



## Distizym® BA-TSA<sub>cid</sub>

Particularly thermostable, extremely acid-tolerant bacterial  $\alpha$ -amylase for starch liquefaction

### Product description

Distizym® BA-TSA<sub>cid</sub> is a special enzyme for starch liquefaction and dextrinisation. The enzyme is produced with a genetically modified strain of *Bacillus licheniformis* (host); the amylase-coding gene was transferred from a strain of *Bacillus stearothermophilus* (donor). The principal enzyme activity is based on a particularly thermostable, extremely acid-tolerant  $\alpha$ -amylase (1,4- $\alpha$ -D-glucan-glucanohydrolase: EC.3.2.1.1).

Distizym® BA-TSA<sub>cid</sub> liquefies and dextrinises gelatinised, digested starches in distilling mashes at a temperature range of 50 - 105 °C, i.e.:

- 50 - 70 °C at pH values of 4.8 - 6.2
- 75 - 85 °C at pH values of 5.3 - 7.2
- 95 - 105 °C at pH values of 5.8 - 6.8
- Under ideal pH conditions, Distizym® BA-TSA<sub>cid</sub> even briefly tolerates temperatures up to 110 °C.

### Dosage

The enzyme's field of activity extends from pH 4.0 - 8.0, the optimum being around pH 5.5 - 6.0 in the presence of substrate and calcium. The temperature range extends from 50 - 105 °C (max. 110 °C), the optimum temperature being in the range of 80 - 100 °C (max. 110 °C), depending on the mash's pH value in the presence of substrate and calcium.

Dosage for barley, wheat and rye:	80 mL/t starch
Dosage for corn and rice:	100 mL/t starch
Dosage for potatoes:	200 mL/t starch

A higher or lower dosage may be necessary in the event of deviations from standard conditions.

#### Classic starch digestion without pressure:

Distizym® BA-TSA<sub>cid</sub> is added to the mash tun after the raw material has been doughed or ground in. The enzyme should be diluted with cold water at a ratio of 1 : 1 before addition. It is added before or at the start of the heating phase. The liquefaction effect commences from 50 °C, from 60 °C Distizym® BA-TSA<sub>cid</sub> exhibits a good liquefaction effect. Depending on the speed of heating, when the final temperature of 80 - 100 °C is reached, a liquefaction rest must be taken, depending on the mash's pH value. It is generally unnecessary to correct the mash's pH. The addition of calcium (as Ca(OH)<sub>2</sub>, CaCl<sub>2</sub>, etc.) at a level of 25-75 ppm, based on pure calcium, is recommended to activate the enzyme.

#### Special, starch digestion process without pressure (Hohenheim dispersing mash process, etc.):

The total dosage of Distizym® BA-TSA<sub>cid</sub> - diluted with cold water - required is added to the mash dispersing tank, or added to the decanted spent wash from wash recycling. The spent wash should have a pH value of at least pH 5.0; if it is below this, then it must be raised. A calcium content of 25 - 75 ppm, based on pure calcium, is recommended to activate and stabilise the enzyme; if it is below this, then calcium (as Ca(OH)<sub>2</sub>, CaCl<sub>2</sub>, etc.) should be added.

Whilst the coarsely ground raw grains are discharged into the mash dispersing tank, the starch gelatinises as a result of continuous injection of steam by the dispersing machine, to release the maximum starch, with simultaneous disintegration of the mash. Dwell-time to achieve the desired degree of disintegration, controlled by hydrosizer, depends on the dispersing machine's size, the grind and mash feed. Enzymatic liquefaction commences at 50 °C, depending on the process the final temperature is around 90 - 95 °C, at which the liquefaction rest also takes place. When the desired degree of liquefaction has been achieved, the starch is further dextrinised and saccharified using Distizym® AG or Distizym® AG ALPHA, potentially also enzymatic protein hydrolysis and reduction of the mash viscosity using Distizym® PROTACID and Distizym® GL after cooling down to 65 °C.

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### Classic high-pressure steam process (Henze steamer, low-temperature method, etc.):

After blow-off, the Distizym® BA-TSA<sub>cid</sub> - diluted with cold water - is added direct to the hot, gelatinised and digested mash. The liquefaction rest is recommended at temperatures of 90 - 95 °C. The addition of 25 - 75 ppm calcium, based on pure calcium, is recommended to activate and stabilise the enzyme. It is generally unnecessary to correct the mash's pH. For extended liquefaction rests at temperatures over 90 °C, we advise adjusting the mash pH to > pH 5.8. For potato processing, the distillate's methanol content can be reduced significantly if mash liquefaction is carried out at a pH value below pH 5.2 and at liquefaction temperatures not exceeding 85 °C.

### Special pressure/thermo process (jet cooker process, high-pressure cooking process according to Michurin, etc.):

Distizym® BA-TSA<sub>cid</sub> is diluted with cold water and added continuously. In the jet cooker method, the enzyme dilution is split, being added at the start of the heating phase and at the end of the jet cooker phase and, in the high-pressure cooking process (HPCP or "hard" starch digestion process at 5 - 6 bar or 150 - 160 °C), is added during the cooling phase after blow-off in the steam separator, at 110 °C depending on the process, or through addition to the saccharification vat in the HPCP or "hard" starch digestion process, when the mash is transferred to the saccharification vat. The mash temperature and pH value are to be coordinated for each starch digestion process (see treatment aim). The addition of 25 - 75 ppm calcium, based on pure calcium, is recommended to activate and stabilise the enzyme.

Figures 1 and 2 show the influence of temperature and pH value on Distizym® BA-TSA<sub>cid</sub>'s enzyme activity.

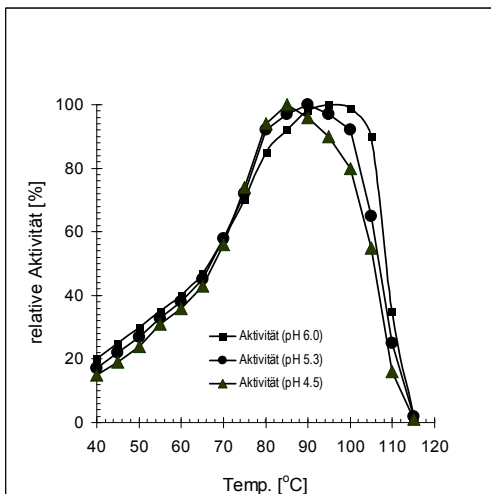


Fig. 1: Influence of temperature on amylase activity (10 % soluble starch).

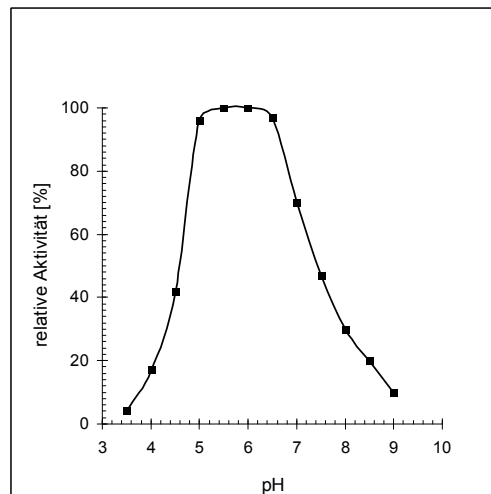


Fig. 2: Influence of pH value on amylase activity (10% soluble starch, 90 °C).



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Figures 3 and 4 show the influence of temperature and pH value on Distizym® BA-TSA<sub>cid</sub>'s enzyme stability.

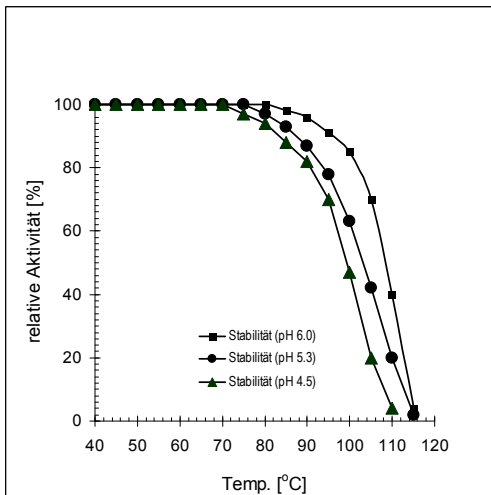


Fig. 3: Influence of temperature on amylase stability (10 % soluble starch, 1 h).

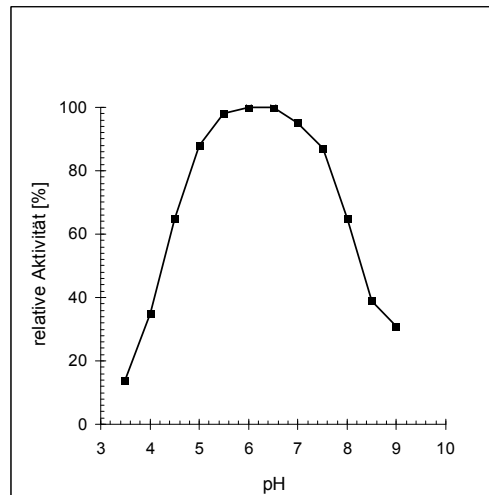


Fig. 4: Influence of pH value on amylase stability (10 % soluble starch, 90 °C, 1 h).

## Storage

Optimum storage is at 0-10 °C. Higher storage temperatures reduce shelf life. Temperatures above 25 °C should be avoided. Opened containers should be tightly sealed and used as soon as possible.