



FERMGEN™

Acid Fungal Protease Enzyme for Ethanol Production

DESCRIPTION

FERMGEN™ is an acid proteolytic enzyme characterized by its ability to hydrolyze proteins under low pH conditions. The broad substrate specificity of FERMGEN™ protease enables the enzyme to easily and efficiently hydrolyze most proteins in a random fashion. The fungal protease is obtained by controlled fermentation of a genetically modified selected strain of *Trichoderma reesei*.

TYPICAL CHARACTERISTICS

Activity: 1000 SAPU/g (minimum)

Appearance: Brown liquid

pH: 4.0 - 5.0

Specific gravity: 1.12 - 1.20 g/ml

The activity of FERMGEN™ protease is expressed in Spectrophotometric Acid Protease Units (SAPU). One SAPU is the amount of enzyme activity that liberates one micromole of tyrosine per minute from a casein substrate under conditions of the assay. A detailed assay method is available upon request.

PERFORMANCE BENEFITS

FERMGEN™ acid fungal protease provides the following benefits to ethanol producers:

- More value-added enzyme product as compared with GC 106 that offers improved process economics to ethanol producers.
- Faster ethanol fermentation rates and yield for corn, milo or wheat based substrates as compared with fermentations without acid fungal protease.
- Provides more essential yeast nutrients in the form of amino acids, peptides and free amino nitrogen.
- Hydrolyzes protein matrices in the corn kernel that bind the various fractions thereby enabling the hydrolysis of the “hard” to hydrolyze starch.
- Works at a pH of 3.0 – 4.5, which is complimented by the average current fermentation pH that is employed in the fuel ethanol industry.
- Works in concert with STARGEN™ 001 to provide a more robust no cook system for granular starch hydrolysis of corn or fractionated corn substrates for fuel ethanol production.

RECOMMENDED OPERATIONAL CONDITIONS

pH	3.5 to 5.0
Dry Substance	26 - 38% w/w
Temperature	The enzyme is effective up to 65°C, but works well at fermentation temperatures of 28 - 35°C

DOSAGE GUIDELINES

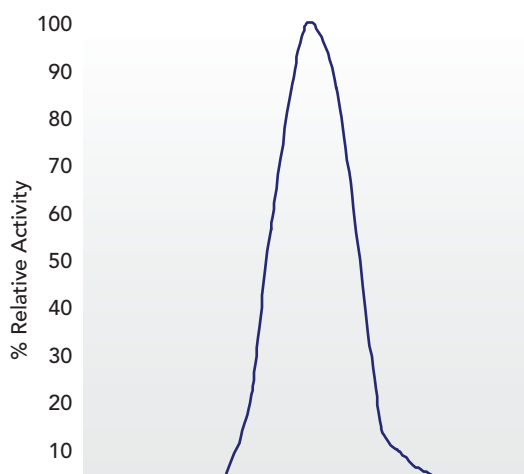
The optimal usage level of FERMGEN™ protease in simultaneous saccharification and fermentation is dependent upon processing parameters such as processing time, pH, temperature and DS-Dry Solids.

Conventional Systems	0.1 - 0.6 KG/MT ds of grain is recommended under most fermentation conditions
Low Energy	0.5 - 1.0 KG/MT ds of grain is recommended under most fermentation conditions

EFFECT OF pH ON ACTIVITY

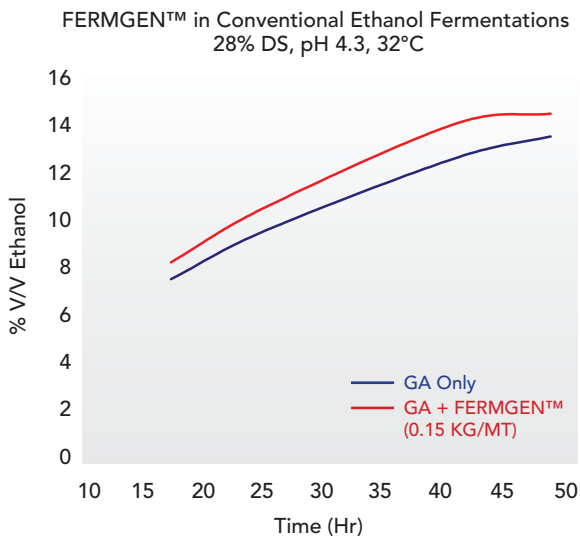
FERMGEN™ protease has a pH activity profile that is ideal for ethanol fermentations. As can be seen on the graph below, FERMGEN™ protease has excellent relative activity at a pH range of 3.0 - 4.5, which is the current average fermentation pH employed in the fuel ethanol industry.

FERMGEN™ pH - Activity Profile



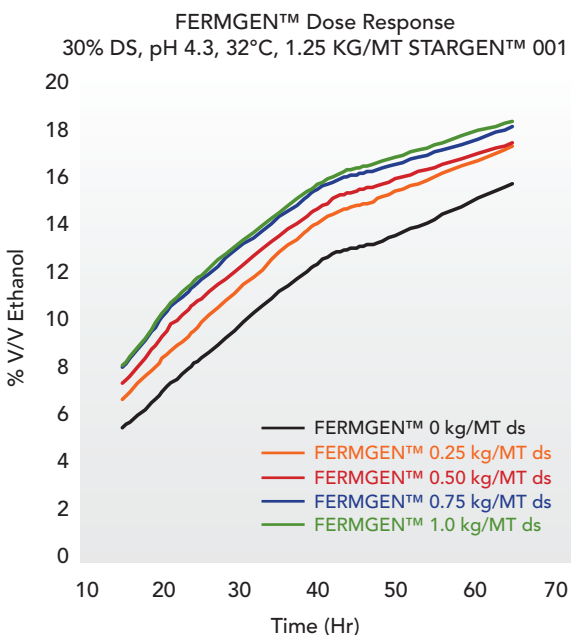
PROTEASE BENEFITS IN CONVENTIONAL SYSTEMS

The addition of FERMGENTM protease to conventional ethanol fermentations increases the rate and yield of ethanol produced.



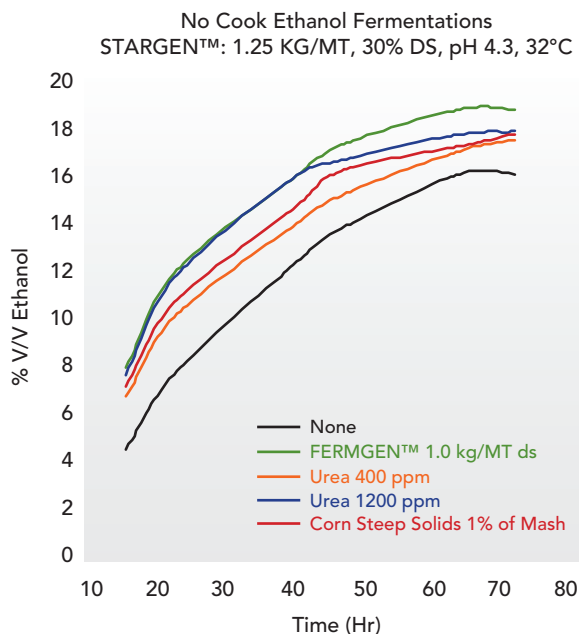
PROTEASE DOSE RESPONSE ON LOW ENERGY FRACTIONATED CORN SYSTEM

FERMGENTM protease also works in concert with STARGENTM to improve the ethanol rate and yield in no cook fractionated enzyme systems.



PROTEASE COMPARISON TO OTHER NITROGENOUS SOURCES IN LOW ENERGY - FRACTIONATED CORN SYSTEM

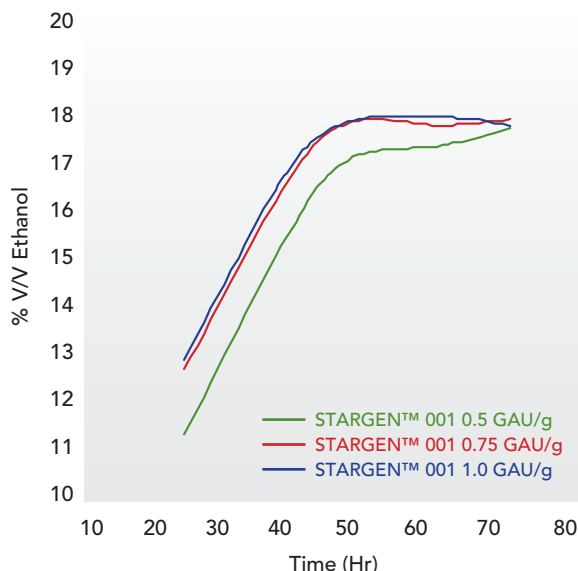
FERMGENTM protease produces essential nutrients that are ideal for improved yeast metabolism resulting in faster ethanol rates and increase yield. The graph below illustrates the effect of protease used in ethanol fermentations and is compared with other nitrogen sources.



PROTEASE DOSE RESPONSE ON LOW ENERGY WITH STARGENTM IN NO COOK FRACTIONATED CORN FERMENTATIONS

FERMGENTM protease also works in concert with STARGENTM enzyme in no cook fractionated corn fermentations as the addition of FERMGENTM protease increases the rate of ethanol produced and allows for a lower dose of STARGENTM enzyme.

FERMGEN™ Dose Response
 FERMGEN™ 1.0 kg/MT, 30% DS, pH 4.3, 32



PACKAGING

FERMGEN™ protease is available in various package sizes. Please consult your DuPont representative for detailed information. Smaller quantities for lab and pilot-scale testing are also available.

STORAGE

To ensure maximum retention of activity, store FERMGEN™ protease under refrigerated conditions with the container closed. Prolonged storage at elevated temperatures 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.

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