GLUCOSYLASE

(see Enzymes CBS, Why and when to use enzymes)

Glucosylase is an exo-1,4-alpha-D-glucosidase (amyloglucosidase EC.3.2.1.3.) from Aspergillus niger which catalyzes the hydrolysis of the alpha-1,4 and alpha-1,6 linkages of starch producing glucose. During hydrolysis, glucose units are removed in a stepwise manner from the non-reducing end of amylose or amylopectin chains. The rate of hydrolysis depends on the type of linkage as well as on the chain length: alpha-1,4 linkages are more readily hydrolyzed than alpha-1,6 linkages.

PURPOSES

Production of glucose syrups.

Increase of wort fermentability (apparent attenuation limit); some 25% of the total carbohydrate of wort is unfermentable. The addition of Glucosylase to the fermenter converts the unfermentable dextrins to glucose which in turn is fermented to alcohol giving an apparent attenuation higher than 100% without loss of palate fullness or head retention. At the same alcohol concentration as a normal attenuated beer the super-attenuated beer will have required 25% less of raw material.
see Attenuation adjustement

TEMPERATURE

Standard assays were carried out at pH 4.3 and at different temperatures.
Glucosylase shows optimum activity at 65-70°C and can be used up to 70°C. However, for prolonged reacting periods a maximum temperature of 60°C is recommended.

pH EFFECT

Standard assays were carried out at 60°C and at different pH values.
Glucosylase has optimum activity at pH 4.7 but has a working range of pH 3.5-6.0

APPLICATION

Glucosylase may be added in the brewhouse at mashing-in, however as the normal mash pH (around 5.7) is far from the Glucosylase optimum pH (around 4.5) and as the alpha-1,6 linkages are hydrolyzed slowly we recommend to help Glucosylase by adding Desatase (alpha-1,6 debranching enzyme, see Desatase technical leaflet). In this case we can achieve apparent attenuations of 90-95%. The enzymes are destroyed during wort boiling and no active enzymes are found in final beer. Care must be taken if the yeast strain is sensitive to glucose as far as the later uptake of maltose is concerned. In this case, we recommend to substitute glucose releasing Glucosylase by the maltose releasing Maltosylase (see Maltosylase technical leaflet)

Glucosylase may be added at the start of fermentation, in this case the more favorable pH and the longer contact period (around 7 days) allow to reach an apparent attenuation higher than 100%. If the yeast strain is sensitive to glucose as far as the later uptake of maltose is concerned Glucosylase may be added at the end of the primary fermentation. The fermentation will restart and will be achieved in 2-3 days reaching an apparent attenuation higher than 100%. The use of some Desatase since the start of primary fermentation will significantly reduce the second fermentation period. Another possibility to avoid the glucose sensitivity of some yeast strains is to replace in the fermenter the glucose releasing Glucosylase by the maltose releasing Maltosylase associated with the alpha-1,6 debranching Desatase. The use of the two last enzymes also allows to reach an apparent attenuation higher than 100% (see their respective technical leaflets) during fermentation.

C B S
Customized Brewing Solutions

Rue du Cloître, 75 - 1020 Brussels - Belgium
FAX : 32-2-479 01 16 - PHONE : 32-2-478 56 18
www.cbsbrew.com - info@cbsbrew.com

As Glucosylase is not inactivated during normal beer pasteurization the use of Glucosylase during fermentation will result in the presence of active Glucosylase in the finished beer. This in itself is not a problem if there is no substrate left in the beer for amyloglucosidase to break down (apparent attenuation has to be higher than 100%). Further great care should be taken not to mix amyloglucosidase treated beer during fermentation with non-treated beer at any stage after termination of fermentation processes.

RATES

- at mashing-in 1-3 l per ton of grist.
- at start of fermentation 3 to 5 ml per hl beer.

ACTIVITY

300 AU/ml. One unit of amyloglucosidase activity is the quantity of enzyme which produces 1 mg of dextrose in one minute from hydrolyzed starch under assay conditions of pH 4.3 and 60°C.

AVAILABILITY

GLUCOSYLASE is avalaible in polypropylene drums of 30 kg.

SAFETY

GLUCOSYLASE is produced according to FAO/WHO JECFA and FCC recommendations for food grade enzymes, supplemented with maximum limits of 5 x 10^4/g for total count and 102/g for moulds.

STORAGE

The declared activity of GLUCOSYLASE is maintained for at least six months when stored at 25°C and for at least one year when stored at 5°C.

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