novozymes®
Bioenergy

STARCH-BASED ETHANOL

www.bioenergy.novozymes.com

NOVOZYMES VISCOZYME® – VISCOSITY REDUCTION

Boosting ethanol capacity and profitability

Why viscosity-reducing enzymes?

Producing fuel ethanol from cereals such as wheat, triticale, barley, and rye presents quite a challenge. Nonstarch polysaccharides such as beta-glucans and arabinoxylans create high viscosity, which has a negative impact on downstream processes.

High viscosity limits the dry substance level in the process, increasing energy and water consumption and lowering ethanol yield. Nonstarch polysaccharides reduce the efficiency of separation, evaporation, and heat exchange.

Viscozyme enzymes enable higher ethanol production capacity and lower operating costs. You get greater flexibility in the choice of cereal and raw material quality together with the ability to process at higher dry substance levels.

Flexibility in raw material choice

- Wheat, triticale, barley, and rye can all be used
- Reduced viscosity level and peaks due to raw material variation or change in particle size

Increased ethanol production capacity

- More dry matter in the mash to boost ethanol output

Reduced overall operating costs

- Higher dry matter levels means lower energy consumption as less water has to be heated, cooled, and evaporated
- Better heat exchange operations due to better mash flow
- Optimized enzyme use

Customized solutions

Optimize your plant design and operations with expert assistance from your Novozymes representative.

Rethink Tomorrow

Viscosity of wheat slurry

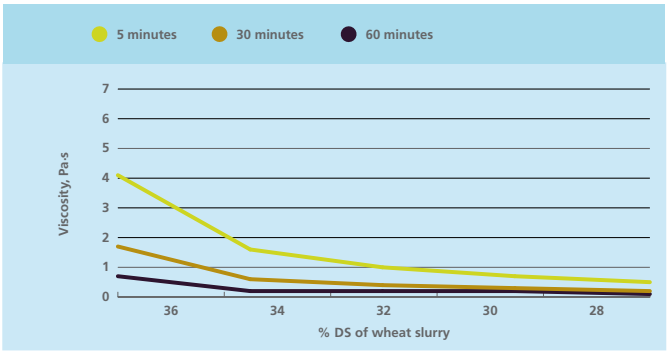

Fig. 1. Viscosity impact of dry solids, time, and Novozymes Viscozyme® Wheat addition. Treated with 0.3 kg Viscozyme Wheat/t DS at pH 5.2, 50 °C, and shear rate 10/s.

Viscosity vs. temperature on wheat mash

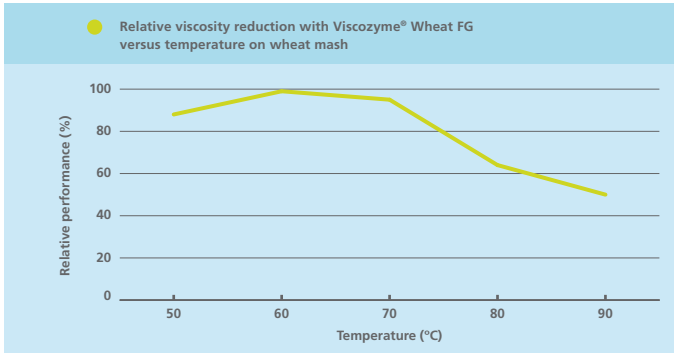

Fig. 2. The relative viscosity from gelatinized starch and from dextrin has been minimized by liquefying for 60 min at 90 °C and pH 5.7 with a high dosage of Novozymes Liquozyme® SC DS (0.3 kg/t DS) before adding Novozymes Viscozyme® Wheat for 60 min at specified temperature and then cooling to 32 °C.

Viscosity vs. temperature on barley mash

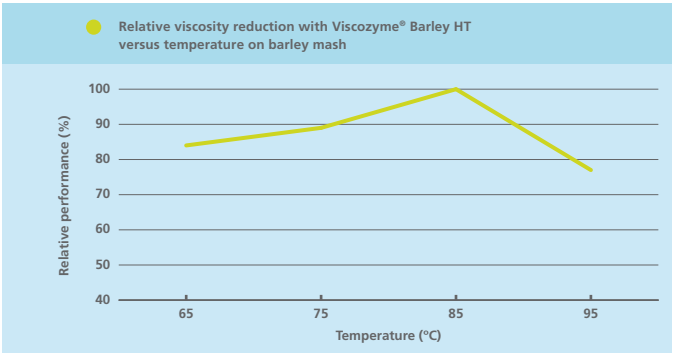

Fig. 3. The relative viscosity from gelatinized starch and from dextrin has been minimized by liquefying for 60 min at 90 °C and pH 5.7 with a high dosage of Novozymes Liquozyme® SC DS (0.3 kg/t DS) before adding Novozymes Viscozyme® Barley HT for 60 min at specified temperature and then cooling to 32 °C.

Water flow versus DS

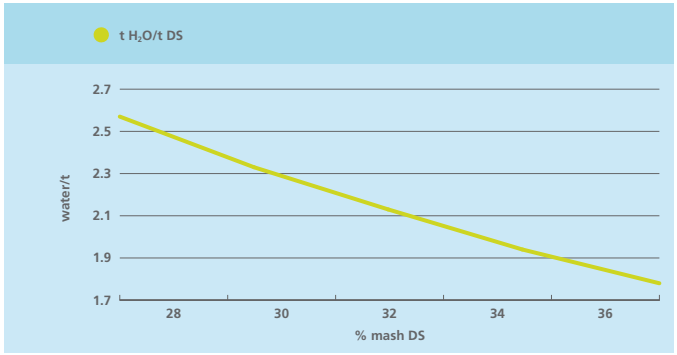

Fig. 4. Water flow versus dry solids for a plant producing 1 million hl ethanol a year. The total flow of water through the plant is reduced by approx. 200,000 m^3.

Our technical specialists will help you achieve your goals of optimal plant design and operations.

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Novozymes is the world leader in bioinnovation. Together with customers across a broad array of industries we create tomorrow's industrial biosolutions, improving our customers' business and the use of our planet's resources.

For more information visit www.bioenergy.novozymes.com

Novozymes North America, Inc. · 77 Perry Chapel Church Road · Franklinton, NC 27525 · USA · Tel. +1 919 494 3000 · Fax +1 919 494 3450

Novozymes (China) Investment Co Ltd. · 14 Xinxi lu · Shangdi Zone · Haidian District · 100085 Beijing · China · Tel. +86 10 6298 7888 · Fax +86 10 6298 1283

Novozymes A/S · Krogshoejvej 36 · 2880 Bagsvaerd · Denmark · Tel. +45 4446 0000 · Fax +45 4446 9999 · www.novozymes.com