

BREWZYME SERIES

PRODUCT INFORMATION BULLETIN

INTRODUCTION

The BrewZyme series is a range of microbial enzyme products designed for application in brewing and alcohol fermentation utilizing malted and unmalted substrates.

It is well recognized in the fermentation industries that the presence of non-starch polysaccharides (NSP) in cereal substrates, like β -glucans in barley or xylans (pentosans) in wheat, can cause processing problems. Other substrates include sorghum, rye, and maize.

Water-soluble components as % dry basis.

| | <u>β-glucans</u> | <u>Pentosans</u> |
|--------|-----------------------------------|------------------|
| Barley | 2.5 - 4.0 | 0.5 - 1.0 |
| Malt | 0.2 - 0.75 | 0.5 - 1.0 |
| Wheat | 0.5 - 1.0 | 2.0 - 3.0 |
| Rye | 0.5 - 1.0 | 2.0 - 3.0 |
| Oats | 2.0 - 3.0 | 0.2 - 0.75 |

The materials above are known to contain varying proportions of different hemicelluloses. These polymers function as linkages in cell wall structure, which encapsulates protein and starch important for yeast nutrition. The presence of water soluble 1,3-1,4- β -glucans and 1,4- β -xylans increases the viscosity of the solution, and thus decreases process efficiency.

In the malting process, natural cereal hemicellulase enzymes do assist in a partial breakdown to water-soluble polysaccharides, which are further degraded to

oligosaccharides. Malted cereal substrates are known to contain less water-soluble NSP than unmalted forms.

However, in the modern mashing/conversion process the temperatures used are too low to promote much further degradation of the water-soluble glucans and xylans. These polymers form gummy substrates that in the brewing and fermentation industries can cause the following problems:

1. Viscosity will increase in the mashing wort resulting in longer mash run-off.
2. Haze in the final beer product will be formed due to inefficient filtration.
3. Extract yield will be lower due to locking-in starch and protein components.

The use of added β -glucanases and xylanases is now a common technique in both malted and unmalted brewing processes.

Product Features

The BrewZyme range contains a complex of fungal carbohydrase enzymes including, but not limited to, the following.

- *endo-1,3- β -glucanase I.U.B. 3.2.1.6*
- *endo-1,4- β -glucanase I.U.B. 3.2.1.4*
- *endo-1,4- β -xylanase I.U.B. 3.2.1.8*

BrewZyme is a product of fermentation of a classical select strain of *Trichoderma longibrachiatum*.

MODE OF ACTION

BrewZyme activity can be described as catalyzing endo-hydrolysis of β -glucans, 1,4- β -glucosides and 1,4- β -xylans in barley, wheat and other cereal substrates.

ACTIVITY

The BrewZyme series includes the following products (typical activities by Dyadic methods are shown in U/g):

| <u>Product</u> | <u>Form</u> | <u>β-Gluc.</u> | <u>Xylanase</u> |
|------------------|-------------|---------------------------------|-----------------|
| BREWZYME BG | Liquid | 7,000 | 800 |
| BREWZYME BG PLUS | Liquid | 12,000 | 1,300 |
| BREWZYME BGX | Liquid | 10,000 | 15,000 |
| BREWZYME BGP | Powder | 35,000 | 5,000 |

One activity unit (U) of β -glucanase and Xylanase is defined as that quantity of enzyme that will liberate 1 mkmol of reducing sugars (expressed as glucose) in one minute under the assay conditions.

ENZYME PROPERTIES

BrewZyme is characterized as a fungal β -glucanase and hemicellulase preparation.

Figs. 1 - 3 illustrate the pH and temperature profiles of activity and stability of the β -glucanase component of BrewZymes.

APPLICATIONS

Being a multicomplex hemicellulase system, the BrewZyme series of products will reduce viscosity in beer brewing as follows:

1. **MALTHOUSE:** diluted into process water for spray application, BrewZyme will shorten germination times at peak demand and encourage conversion of poor quality barley to acceptable malts.

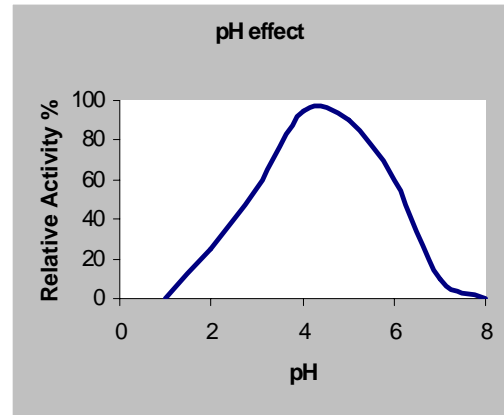


Figure 1.

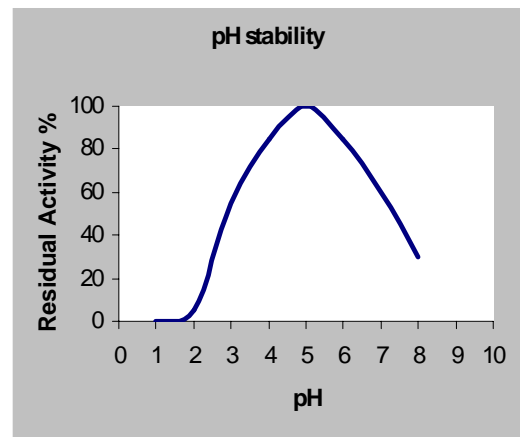


Figure 2.

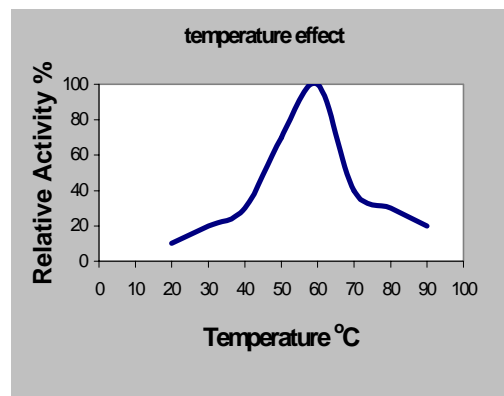


Figure 3.

2. MASHING: BrewZyme will increase wort filterability and improve lautering.
3. BEER: added at fermenter or settling tank, BrewZyme will assist in modifying β -glucan/xylan haze and, as a result, improve filtration.

BrewZyme can also be beneficial in:

- a) ADJUNCT BREWING: barley, wheat, and other cereals in combination with malt.
- b) ALL MALT BREWING: for modification of poor malts with high glucan content.

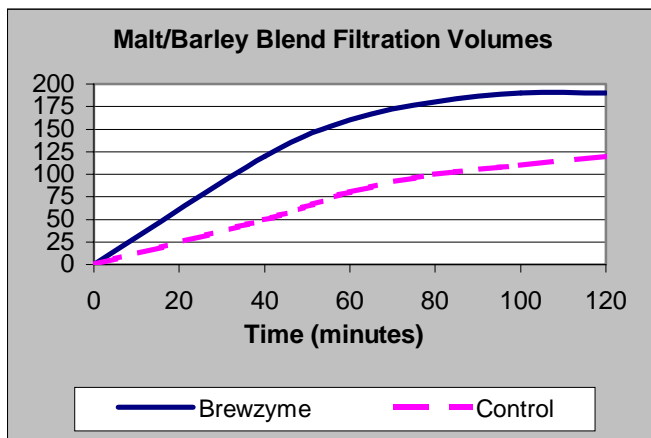


Fig. 4. Improvement of Filtration of Malt/Barley Blend (60:40) using BrewZyme.

MASHING TRIAL - EXAMPLE

Lab trials: 100% malt with high β -glucan content, grist + 0.2 mm grind

Brewzyme addition: to mash treatment

| Brewzyme Dose, Liters/ton | Filtration Vd./ 30min, mL | Increase, % | Viscosity, cps | Extract, liter/kg |
|---------------------------|---------------------------|-------------|----------------|-------------------|
| 0 | 244 | 0 | 1.49 | 296.0 |
| 0.3 | 284 | 12.9 | 1.44 | 296.7 |
| 0.5 | 296 | 17.7 | 1.44 | 296.7 |
| 1.0 | 298 | 18.1 | 1.44 | 296.8 |

05/01

DOSE RATES

Addition rates can be varied dependant on the grist composition. In mashing the enzyme is added proportionally to the unmalted fraction.

GENERAL RECOMMENDED

DOSE RATES

MASHING (ml/ton grist) -

All-malt,
BREWZYME BG 100ml/ton total grist
 malt/barley,
BREWZYME BG PLUS 300-400ml/ton barley
 malt/wheat,
BREWZYME BGX 400ml/ton wheat

BEER (ml/hectoliter) -

BREWZYME BG PLUS 0.1 - 0.3

MALTHOUSE (% w/w on barley) -

BREWZYME BG PLUS 0.01 - 0.03

Note: An excessive enzyme addition in a standard fixed time may result in over-action. A partial degradation of "insoluble NSP's" to soluble forms may occur, which is not always desirable.

PACKAGING

Liquid BREWZYME products are packed in 240-kg plastic drums as a standard. Other package sizes are available upon request.

Powder BREWZYME is packed in 75-kg fiber drums.

STORAGE

All BREWZYME grades are fully stabilized to give a sufficient shelf life at a temperature up to 43°C. Recommended storage for extended shelf life is 5 - 15°C.

STATUS

BREWZYME grades are produced from a non-GMO culture. The products are FDA approved, Food Grade and conform too FCC and WHO/FAO standards.

Liquid BREWZYME products have Kosher status.

DISCLAIMER

Nothing disclosed is to be construed as a recommendation to use our products in violation of any patents. The information presented is believed to be accurate. However, said information and products are offered without warranty or guarantee, except as to the composition and purity stated herein since the ultimate conditions of use and variability of the materials treated is beyond our control. We recommend that the prospective user determines the suitability of our materials and suggestions before adopting them on a commercial scale. The goods described herein are sold "as is" and "with all faults". The seller specifically disclaims all warranties in connection with the sale of the goods, both express and implied, including, without limitation, the warranties of merchantability and fitness for any particular purpose, as those terms are defined in the uniform commercial code of Florida. The seller shall not be liable for any incidental or consequential damages whatsoever.