in mashing by endogenous proteases. Low modified malt as well as high adjunct ratios reduce the amount of solubilized FAN in the wort. To ensure desirable fermentation performance, yeast needs to be provided with sufficient FAN for growth. This translates into acceptable and reproducible beer quality.

Benefits

- FAN control for consistent yeast growth and optimal fermentation
- FAN optimization in high barley/adjunct brewing
- Improvement of mash lautering/filtration
- Yield improvement

Products

Two products can be used to increase FAN content in wort:

Novozymes Neutrase® 0.8 L BrewQ is an endo-protease that hydrolyzes internal peptide bonds to increase the amount of FAN. This enzyme works at similar conditions as the malt endogenous enzymes and should be used to support low proteolytic activity in undermodified malt and/or low adjunct ratios.

Novozymes FAN Boost™ is an endoprotease that hydrolyzes internal peptide bonds to increase the amount of FAN. This enzyme is intended to be used for high adjunct ratios with low/no proteolytic activity. Additionally, FAN Boost™ is thermostable minimizing LOX (Lipoxygenase) activity during mashing.

Performance

The traditional way to increase FAN is to use over modified malt and a long protein rest during mashing. Both methods, however, have often shown to be insufficient to give an acceptable FAN level when using high amounts of adjunct. Novozymes proteases are working in synergy with the in-cereal amino and carboxypeptidase to provide more amino acid during an efficient mashing.

The endo-protease hydrolyzes internal peptide bonds. This reaction generates more substrate for the in-cereal peptidases releasing higher amounts of FAN (Free Amino Nitrogen)

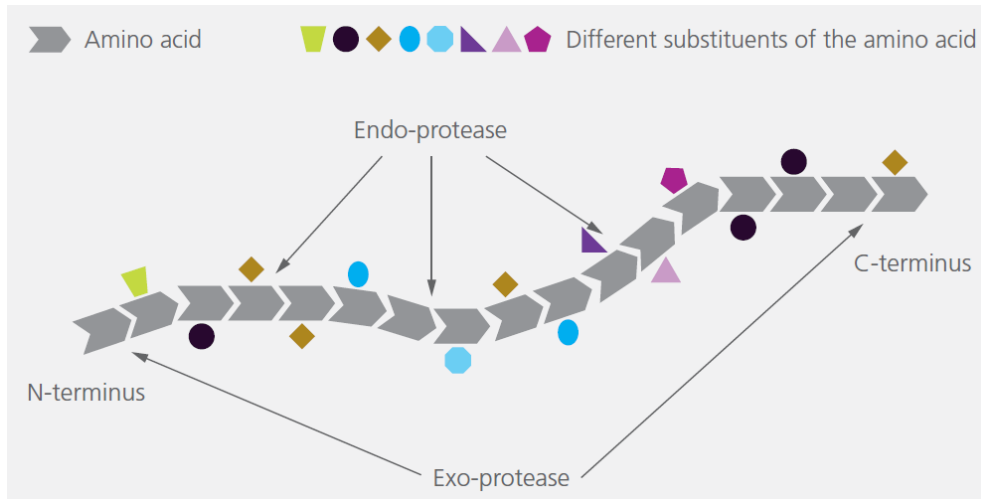


Fig. 1.

Usage - Neutrase® 0.8 L BrewQ

Adding Neutrase® at mashing-in can be used to raise the level of FAN. This is useful when working with poorly modified malt or adjunct. With normal malt, no more than 30-40% of the protein is rendered soluble. With Neutrase®, this figure may be brought up to 40-50%.

The enzyme is added during mashing-in after at least 1/3 of the total grist is loaded.

Dosage: 0.25-2.5 kg/ton of grist
Optimum temperature: 45-55°C

Usage - FAN Boost™

Lipoxygenase (LOX) activity is derived from malted barley and is implicated in the lipid oxidation and stale flavor formation during malting and mashing, that can later surface as defects in finished beer. LOX activity during mashing can be reduced or avoided by eliminating the standard protein rest at 45–50°C and conducting proteolysis at higher temperatures. LOX rapidly denatures at temperatures above 65°C.

Therefore, to ensure sufficient FAN and minimize LOX activity during mashing, a thermostable protease is advantageous. Novozymes offers FAN Boost™ for FAN generation at higher temperatures, ensuring high-quality FAN production and flavor stable beer.

- FAN control for improved yeast growth and stable fermentations
- Eliminate the need for standard protein rest to generate FAN, saving the brew house time and energy
- Enable high adjunct inclusion rates
- Enhanced flavor stability by avoiding Lipoxygenase (LOX) working temperature

FAN Boost™ is added at mash-in, once grist and liquor are added (do not add directly to heated liquor). The product is completely deactivated during wort boiling. The proper dosage of FAN Boost™ will depend on malt quality, adjunct ratio and FAN specification. A standard liquefaction and mashing profile is illustrated in figure 1, while a recommended liquefaction and mashing profile when using FAN Boost™ is illustrated in figure 2.

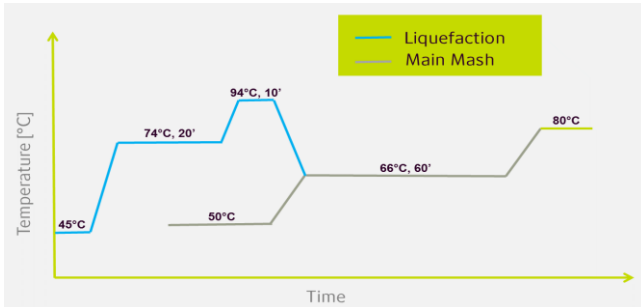


Fig. 2. Standard liquefaction and mashing profile

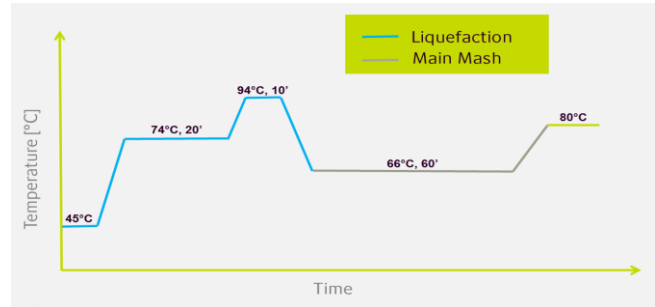


Fig. 3. FAN Boost™ liquefaction and mashing profile

With the addition of FAN Boost™ in the cereal cooker the standard protein rest in the main mash can be eliminated as shown in figure 3. This allows for energy savings and reduction in main-mash vessel occupancy time. Also, the liquefaction and mashing profile gives the option to use the standard cereal cooker and mash tun setup, or a single vessel.

Dosage:

Considering a recipe of 55:45 corn grits to barley malt, a dosage of 2.5 kg FAN Boost™ per ton grist was found to be effective at producing 12 mg/L/°P of FAN in the wort. The FAN dosage recommendation for malt-wort is 10–18 mg/L/°P.

Optimum temperature: 65-75°C

Optimum pH and temperature

Neutrase® 0.8 L BrewQ: The optimal working conditions for Neutrase® are 45-55°C and pH 5.5-7.5

FAN Boost™: The working conditions for FAN Boost™ is at normal brewing pH and a temperature of 65–75°C

Product data

Neutrase® 0.8 L BrewQ	
Declared enzyme	Protease
Catalyzes the following reaction:	Metallo endoprotease that hydrolyzes internal peptide bonds
Declared activity	0.8 AU-N/g
E.C./I.U.B no.:	3.4.24.28
Physical form	Liquid
Production method	The enzyme is manufactured by fermentation of a microorganism that is not present in the final product. The production organism is not modified using modern biotechnology
Density	1.26 g/ml

FAN Boost™

Declared enzyme	Protease (Subtilisin)
Catalyzes the following reaction:	Serine endoprotease that hydrolyzes internal peptide bonds
Declared activity	4 AU_A/g
E.C./I.U.B no.:	3.4.21.62
Physical form	Liquid
Production method	The enzyme is manufactured via fermentation of a microorganism not present in the final product. The production organism is not modified using modern biotechnology
Density	1.17 g/ml

Stability

Please see the Product Data Sheet at Novozymes Market.

Safety, handling and storage

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

Get ahead

Staying ahead of the dynamic food and beverage market requires the best technology and expertise to become even more flexible, efficient and profitable. With our solutions and expertise, Novozymes can support you on that journey. Let's transform the quality and sustainability of your business together.

About Novozymes

Novozymes is the world leader in biological solutions. Together with customers, partners and the global community, we improve industrial performance while preserving the planet's resources and helping build better lives. As the world's largest provider of enzyme and microbial technologies, our bioinnovation enables higher agricultural yields, low-temperature washing, energy-efficient production, renewable fuel and many other benefits that we rely on today and in the future. We call it Rethink Tomorrow.

Novozymes Switzerland AG

Neumattweg 16
4243 Dittingen
Switzerland
foodandbeverages@novozymes.com

Novozymes A/S

Krogshøjvej 36
2880 Bagsvaerd
Denmark