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Report Name: FSSAI Publishes List of Enzymes Derived from Genetically Modified Microorganisms in the Official Gazette of India

Country: India

Post: New Delhi

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Report Highlights:

On October 27, 2022, the Ministry of Health and Family Welfare/Food Safety and Standards Authority of India (FSSAI) published notification F.No. STD/FA/A-1.30/No.1/2020-FSSAI(P-I) in the Gazette of India: Extraordinary (Official Gazette). The notification was subsequently published on the FSSAI website on October 31, 2022. The notification issued includes the Food Safety and Standards (Food Product Standards and Food Additives) Second Amendment Regulations, 2022. Table '11 A' of Appendix 'C' of the regulation will include details regarding the list of enzymes derived from genetically modified microorganisms.

DISCLAIMER: The information contained in this report was retrieved from the Food Safety and Standards Authority of India's (FSSAI) website <http://www.fssai.gov.in>. The Foreign Agricultural Service (FAS) Office of Agricultural Affairs at the U.S. Embassy in New Delhi, USDA, and/or the U.S. government make no claim of accuracy or authenticity. The Government of India has not officially endorsed this report. Import approval for any product is subject to local rules and regulations as interpreted by Indian officials at the time of product entry. [Note: Use Google Chrome to access the links that do not open in Internet Explorer. Indian host sites will geo-block site access on a rolling basis].

GENERAL INFORMATION:

On October 27, 2022, the Ministry of Health and Family Welfare/Food Safety and Standards Authority of India (FSSAI) published notification F.No. STD/FA/A-1.30/No.1/2020-FSSAI(P-I) in the Gazette of India: Extraordinary (Official Gazette). The notification was subsequently published on the FSSAI website on October 31, 2022. The notification issued includes the [Food Safety and Standards \(Food Product Standards and Food Additives\) Second Amendment Regulations, 2022](#). Table '11 A' of Appendix 'C' in the regulation will include details regarding the list of enzymes derived from Genetically Modified Microorganisms. Details on the enzymes in the list include the name, production organism, donor organism or source, functional and technological purpose, indicative food uses as well as the residual level.

The full text of the notification is pasted below at the end of this report and is available on the FSSAI's website located at:
https://fssai.gov.in/upload/notifications/2022/10/635f6a08b7c16Gazette_Notification_Processing_Aids_31_10_2022.pdf

FOOD SAFETY AND STANDARDS AUTHORITY OF INDIA

NOTIFICATION

New Delhi, the 27th October, 2022

F.No. STD/FA/A-1.30/No.1/2020-FSSAI(P-I).—Whereas the draft Food Safety and Standards (Food Products Standards and Food Additives) Amendment Regulations, 2021, were published as required by sub-section (1) of section 92 of the Food Safety and Standards Act, 2006 (34 of 2006) vide notification of the Food Safety and Standards Authority of India number F.No. STD/FA/A-1.30/No.1/2020-FSSAI(P-I), dated the 27th December, 2021, in the Gazette of India, Extraordinary, Part III, section 4, inviting objections and suggestions from persons likely to be affected thereby before the expiry of period of sixty days from the date on which the copies of the Official Gazette containing the said notification were made available to the public;

And whereas copies of the said Gazette were made available to the public on the 4th January, 2022;

And whereas objections and suggestions received from the public in respect of the said draft regulations have been considered by the Food Safety and Standards Authority of India;

Now, therefore, in exercise of the powers conferred by clause (e) of sub-section (2) of section 92 of the Food Safety and Standard Act, 2006, the Food Safety and Standards Authority of India hereby makes the following regulations further to amend the Food Safety and Standards (Food Products Standards and Food Additives) Regulations, 2011, namely:—

1. (1) These regulations may be called the Food Safety and Standards (Food Products Standards and Food Additives) Second Amendment Regulations, 2022.

(2) They shall come into force on the date of their publication in the Official Gazette.

2. In the Food Safety and Standards (Food Products Standards and Food Additives) Regulations, 2011, in Appendix C, under the heading “II. USE OF PROCESSING AIDS IN FOOD PRODUCTS”, after TABLE 11 relating to “ENZYMES (for treatment or processing of raw materials, foods, or ingredients)”, the following Table shall be inserted, namely:—

“TABLE 11 A: Enzymes derived from Genetically Modified Microorganisms (GMM)

Sl. No	Enzyme Name	Production Organism	Donor Organism or Source	Functional and technological purpose	Indicative food uses	Residual level (mg/kg) (Not more than)
1.	Glucose oxidase (EC No. 1.1.3.4)	<i>Aspergillus oryzae</i>	<i>Aspergillus niger</i>	Dough stabilizer	Baking and other cereal-based processes (bread, pasta, noodles, snacks)	GMP
		<i>Aspergillus niger</i>	<i>Penicillium chrysogenum</i>	Dough stabilizer, food preservative, color stabilizer and for reduced alcohol wine production	Bakery products and other cereal based products (e.g. pasta, noodles, snacks), Egg processing, fruit and vegetable processing, Production of	GMP

		<i>Aspergillus niger</i>	<i>Aspergillus niger</i>	For conversion of glucose to gluconic acid in presence of dissolved oxygen	beer and other cereal based beverages In food processing to remove glucose and oxygen and in bakery application	GMP
2.	Hexose oxidase (EC No. 1.1.3.5)	<i>Hansenula polymorpha</i>	<i>Chondrus crispus</i>	To catalyze the oxidation of C6 sugars into their corresponding lactones and hydrogen peroxide	In food processing of wide range of products for dough-strengthenin, oxygen scavenging, curd formation and to reduce the occurrence of excessive maillard reactions	GMP
3.	Catalase (EC No. 1.11.1.6)	<i>Aspergillus niger</i>	<i>Aspergillus niger</i>	Catalyzes the decomposition of hydrogen peroxide to water and oxygen	In food processing for enzymatic production of gluconic acid, removal of hydrogen peroxide or generation of oxygen in foods and beverages	GMP
		<i>Trichoderma reesei</i>	<i>Aspergillus niger</i>	Catalyzes the decomposition of hydrogen peroxide to water and oxygen	For egg processing	GMP
4.	Peroxidase (EC No. 1.11.1.7)	<i>Aspergillus niger</i>	<i>Marasmiusscorodoni</i>	Preservation of raw milk, yoghurt and cheese	Dairy processing (whey processing) and Production of bakery products	GMP
5.	Phosphatidylcholine-sterol O-acyltransferase (EC No. 2.3.1.43)	<i>Bacillus licheniformis</i>	<i>Aeromonassalmonicida</i>	Modification of phospholipids to lysophospholipids and cholesterol ester	Baking, dairy, egg processing, fats and oils Processing, meat processing	GMP
6.	1,4-alpha-glucan branching (EC No. 2.4.1.18)	<i>Bacillus subtilis</i>	<i>Rhodothermus obamensis</i>	Converts amylose into amylopectin	Starch processing	
7.	4-alpha-glucanotransferase (amylomaltase) (EC No. 2.4.1.25)	<i>Bacillus amyloliquefaciens</i>	<i>Thermus thermophilus</i>	Modification of the structural properties of starch to mimic fat.	Starch processing	GMP

8.	Triacylglycerol Lipase (EC No. 3.1.1.3)	<i>Aspergillus niger</i>	<i>Fusarium culmorum</i>	Improvement of texture of fat in bakery products, flavour modification, interesterification of fats, degumming of oils and fats	Production of bakery products dairy processing oils and fats processing	GMP
		<i>Kluyveromyces lactis</i>	Calf, goat, lamb	Improvement of texture of n bakery products, flavour modification, interesterification of fats, degumming of oils and fats	Production of bakery products dairy processing oils and fats processing	GMP
		<i>Hansenula polymorpha</i>	<i>Fusarium heterosporum</i>	Improvement of texture of bakery products, modifying egg yolk for use in cake preparation and degumming of oils and fats	Production of Bakery products, egg processing, fats and oils processing	GMP
		<i>Aspergillus niger</i>	<i>Candida antarctica</i>	Degumming of oils and fats	Oils and Fats processing	GMP
		<i>Aspergillus oryzae</i>	<i>Humicola lanuginosa and Fusarium oxysporum</i>	Improvement of texture of bakery products, flavour modification, modifying egg yolk for use in cake preparation interesterification of fats, degumming of oils and fats	Bakery and other cereal-based products(bread, pasta, noodles, snacks), brewing and other cereal-based beverages, egg processing oils and fats processing	GMP
		<i>Aspergillus oryzae</i>	<i>Fusarium oxysporum</i>	Improvement of texture of bakery products, flavour modification, modifying egg yolk for use in cake preparation interesterification of fats, degumming of oils and fats	Bakery and other cereal-based products (bread, pasta, noodles, snacks) Egg processing, brewing and other cereal-based beverages	GMP
		<i>Aspergillus oryzae</i>	<i>Thermomyces lanuginosus</i>	Improvement of texture of bakery products, flavour modification, modifying egg yolk for use in cake preparation, interesterification of fats, degumming of oils and fats	Bakery and other cereal-based products (bread, pasta, noodles, snacks), brewing and other cereal-based beverages egg processing oils and fats	GMP

		<i>Aspergillus oryzae</i>	<i>Rhizomucor miehei</i>	Interesterification of fats, degumming of oils and fats	processing oils and fats processing	GMP
		<i>Trichoderma reesei</i>	<i>Aspergillus niger</i>	As a processing aid in food manufacturing to catalyze the hydrolysis of ester bonds in triglycerides primarily in 1 and 3 positions of fatty acids in triglycerides with release of fatty acids and glycerol	For use in baking and brewing process, in the manufacture of cereal beverage, in pasta production, and in potable alcohol production	GMP
9.	Phospholipase A2 (EC No. 3.1.1.4)	<i>Aspergillus niger</i>	<i>Porcine pancreas</i>	Oil degumming	Production of bakery products , egg processing, oils and fats processing	GMP
10.	Lysophospholipase (EC No. 3.1.1.5)	<i>Aspergillus niger</i>	<i>Aspergillus niger</i>	Dough stabilizer, Improvement of texture of bakery products, enhance filtration rate of syrups, De-gumming of oils and fats	Bakery and other cereal-based products(bread, pasta, noodles, snacks) starch based products oils and fats processing	GMP
11.	Pectin esterase (EC No. 3.1.1.11)	<i>Aspergillus niger</i>	<i>Aspergillus niger</i>	Juice extraction, concentration and clarification of fruit juices, gelation of fruit, and to modify texture and rheology of fruit and vegetable-based products	Fruit and vegetable products, flavouring production	GMP
		<i>Aspergillus oryzae</i>	<i>Aspergillus aculeatus</i>	Juice extraction, concentration and clarification of fruit juices, gelation of fruit, and to modify texture and rheology of fruit and vegetable-based products	Fruit and vegetable products	GMP
12.	Phospholipase A1 (EC No. 3.1.1.32)	<i>Aspergillus oryzae</i>	<i>Fusarium venenatum</i>	To modify the functionality of dairy products and its ingredients	Milk and dairy based products	GMP
		<i>Aspergillus niger</i>	<i>Aspergillus niger</i>	De-gumming of oils and fats	Oils and fats processing	GMP
		<i>Aspergillus niger</i>	<i>Talaromyces leycettanus</i>	De-gumming of oils and fats	Oils and Fats processing	GMP
13.	3-phytase (EC No. 3.1.3.8)	<i>Aspergillus niger</i>	<i>Aspergillus niger</i> (<i>A. niger</i> also include <i>A. tubingensis</i>)	Phytate reduction in cereals and legumes	Bakery products and other cereal and legume based products (e.g.	GMP

					pasta, noodles, snacks), soy sauce	
14.	Phytase (EC No. 3.1.3.26)	<i>Trichoderma reesei</i>	<i>Buttiauxella sp.</i>	Hydrolysis of <u>phytic acid</u>	In potable alcohol production and in animal feed	GMP
15.	Phospholipase C (EC No. 3.1.4.3)	<i>Pichia pastoris</i> (now renamed as <i>Komagataellapha ffiti</i>)	Soil	De-gumming of oils and fats	Oils and fats processing	GMP
		<i>Bacillus licheniformis</i>	<i>Bacillus thuringiensis</i>	De-gumming of oils and fats	Oils and fats processing	GMP.
16.	Phosphoinositide phospholipase C (EC No. 3.1.4.11)	<i>Pseudomonas fluorescens</i>	Soil	De-gumming of oils and fats	Oils and fats processing	GMP
		<i>Bacillus licheniformis</i>	<i>Pseudomonas sp-62186</i>	De-gumming of oils and fats	Oils and Fats processing	GMP
17.	Alpha –amylase (EC No. 3.2.1.1)	<i>Bacillus subtilis</i>	<i>Alicyclobacillus pohliae</i>	Antistaling agent in combination with lipase	Bakery products	GMP
		<i>Bacillus licheniformis</i>	<i>Bacillus licheniformis</i>	Liquefaction and thinning of starch, fermentation, Starch processing into dextrins and of oligosaccharides. High DE-maltodextrin production	Brewing, Potable alcohol production, Grain or Carbohydrate, non-alcoholic Beverages, and bakery products, processing of starch for other purposes	GMP
		<i>Bacillus licheniformis</i>	<i>Geobacillus stearothermophilus</i>	Liquefaction and thinning of starch, fermentation, starch processing into dextrins and oligosaccharides and high DE-maltodextrin.	Processing of starch for baking, brewing and fermentation	GMP
		<i>Bacillus licheniformis</i>	<i>Cytophaga sp.</i>	Liquefaction and thinning of starch, fermentation	Processing of starch for baking and brewing processes	GMP
		<i>Pseudomonas fluorescens</i>	<i>Thermococcales</i>	Starch processing into dextrins and oligosaccharides and high DE-maltodextrin	Processing of starch for baking, brewing and fermentation	GMP
		<i>Aspergillus niger</i>	<i>Rhizomucor pusillus</i>	Starch processing into dextrins and oligosaccharides and high DE-maltodextrin	Processing of starch for baking, brewing and fermentation and other processes	GMP

		<i>Trichoderma reesei</i>	<i>Aspergillus clavatus</i>	Starch processing into dextrins and of oligosaccharides. High DE-maltodextrin production	In Carbohydrate or starch processing, brewing and potable alcohol production	GMP
		<i>Trichoderma reesei</i>	<i>Aspergillus kawachii</i>	Starch processing into dextrins and of oligosaccharides. High DE-maltodextrin production	In Carbohydrate or starch processing, brewing and potable alcohol production	GMP
		<i>Bacillus amyloliquefaciens</i>	<i>Bacillus amyloliquefaciens</i>	As processing aid in food manufacturing to hydrolyze polysaccharides	Carbohydrate or grain processing, potable alcohol production, brewing, cereal processes, non-alcoholic beverages	GMP
		<i>Trichoderma reesei</i>	<i>Aspergillus terreus</i>	Starch processing into dextrins and of oligosaccharides. High DE-maltodextrin production	Brewing, Potable alcohol production, grain or carbohydrate, non-alcoholic beverages, cereal processes	GMP
18.	Beta-amylase (EC No. 3.2.1.2)	<i>Bacillus licheniformis</i>	<i>Bacillus flexus</i>	Starch processing into maltose	Starch processing for maltose-based syrups	GMP
19.	Glucoamylase (Glucan 1,4-alpha-glucosidase or Acid maltase or Amyloglucosidase) (EC No. 3.2.1.3)	<i>Trichoderma reesei</i>	<i>Trichoderma reesei</i>	Processing of polysaccharides and oligosaccharides for improved fermentation and liquefaction	Brewing, fermentation and starch liquifaction and saccharification	GMP
		<i>Aspergillus niger</i>	<i>Gloeophyllum trabeum</i>	Processing of polysaccharides and oligosaccharides for improved brewing fermentation, clarification and starch liquefaction, starch liquefaction and Saccharification	Brewing, fermentation and starch liquifaction and saccharification	GMP
		<i>Aspergillus niger</i>	<i>Aspergillus niger</i>	Processing of polysaccharides and oligosaccharides for improved brewing fermentation, clarification and starch liquefaction	Brewing, fermentation and starch liquifaction and saccharification	GMP
		<i>Aspergillus niger</i>	<i>Talaromyces emersonii</i>	Processing of polysaccharides and	Brewing, fermentation	GMP

				oligosaccharides for improved brewing fermentation, clarification and starch liquefaction	and starch liquefaction and saccharification processes	
		<i>Aspergillus niger</i>	<i>Trametes cingulata</i>	Processing of polysaccharides and oligosaccharides for improved brewing fermentation, clarification and starch liquefaction and Saccharification	Brewing, fermentation and starch liquefaction and saccharification processes	GMP
		<i>Aspergillus niger</i>	<i>Penicillium oxalicum</i>	Processing of polysaccharides and oligosaccharides for improved brewing fermentation, clarification and starch liquefaction and Saccharification	Brewing, fermentation and starch liquefaction and saccharification	GMP
		<i>Trichoderma reesei</i>	<i>Aspergillus fumigatus</i>	Processing of polysaccharides and oligosaccharides for improved fermentation and liquefaction	For carbohydrate or grain processing, brewing and potable alcohol production	GMP
		<i>Trichoderma reesei</i>	<i>Fusarium verticillioides</i>	Processing of polysaccharides and oligosaccharides for improved fermentation and liquefaction	For carbohydrate or grain processing, brewing and potable alcohol production	GMP
20.	Cellulase (EC No. 3.2.1.4)	<i>Trichoderma reesei</i>	<i>Aspergillus fumigatus</i>	Hydrolysis of amorphous cellulose	Brewing	GMP
		<i>Trichoderma reesei</i>	<i>Penicillium emersonii</i>	Hydrolysis of amorphous cellulose. Saccharification	Brewing	GMP
		<i>Trichoderma reesei</i>	<i>Trichoderma reesei</i>	As processing aid in food manufacturing or breakdown of cellulose	For carbohydrate processing, potable alcohol production, maceration in fruit and vegetable processing, brewing and wine production and in food processing of other wide range of products like coffee	GMP
21.	Beta-glucanase (endo-beta glucanase or endo-1,3-beta glucanase) (EC No. 3.2.1.6)	<i>Bacillus subtilis</i>	<i>Bacillus subtilis</i>	Hydrolysis of beta-glucans, to improve the brewing properties of beer	Brewing processes	GMP

22.	Xylanase (Endo-1,4-beta-xylanase) (EC No. 3.2.1.8)	<i>Aspergillus niger</i>	<i>Aspergillus niger</i>	Hydrolysis of plant carbohydrates to improve quality of bakery products (firmness, stiffness, consistency and others)	Bakery and other cereal based products	GMP
		<i>Aspergillus oryzae</i>	<i>Humicola lanuginosus</i>	Dough stabilizer, enhancing loaf volume, enhance crumb structure and bloom	Bakery products	GMP
		<i>Bacillus subtilis</i>	<i>Bacillus subtilis</i>	Dough stabilizer, enhancing loaf volume, enhance crumb structure bloom and loaf softening, hydrolysis of plant carbohydrates to improve quality of bakery products (firmness, stiffness, consistency and others)	Bakery products, carbohydrate or starch processing, Brewing, Potable alcohol production, non-alcoholic beverages processing	GMP
		<i>Trichoderma reesei</i>	<i>Talaromyces leycettanus</i>	To improve filtration in brewing, Starch liquefaction and enhance oil extraction from grain	Baking and Brewing and oil extraction -	GMP
		<i>Aspergillus niger</i>	<i>Rasamsonia emersonii</i>	Dough stabilizer, enhancing loaf volume, crumb structure, bloom and loaf softening, improving filtration in brewing, starch liquefaction	Bakery products production of beer and other cereal based beverages	GMP
		<i>Trichoderma reesei</i>	<i>Aspergillus niger</i>	Dough stabilizer, enhancing loaf volume, crumb structure, bloom and loaf softening, to improve filtration in brewing, starch liquefaction	Brewing and baking products, potable alcohol production, non-alcoholic beverages	GMP
		<i>Aspergillus oryzae</i>	<i>Aspergillus aculeatus</i>	Dough stabilizer, enhance loaf volume, crumb structure, bloom and loaf softening, to improve filtration in brewing, starch liquefaction	Baking brewing and other cereal-based beverages and starch processing	GMP
		<i>Bacillus licheniformis</i>	<i>Bacillus licheniformis</i>	Dough stabilizer, enhancer of loaf volume, enhance crumb structure, bloom and loaf softening, starch liquefaction	Baking and brewing processes grain treatment	GMP
		<i>Trichoderma reesei</i>	<i>Fusarium verticillioides</i>	Hydrolysis of plant carbohydrates to improve quality of bakery products (firmness, stiffness, consistency and others)	As processing aid in carbohydrate or starch processing and potable alcohol production	GMP
23.	Endo-Polygalacturonase	<i>Aspergillus niger</i>	<i>Aspergillus niger</i>	Extraction and clarification of juice from	Fruit and vegetable	GMP

	(Pectinase) (EC No 3.2.1.15)			fruits and vegetables, extraction of flavors	processing, flavouring production	
24.	Alpha-glucosidase (EC No 3.2.1.20)	<i>Trichoderma reesei</i>	<i>Aspergillus niger</i>	Aids in fermentation, hydrolysis of terminal, non-reducing (1 ~4)-linked alpha-D-glucose residues with release of alpha-D-glucose	Brewing and starch processing	GMP
25.	Lactase (Beta-galactosidase) (EC No 3.2.1.23)	<i>Kluyveromyces lactis</i>	<i>Kluyveromyces lactis</i>	Hydrolysis of lactose content of in whey or milk	Dairy products and processing	GMP
		<i>Bacillus subtilis</i>	<i>Bifidobacterium bifidum</i>	Hydrolysis of lactose content of whey or milk	Dairy products and production of GOS (galacto-oligosaccharide)	GMP
		<i>Aspergillus niger</i>	<i>Aspergillus oryzae</i>	Hydrolysis of lactose content of whey or milk	Dairy products and processing	GMP
		<i>Bacillus licheniformis</i>	<i>Bifidobacterium bifidum</i>	Hydrolysis of lactose content of whey or milk	Dairy products and processing	GMP
		<i>Bacillus subtilis</i>	<i>Lactobacillus delbrueckii</i> subsp. <i>bulgaricus</i>	Hydrolysis of lactose content of in whey or milk	In dairy processing, GOS (galacto-oligosaccharide) production and production of low lactose products	GMP
		<i>Aspergillus oryzae</i>	<i>Aspergillus oryzae</i>	Hydrolysis of lactose content of in whey or milk	In dairy processing, GOS (galacto-oligosaccharide) production and production of low lactose products	GMP
26.	Trehalase (EC No 3.2.1.28)	<i>Trichoderma reesei</i>	<i>Trichoderma reesei</i>	Starch processing for fermentation	Brewing process	GMP
		<i>Aspergillus niger</i>	<i>Myceliophthora sepdenii</i>	Starch processing for fermentation	Brewing process	GMP
27.	Pullulanase (EC No 3.2.1.41)	<i>Bacillus licheniformis</i>	<i>Bacillus deramificans</i>	Hydrolysis of pullulan in starch processing, as processing aid in efficient starch hydrolysis and saccharification	Brewing processes and production of sweeteners, manufacture of starch or carbohydrate processing	GMP
		<i>Bacillus subtilis</i>	<i>Bacillus acidopullulyticus</i>	Hydrolysis of pullulan in starch processing	Brewing processes and	GMP

					manufacture of sweeteners	
		<i>Bacillus subtilis</i>	<i>Bacillus deramificans</i>	Hydrolysis of pullulan in grain processing	Brewing and starch processing	GMP
28.	Alpha arabinofuranosidase (EC No. 3.2.1.55)	<i>Trichoderma reesei</i>	<i>Talaromyces pinophilus</i>	Separation of soluble and starch or gluten fractions	Potable alcohol production	GMP
29.	Maltotetraohydrolase or glucan 1,4-alpha-maltotetraohydrolase (EC No. 3.2.1.60)	<i>Bacillus licheniformis</i>	<i>Pseudomonas stutzeri (saccharophila)</i>	Dough stabilizer, anti-staling agent in baking, antiretrogradation agent to enhance the quality attributes of bakery products	Baking, carbohydrate or grain processing	GMP
30.	Mannan endo-1,4-beta-mannosidase (β-mannanase) (EC No. 3.2.1.78)	<i>Aspergillus niger</i>	<i>Talaromyces leycettanus</i>	Hydrolysis of mannan to inhibit gel formation during freeze-drying of the instant coffee	Coffee processing	GMP.
31.	Glucan 1,4-alpha-maltohydrolase (Maltogenic alpha-amylase) (EC No 3.2.1.133)	<i>Bacillus subtilis</i>	<i>Geobacillus stearothermophilus</i>	Anti-staling agent to prevent retrodegradation of starch in baking, industry. Production of tailor-made sweetener syrups with low viscosity, high maltose contents	Bakery products and sweetener syrups	GMP
		<i>Bacillus licheniformis</i>	<i>Geobacillus stearothermophilus</i>	Anti-staling agent to prevent retro-degradation of starch in baking, industry. Production of tailor-made sweetener syrups with low viscosity, high maltose contents	As processing aid in bakery, starch processing, brewing and potable alcohol	GMP
32.	Carboxypeptidase (EC No. 3.4.16.5)	<i>Aspergillus niger</i>	<i>Aspergillus niger</i>	Used to accelerate the development of flavors and the de-bittering during the ripening process of cheese. debittering agent in cheese manufacture.	Cheese, enzyme modified cheese, cheese powders and fermented meat	GMP
33.	Chymotrypsin (EC No. 3.4.21.1)	<i>Bacillus licheniformis</i>	<i>Nocardio psisprasina</i>	Increased digestibility of protein and reduce allergenicity	Protein hydrolysis, yeast processing	GMP.
34.	Serine protease with trypsin specificity Or (Trypsin) (EC No. 3.4.21.4)	<i>Fusarium venenatum</i>	<i>Fusarium oxysporum</i>	Increased digestibility of protein and reduce allergenicity	Dairy processing protein hydrolysis	GMP
35.	Acid prolylendopeptidase (EC No. 3.4.21.26)	<i>Aspergillus niger</i>	<i>Aspergillus niger</i>	Degradation of cereal storage proteins to smaller peptides for optimal fermentation beer stability, prevention	Beer and other cereal based beverages	GMP

				of chill haze without loss of foam properties		
36.	Serine protease (Subtilisin) (EC No. 3.4.21.62)	<i>Bacillus subtilis</i>	<i>Bacillus amyloliquefaciens</i>	Facilitates protein hydrolysis during processing	Protein processing	GMP
		<i>Bacillus licheniformis</i>	<i>Pyrococcus furiosus</i>	Hydrolysis of proteins	Protein hydrolysis and protein hydrolysates	GMP
		<i>Bacillus subtilis</i>	<i>Bacillus lentus</i>	To catalyze protein hydrolysis	As processing aid in plant protein processing, fish and seafood protein processing, yeast processing, animal protein processing, xanthan gum processing, and microalgae processing	GMP.
37.	Chymosin (EC No. 3.4.23.4)	<i>Trichoderma reesei</i>	<i>Bos taurus (bovine)</i>	Milk Coagulant, processing aid in cheese manufacturing. Chymosin helps in coagulating milk by hydrolyzing milk protein	Milk or dairy processing, production of cheese, whey and lactose	GMP
		<i>Cluyveromyces lactis</i>	<i>Bovine pro-chymosin</i>	Milk Coagulant	Milk processing	GMP
38.	Aspergillopepsin I, aspartic protease) (EC No. 3.4.23.18)	<i>Trichoderma reesei</i>	<i>Trichoderma reesei</i>	Catalyses hydrolysis of proteins with broad specificity	Processing of proteins, clarification of fruit and vegetable juices and alcoholic drinks, modification of wheat gluten in bakery products	GMP
39.	Mucorpepsin (Mucor rennin) (EC No. 3.4.23.23)	<i>Aspergillus oryzae</i>	<i>Rhizomucor miehei</i>	Milk coagulation in cheese making.	Dairy processing	GMP.
40.	Bacillolysin (Bacillus metalloendopeptidase) (EC No. 3.4.24.28)	<i>Bacillus amyloliquefaciens</i>	<i>Bacillus amyloliquefaciens</i>	Protein processing into peptides and hydrolysate	Production of bakery products and other cereal based products (e.g. pasta, noodles, snacks), production of beer and other cereal	GMP

					based beverages, dairy processing, flavouring production, production of cereal based distilled alcoholic beverages, protein processing and yeast processing	
		<i>Bacillus subtilis</i>	<i>Bacillus amyloliquefaciens</i>	Protein processing into peptides and hydrolysate	Production of bakery products and other cereal based products (e.g. pasta, noodles, snacks), production of beer and other cereal based beverages, dairy processing, flavouring production, production of cereal based distilled alcoholic beverages, protein processing and yeast processing	GMP
41.	Asparaginase (EC No 3.5.1.1)	<i>Aspergillus niger</i>	<i>Aspergillus niger</i>	Reduce acrylamide levels	Production of bakery products and other cereal based products (e.g. pasta, noodles, snacks) potato processing and coffee processing	GMP
		<i>Aspergillus oryzae</i>	<i>Aspergillus oryzae</i>	Reduce acrylamide levels	Baking and other cereal-based processes (bread, pasta, noodles, snacks)	GMP

					coffee processing and potato processing	
		<i>Bacillus subtilis</i>	<i>Pyrococcus furiosus</i>	Reduce acrylamide levels	Baking and other cereal-based processes (bread, pasta, noodles, snacks) coffee and cocoa processing fruit and vegetable processing	GMP
42.	Glutaminase (EC No. 3.5.1.2)	<i>Bacillus licheniformis</i>	<i>Bacillus licheniformis</i>	In controlling the taste and flavor of fermented foods containing ingredients such as; casein, whey protein, soy and wheat protein	Dairy processing egg processing protein processing yeast processing	GMP
43.	Acetolactate decarboxylase (Alpha - acetolactate decarboxylase) (EC No. 4.1.1.5)	<i>Bacillus licheniformis</i>	<i>Bacillus brevis</i>	In brewing beverage processes and beverage alcohol (distilling) processes 1) Reduces formation of diacetyl during fermentation and thereby a reduction of the off-flavours 2) Enhances maturation process and thereby reduces production time.	Brewing and other production of cereal based alcoholic beverages	GMP
		<i>Bacillus subtilis</i>	<i>Brevibacillus brevis</i>	<u>Butanoate metabolism</u> and <u>C-5 branched dibasic acid metabolism</u>	In brewing and potable alcohol production	GMP
44.	Pectin lyase (EC No. 4.2.2.10)	<i>Aspergillus niger</i>	<i>Aspergillus niger</i>	Enhances juice extraction from vegetables and fruits and for juice clarification	Fruit and vegetable processing, production of wine, flavouring production and coffee processing	GMP
45.	Glucose isomerase (EC No. 5.3.1.5)	<i>Streptomyces rubiginosus</i>	<i>Streptomyces rubiginosus</i>	Reversible isomerization of glucose to fructose	Production of high fructose com syrup	GMP

S GOPALAKRISHNAN, Chief Executive Officer

[ADVT.-III/4/Ext./355/2022-23]

Attachments:

No Attachments.