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APPENDIX

Appendix I

Termamyl 60 L

Description

Termamyl is a liquid enzyme preparation containing an outstandingly heat - stable alpha - amylase produced by a selected strain of Bacillus licheniformis. This enzyme is an endo - amylase which will hydrolyze 1, 4 - alpha - glucosidic linkages in amylose and amylopectin at random. Starch is therefore a rapidly broken down to soluble dextrins and oligo-saccharides.

Product Type

Termamyl is available as "Termamyl 60 L". The product is dark brown liquid with a density of approximately 1,2 gm/ml and a pH in the range of 6 - 8.

Product Specification

Activity

Termamyl 60 L	60 KNU/gm

Other characteristics

The food grade products comply with FAO/WHO JECFA and FCC recommended specifications for food grade enzymes, supplemented with maximum limits of 5×10^4/gm for total viable count and 10^2/gm for moulds.

Solubility

The active enzyme components of Termamyl are readily soluble in water at all concentrations which occur in normal usage. Turbidity which may occur in the enzyme preparation has no influence on the volumetric activity or handling characteristics of the product.

Handling Precautions

The product is non - flammable and completely miscible with water. Unnecessary contact with the product or inhalation of dust from the dried product should be avoided. In cases of spillage or accidental contact with skin or eyes, flush with water.

Storage

When Termamyl is stored at a temperature of 25°C, the declared activity is maintained for at least three months. For longer storage periods, a loss in activity of 1-2% per month may occur. When stored at 5°C, the product will maintain the declared activity for at least one year.

Typical Process Conditions

Enzyme	Termamyl 60 L	
Starch concentration	30-40% dry substance	
pH	6,5 - 7,0	
Temperature	105°C	95°C
Reaction time	5 minutes	60 - 120 minutes
Enzyme dosage	1,2 kg/ton starch dry substance	

Appendix II

AMG

Description

AMG - Amyloglucosidase NOVO - is exo - amylase produced from a strain of Aspergillus niger. Amyloglucosidase catalyzes the stepwise hydrolysis of 1, 4 - alpha - linkages in starch and oligosaccharides by removing glucose units from the non-reducing end of the molecule. The rate of hydrolysis depends on the chain length of the molecule. Maltotetraose and oligosaccharides with higher molecular weight are hydrolyzed more rapidly than maltotriose which again is hydrolyzed more rapidly than maltose. Amyloglucosidase also catalyzes the hydrolysis of 1, 6 - alpha-linkages, although more slowly than that of 1, 4 - alpha - linkages. It is therefore possible to obtain almost complete conversion of liquefied starch to glucose by saccharifying with AMG.

Product Type

AMG is available as AMG 150 L. The product is dark brown liquid with a slight smell typical of fermentation products, a density of about 1.17 gm/ml, and a pH of between 3 and 5.

Product specification

Activity

AMG 150 L	150 AGU/ml

Other characteristics

The products comply with FAO/WHO JECFA and FCC recommended specifications for food grade enzymes, supplemented with maximum limits of 5 x 10^4/gm for total viable count and 10^2/gm for moulds.

Transglucosidase

Transglucosidase catalyzes the transfer of a glycosyl moiety from a 1, 4 - alpha position to a 1, 6 - alpha position. Saccharification with an amyloglucosidase which contains transglucosidase will lead to the formation of panose and isomaltose.

AMG 150 L is free from transglucosidase.

Solubility

The active enzyme components of AMG are readily soluble in water at all concentrations which occur in normal usage. Turbidity which may occur in the enzyme preparation has no influence on the volumetric activity or handling characteristics of the product.

Handling Precautions

The product is non - flammable and completely miscible with water. Unnecessary contact with the product or inhalation of dust from the dried product should be avoided. In case of spillage or accidental contact with skin or eyes, flush with water.

Storage

When AMG is stored at a temperature of 25°C, the declared activity

is maintained for three months. For longer storage periods, a loss in activity of 1-2 % per month may occur. When stored at 5°C, the product will maintain the declared activity for at least one year.

Typical Process Conditions

Enzyme	AMG 150 L
Substrate concentration	30 - 40% dry substance
pH	4.5
Temperature	60°C
Reaction time	48 hours
Enzyme dosage	1.5 l/ton starch dry substance

Appendix III

Sweetzyme

Description

Sweetzyme is an immobilized glucose isomerase produced from a selected strain of Bacillus coagulans. The enzyme catalyzes the conversion of glucose to fructose and is mainly used for converting a glucose syrup obtained by enzymatic liquefaction and saccharification of starch into a fructose syrup containing 42% fructose.

Product Types

Sweetzyme is available in two product forms both of which are immobilized:

Sweetzyme Type A

Sweetzyme Type Q

Type A is a dry brown powder with a particle size range of 0 - 0.4 mm and is used in batch operation with stirred tank reactors. Type Q is a dry brown extrudate with a particle size range of 0.3 - 1.0 mm (as determined by sieve analysis) and is well suited for use in fixed - bed reactors.

Activity and density

	Sweetzyme type A	Sweetzyme type Q
Activity	150 GINU/gm	200 IGIC/gm
True density, approx.	1,400 gm/l	1,400 gm/l
Wet bulk density, approx. (as loaded)	-	280-320 kg/m^3
Volumetric activity	-	60-75 IGIC/ml

The activity is not standardized but is declared individually for each batch of enzyme.

Other characteristics

The products comply with FAO/WHO JECFA and FCC recommended specifications for food grade enzymes, supplemented with maximum limits of 5 x 10^4/gm for total viable count and 10^2/gm for moulds.

Handling Precautions

Unnecessary contact with the product or inhalation of dust from the dried product should be avoided. It is recommended to use protective spectacles and gloves during handling. In case of spillage or accidental contact to skin or eyes, rinse by flushing with water.

Storage

Refrigerated stroage is strongly recommended. When stored at 0 - 5°C, the activity loss is less than 1% per month. At 25°C, the activity loss is about 5% per month.

Typical Process Conditions

Sweetzyme type A

Enzyme	Sweetzyme type A
Substrate concentration	40 - 50% dry substance
Substrate, glucose content	93 - 97%
pH	6,5 - 7,0
Temperature	60 - 65°C
Dosage of $MgSO_4.7H_2O$	2 gm/l syrup
Dosage of $CoCL_2.6H_2O$	0,1 gm/l syrup
Reaction time	20 - 24 hours
Enzyme consumption (500 GINU/gm)	1.6 kg/ton dry substance

Sweetzyme type Q

Enzyme	Sweetzyme type Q
Substrate concentration	35 - 45% dry substance
Substrate, glucose content	93 - 97%
Inlet pH (25°C)	8.5
Temperature	65°C
Dosage of $MgSO_4.7H_2O$	0.1 gm/l syrup
Enzyme consumption (150 IGIC/gm)	0.85 kg/ton dry substance

VITA

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