DISTILLASE® CS

Saccharifying Enzyme for Ethanol Production

DESCRIPTION

DISTILLASE® CS enzyme is an optimized, concentrated blend of enzymes that produces glucose from liquefied starch. DISTILLASE® CS enzyme contains fungal 1,4-α-Dglucan glucohydrolase (E.C. 3.2.1.3) commonly referred to as glucoamylase or amyloglucosidase and fungal alpha-amylase (E.C.3.2.1.1). Both enzymes are derived from recombinant strains of *Trichoderma reesei*. The glucoamylase in DISTILLASE® CS enzyme catalyzes the release of successive glucose units from the nonreducing ends of soluble dextrins and oligosaccharides, while the alpha-amylase at the same time can generate those oligosaccharides and dextrins.

TYPICAL CHARACTERISTICS

Activity: 570 GAU/g (minimum)
Appearance: Clear brown liquid
pH: 4.0 - 4.5
Specific gravity: 1.13 - 1.16 g/ml
Formulation: Food grade

UNIT DEFINITION

One **G**lucoa**m**ylase **U**nit (**GAU**) is the amount of enzyme that will liberate one gram of reducing sugars calculated as glucose per hour from soluble starch substrate under the conditions of the assay. A detailed assay method is available upon request.

PERFORMANCE BENEFITS

DISTILLASE® CS enzyme provides the following benefits to ethanol producers:

- Increased ethanol yield by complete saccharification of liquefied starch
- Less unfermentated starch in stillage and DDGS.
- Improved performance in pre-saccharification processes
- Increased fermentation rates and shorter fermentation times

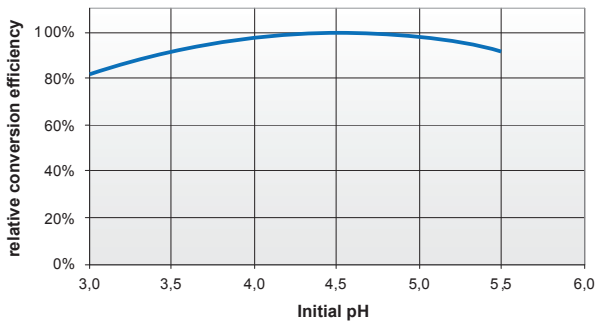
APPLICATION RECOMMENDATIONS

DISTILLASE® CS enzyme is used to saccharify liquefied starch from various sources including wheat, corn, sorghum, barley, rye, rice and cassava. The resultant glucose product is fermented by yeast to yield ethanol.

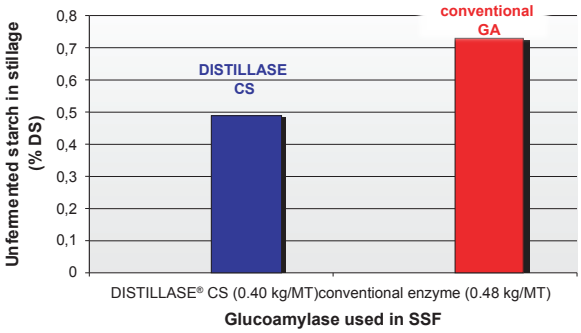
RECOMMENDED OPERATIONAL CONDITIONS	
Optimum pH range	4.0 - 5.0
Effective pH range	3.2 - 5.8
Effective temperature range	28 - 65°C (83 - 149°F)
Pre-saccharification	1 - 16 hours at 60 - 65°C (140 - 149°F)
DISTILLASE® CS dosage	Please contact your DuPont Technical Representative for recommendations specific to your liquefaction process

DOSAGE GUIDELINES

DISTILLASE® CS enzyme is generally added at a level of 0.055 to 0.075 % w/w (starch, dry solid basis). This corresponds to a level of 0.375 to 0.50 kg DISTILLASE® CS / MT grain `as is'. The actual enzyme requirement is dependant on the temperature, reaction time and pH of the individual plant saccharification/fermentation process, and its desired results. Fermentation performance may be enhanced by the addition of an acid fungal protease like FERMGEN™.



Effect of initial fermentation pH on conversion efficiency with DISTILLASE® CS enzyme (whole ground wheat, 30% DS, 32°C)



Effect of DISTILLASE® CS enzyme and conventional glucoamylase on residual starch of fermented wheat mash

COMPLETE SACCHARIFICATION OF STARCH

DISTILLASE® CS enzyme converts more starch to fermentable sugars compared to other comparable products.

PACKAGING

DISTILLASE® CS enzyme is available in various packaging sizes. Please contact DuPont for detailed information.

REGULATORY STATUS

This product complies with the current recommended purity specifications for food-grade enzymes given by the Joint FAO/WHO Expert Committee on Food Additives (**JECFA**) and the Food Chemicals Codex (**FCC**) and is **GRAS** (Generally Recognized As Safe) in the United States for use in carbohydrate processing.

STORAGE

To ensure maximum retention of activity, store DISTILLASE® CS enzyme under refrigerated conditions with the container closed. Prolonged storage at elevated temperature should be avoided.

SAFETY & ENZYME HANDLING

Inhalation of enzyme dust and mists should be avoided. In case of contact with the skin or eyes, promptly rinse with water for at least 15 minutes.

For detailed handling information, please refer to the appropriate Material Safety Data Sheet, the Enzyme Technical Association (**ETA**) handbook *Working Safely With Enzymes*, and the Association of Manufacturers and Formulators of Enzyme Products (**AMFEP**) handbook *Guide to the Safe Handling of Microbial Enzyme Preparations*. All are available from DuPont.

TECHNICAL SERVICE

Information covering specific applications of this product is available. DuPont will work with customers to enhance processes and solve problems. Let us know what you need and we will assist you.

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