



## LIST OF ENZYMES OCTOBER 2009

Amfep/09/68

principal enzyme	host organism	donor organism	iub	food	feed	tech
Acetolactate decarboxylase (alpha)	Bacillus amyloliquefaciens or subtilis	Bacillus sp.	4.1.1.5	Y	N	N
Acetolactate decarboxylase (alpha)	Saccharomyces cerevisiae	Enterobacter sp.	4.1.1.5	Y	N	N
Acetylhexosaminidase (beta-L-N)	Streptomyces violaceoruber	Streptomyces sp.	3.1.2.52	Y	N	N
Alginate lyase	Sphingobacterium multivorum	none	4.2.2.3	Y	N	N
Aminoacylase	Aspergillus melleus	none	3.5.1.14	N	N	Y
Aminopeptidase	Aspergillus niger*	none	3.4.11.x@	Y	N	Y
Aminopeptidase	Aspergillus oryzae	none	3.4.11.x@	Y	N	Y
Aminopeptidase	Rhizopus oryzae ****	none	3.4.11.x@	Y	N	N
Aminopeptidase	Trichoderma reesei or longibrachiatum	Aspergillus sp.	3.4.11.x@	Y	Y	Y
AMP deaminase	Aspergillus melleus	none	3.5.4.6	Y	N	Y
AMP deaminase	Aspergillus oryzae	none	3.5.4.6	Y	N	N
Amylase (alpha)	Aspergillus niger*	none	3.2.1.1	Y	N	N
Amylase (alpha)	Aspergillus oryzae	none	3.2.1.1	Y	Y	Y
Amylase (alpha)	Bacillus amyloliquefaciens or subtilis	Bacillus sp.	3.2.1.1	Y	Y	Y
Amylase (alpha)	Bacillus amyloliquefaciens or subtilis	none	3.2.1.1	Y	Y	Y
Amylase (alpha)	Bacillus amyloliquefaciens or subtilis	Thermoactinomyces sp.	3.2.1.1	Y	Y	N
Amylase (alpha)	Bacillus licheniformis	Bacillus sp.	3.2.1.1	Y	N	Y
Amylase (alpha)	Bacillus licheniformis	none	3.2.1.1	Y	N	Y
Amylase (alpha)	Bacillus licheniformis	Pseudomonas sp.	3.2.1.1	Y	N	N
Amylase (alpha)	Bacillus stearothermophilus	none	3.2.1.1	Y	N	Y
Amylase (alpha)	Microbacterium imperiale	none	3.2.1.1	Y	N	N
Amylase (alpha)	Trichoderma reesei or longibrachiatum	Aspergillus sp.	3.2.1.1	Y	N	Y
Amylase (beta)	Barley	none	3.2.1.2	Y	N	N
Amylase (beta)	Soybean	none	3.2.1.2	Y	N	N
Arabinanase	Aspergillus niger*	none	3.2.1.99	Y	Y	N
Arabinofuranosidase	Aspergillus niger*	Aspergillus sp.	3.2.1.55	Y	N	N
Arabinofuranosidase	Aspergillus niger*	none	3.2.1.55	Y	N	N
Arylesterase	Bacillus amyloliquefaciens or subtilis	Mycobacterium sp.	3.1.1.2	N	N	Y
Ascorbate oxidase	Cucurbita pepo	none	1.10.3.3	Y	N	N
Asparaginase	Aspergillus niger*	Aspergillus sp.	3.5.1.1	Y	N	N
Asparaginase	Aspergillus oryzae	Aspergillus sp.	3.5.1.1	Y	N	N

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Carboxypeptidase (serine-type)	Aspergillus niger*	Aspergillus sp.	3.4.16.x	Y	N	N
Catalase	Aspergillus niger*	Aspergillus sp.	1.11.1.6	Y	N	Y
Catalase	Aspergillus niger*	none	1.11.1.6	Y	N	Y
Catalase	Aspergillus oryzae	Scytalidium sp.	1.11.1.6	N	N	Y
Catalase	Micrococcus luteus or lysodeikticus	none	1.11.1.6	Y	Y	Y
Cellobiose dehydrogenase	Fusarium venenatum	Microdochium sp.	1.1.99.18	Y	N	N
Cellulase	Aspergillus niger*	none	3.2.1.4	Y	Y	N
Cellulase	Aspergillus oryzae	Humicola sp.	3.2.1.4	N	N	Y
Cellulase	Aspergillus oryzae	Myceliophthora sp.	3.2.1.4	N	N	Y
Cellulase	Aspergillus oryzae	Thielavia sp.	3.2.1.4	N	N	Y
Cellulase	Bacillus amyloliquefaciens or subtilis	Bacillus sp.	3.2.1.4	N	N	Y
Cellulase	Bacillus licheniformis	Bacillus sp.	3.2.1.4	N	N	Y
Cellulase	Humicola insolens	none	3.2.1.4	N	N	Y
Cellulase	Penicillium funiculosum	none	3.2.1.4	Y	Y	Y
Cellulase	Penicillium or Talaromyces emersonii	none	3.2.1.4	Y	N	N
Cellulase	Streptomyces lividans	Streptomyces sp.	3.2.1.4	N	N	Y
Cellulase	Trichoderma reesei or longibrachiatum	none	3.2.1.4	Y	Y	Y
Cellulase	Trichoderma reesei or longibrachiatum	Trichoderma sp.	3.2.1.4	Y	Y	Y
Cellulase	Trichoderma viride	none	3.2.1.4	Y	Y	Y
Chitinase	Streptomyces violaceoruber	Streptomyces sp.	3.2.1.14	Y	N	N
Cyclodextrin glucanotransferase	Bacillus licheniformis	Thermoanaerobacter sp.	2.4.1.19	Y	N	N
Dextranase	Chaetomium erraticum	none	3.2.1.11	Y	N	Y
Dextranase	Penicillium lilacinum	none	3.2.1.11	Y	N	N
Dextranucrase	Leuconostoc mesenteroides	none	2.4.1.5	Y	N	Y
Esterase	Rhizomucor miehei	none	3.1.1.1	Y	N	N
Ferulic acid esterase	Aspergillus niger*	none	3.1.1.73	Y	N	N
Ferulic acid esterase	Streptomyces werraensis	none	3.1.1.73	Y	N	Y
Galactosidase (alpha)	Aspergillus niger*	none	3.2.1.22	Y	N	N
Galactosidase (alpha)	Aspergillus oryzae	Aspergillus sp.	3.2.1.22	N	Y	N
Galactosidase (alpha)	Saccharomyces cerevisiae	Guar plant	3.2.1.22	Y	Y	N
Glucanase (beta)	Aspergillus niger*	none	3.2.1.6	Y	Y	N
Glucanase (beta)	Aspergillus oryzae	Thermoascus sp.	3.2.1.6	Y	N	N
Glucanase (beta)	Bacillus amyloliquefaciens or subtilis	Bacillus sp.	3.2.1.6	Y	Y	Y
Glucanase (beta)	Bacillus amyloliquefaciens or subtilis	none	3.2.1.6	Y	Y	N
Glucanase (beta)	Cellulosimicrobium cellulans	none	3.2.1.6	Y	N	N

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Glucanase (beta)	Disporotrichum dimorphosporum	none	3.2.1.6	Y	N	N
Glucanase (beta)	Humicola insolens	none	3.2.1.6	Y	Y	N
Glucanase (beta)	Penicillium funiculosum	none	3.2.1.6	Y	Y	N
Glucanase (beta)	Penicillium or Talaromyces emersonii	none	3.2.1.6	Y	N	Y
Glucanase (beta)	Trichoderma harzianum	none	3.2.1.6	Y	N	N
Glucanase (beta)	Trichoderma reesei or longibrachiatum	none	3.2.1.6	Y	Y	Y
Glucanase (beta)	Trichoderma reesei or longibrachiatum	Trichoderma sp.	3.2.1.6	Y	Y	Y
Glucoamylase or Amyloglucosidase	Aspergillus niger*	Aspergillus sp.	3.2.1.3	Y	N	N
Glucoamylase or Amyloglucosidase	Aspergillus niger*	none	3.2.1.3	Y	N	Y
Glucoamylase or Amyloglucosidase	Aspergillus niger*	Talaromyces sp.	3.2.1.3	Y	N	Y
Glucoamylase or Amyloglucosidase	Rhizopus niveus	none	3.2.1.3	Y	N	N
Glucoamylase or Amyloglucosidase	Rhizopus oryzae ****	none	3.2.1.3	Y	N	N
Glucoamylase or Amyloglucosidase	Trichoderma reesei or longibrachiatum	Trichoderma sp.	3.2.1.3	Y	N	Y
Glucose isomerase	Streptomyces murinus	none	5.3.1.5	Y	N	N
Glucose isomerase	Streptomyces olivochromogenes	none	5.3.1.5	Y	N	N
Glucose isomerase	Streptomyces rubiginosus	Streptomyces sp.	5.3.1.5	Y	N	Y
Glucose oxidase	Aspergillus niger*	Aspergillus sp.	1.1.3.4	Y	Y	Y
Glucose oxidase	Aspergillus niger*	none	1.1.3.4	Y	Y	Y
Glucose oxidase	Aspergillus oryzae	Aspergillus sp.	1.1.3.4	Y	N	N
Glucose oxidase	Penicillium chrysogenum	none	1.1.3.4	Y	N	N
Glucosidase (alpha)	Aspergillus niger*	none	3.2.1.20	Y	N	N
Glucosidase (beta)	Aspergillus niger*	none	3.2.1.21	Y	Y	Y
Glucosidase (beta)	Penicillium multicolor	none	3.2.1.21	Y	N	N
Glucosidase (exo-1.3-beta)	Penicillium funiculosum	none	3.2.1.58	Y	N	N
Glucosidase (exo-1.3-beta)	Trichoderma harzianum	none	3.2.1.58	Y	N	N
Glucosyltransferase or Transglucosidase	Aspergillus niger*	none	2.4.1.24	Y	N	N
Glucosyltransferase or Transglucosidase	Trichoderma reesei or longibrachiatum	Trichoderma sp.	2.4.1.24	Y	N	N
Glutaminase	Aspergillus niger*	none	3.5.1.2	Y	N	N
Glutaminase	Bacillus subtilis	none	3.5.1.2	Y	N	N
Hemicellulase	Aspergillus niger*	none	_____	Y	Y	Y
Hemicellulase	Bacillus amyloliquefaciens or subtilis	Bacillus sp.	_____	Y	Y	N
Hemicellulase	Bacillus amyloliquefaciens or subtilis	none	_____	Y	N	N
Hemicellulase	Trichoderma reesei or longibrachiatum	none	_____	Y	N	N
Hexose oxidase	Pichia angusta or Hansenula polymorpha	Chordrus sp.	1.1.3.5	Y	N	N
Inulase	Aspergillus niger*	none	3.2.1.7	Y	N	N

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Inulase	Aspergillus oryzae	Aspergillus sp.	3.2.1.7	Y	N	N
Invertase or Fructofuranosidase (beta)	Saccharomyces cerevisiae	none	3.2.1.26	Y	Y	N
Laccase	Aspergillus niger*	none	1.10.3.2	Y	N	Y
Laccase	Aspergillus oryzae	Myceliophthora sp.	1.10.3.2	Y	N	Y
Laccase	Aspergillus oryzae	Polyporus sp.	1.10.3.2	Y	N	Y
Laccase	Trametes hirsuta	none	1.10.3.2	Y	N	Y
Laccase	Trametes versicolor	none	1.10.3.2	Y	N	Y
Laccase	Trichoderma reesei or longibrachiatum	Thielavia sp.	1.10.3.2	Y	N	Y
Lactase or Galactosidase (beta)	Aspergillus oryzae	Aspergillus sp.	3.2.1.23	Y	N	N
Lactase or Galactosidase (beta)	Aspergillus oryzae	none	3.2.1.23	Y	N	Y
Lactase or Galactosidase (beta)	Bacillus circulans	none	3.2.1.23	Y	N	Y
Lactase or Galactosidase (beta)	Kluyveromyces lactis	Kluyveromyces sp.	3.2.1.23	Y	N	N
Lactase or Galactosidase (beta)	Kluyveromyces lactis	none	3.2.1.23	Y	N	N
Lipase monoacylglycerol	Penicillium camembertii	none	3.1.1.23	Y	N	N
Lipase triacylglycerol	Aspergillus niger*	Candida sp.	3.1.1.3	Y	N	N
Lipase triacylglycerol	Aspergillus niger*	Fusarium sp.	3.1.1.3	Y	N	N
Lipase triacylglycerol	Aspergillus niger*	none	3.1.1.3	Y	N	N
Lipase triacylglycerol	Aspergillus oryzae	Aspergillus sp.	3.1.1.3	N	N	Y
Lipase triacylglycerol	Aspergillus oryzae	Candida sp.	3.1.1.3	Y	N	Y
Lipase triacylglycerol	Aspergillus oryzae	Fusarium sp.	3.1.1.3	Y	N	N
Lipase triacylglycerol	Aspergillus oryzae	Humicola sp.	3.1.1.3	N	N	Y
Lipase triacylglycerol	Aspergillus oryzae	Rhizomucor sp.	3.1.1.3	Y	N	Y
Lipase triacylglycerol	Aspergillus oryzae	Thermomyces sp.	3.1.1.3	Y	N	Y
Lipase triacylglycerol	Bacillus licheniformis	Aeromonas sp.	3.1.1.3	Y	N	N
Lipase triacylglycerol	Calf gullets	none	3.1.1.3	Y	N	N
Lipase triacylglycerol	Candida lipolytica	none	3.1.1.3	Y	N	N
Lipase triacylglycerol	Candida rugosa	none	3.1.1.3	Y	N	Y
Lipase triacylglycerol	Goat gullets	none	3.1.1.3	Y	N	N
Lipase triacylglycerol	Lamb gullets	none	3.1.1.3	Y	N	N
Lipase triacylglycerol	Mucor javanicus	none	3.1.1.3	Y	N	N
Lipase triacylglycerol	Penicillium roqueforti	none	3.1.1.3	Y	N	N
Lipase triacylglycerol	Pichia angusta or Hansenula polymorpha	Fusarium sp.	3.1.1.3	Y	N	N
Lipase triacylglycerol	Rhizomucor miehei	none	3.1.1.3	Y	N	N
Lipase triacylglycerol	Rhizopus niveus	none	3.1.1.3	Y	N	N
Lipase triacylglycerol	Rhizopus oryzae ****	none	3.1.1.3	Y	N	N

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Lipoxygenase	Escherichia coli	Pea	1.13.11.12	Y	N	N
Lysozyme	Chicken egg	none	3.2.1.17	Y	N	N
Maltogenic amylase	Bacillus amyloliquefaciens or subtilis	Bacillus sp.	3.2.1.133	Y	N	N
Mannanase (endo-1.4-beta)	Aspergillus niger*	none	3.2.1.78	Y	Y	N
Mannanase (endo-1.4-beta)	Bacillus halodurans or lentus	none	3.2.1.78	N	Y	Y
Mannanase (endo-1.4-beta)	Bacillus licheniformis	Bacillus sp.	3.2.1.78	N	N	Y
Mannanase (endo-1.4-beta)	Trichoderma reesei or longibrachiatum	Trichoderma sp.	3.2.1.78	N	Y	Y
Organophosphate esterase	Escherichia coli	Flavobacterium sp.	3.1.8.1	N	N	Y
Pectate lyase	Bacillus licheniformis	Bacillus sp.	4.2.2.2	N	N	Y
Pectate lyase	Bacillus subtilis	none	4.2.2.2	Y	N	Y
Pectin lyase	Aspergillus niger*	Aspergillus sp.	4.2.2.10	Y	Y	Y
Pectin lyase	Aspergillus niger*	none	4.2.2.10	Y	Y	N
Pectin lyase	Aspergillus sojae	none	4.2.2.10	Y	N	N
Pectin lyase	Penicillium funiculosum	none	4.2.2.10	Y	N	N
Pectin lyase	Rhizopus oryzae ****	none	4.2.2.10	Y	N	N
Pectin lyase	Trichoderma reesei or longibrachiatum	Aspergillus sp.	4.2.2.10	Y	Y	Y
Pectin methylesterase or Pectinesterase	Aspergillus niger*	Aspergillus sp.	3.1.1.11	Y	Y	N
Pectin methylesterase or Pectinesterase	Aspergillus niger*	none	3.1.1.11	Y	Y	N
Pectin methylesterase or Pectinesterase	Aspergillus oryzae	Aspergillus sp.	3.1.1.11	Y	N	Y
Pectin methylesterase or Pectinesterase	Aspergillus sojae	none	3.1.1.11	Y	N	N
Pectin methylesterase or Pectinesterase	Penicillium funiculosum	none	3.1.1.11	Y	N	N
Pectin methylesterase or Pectinesterase	Rhizopus oryzae ****	none	3.1.1.11	Y	N	N
Pectin methylesterase or Pectinesterase	Trichoderma reesei or longibrachiatum	Aspergillus sp.	3.1.1.11	Y	Y	Y
Penicillin amidase	Escherichia coli	Alcaligenes sp.	3.5.1.11	N	N	Y
Pentosanase	Aspergillus niger*	none	_____	Y	N	N
Pentosanase	Bacillus amyloliquefaciens or subtilis	Bacillus sp.	_____	Y	N	N
Pentosanase	Bacillus amyloliquefaciens or subtilis	none	_____	Y	N	N
Pentosanase	Humicola insolens	none	_____	Y	N	N
Pentosanase	Trichoderma reesei or longibrachiatum	none	_____	Y	Y	N
Peroxidase	Aspergillus oryzae	Coprinus sp.	1.11.1.7	N	N	Y
Peroxidase	Soybean hulls	none	1.11.1.7	Y	N	N
Phosphodiesterase	Leptographium procerum	none	3.1.4.1	Y	N	N
Phosphodiesterase	Penicillium citrinum	none	3.1.4.1	Y	N	Y
Phospholipase A	Aspergillus niger*	none	3.1.1.4	Y	N	N
Phospholipase A	Aspergillus niger*	Pig pancreas	3.1.1.4	Y	N	Y

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Phospholipase A	Aspergillus oryzae	Fusarium sp.	3.1.1.4	Y	N	N
Phospholipase A	Ox pancreas	none	3.1.1.4	Y	N	N
Phospholipase A	Pig pancreas	none	3.1.1.4	Y	N	N
Phospholipase A	Streptomyces violaceoruber	none	3.1.1.4	Y	N	N
Phospholipase A	Streptomyces violaceoruber	Streptomyces sp.	3.1.1.4	Y	N	N
Phospholipase A	Trichoderma reesei or longibrachiatum	Aspergillus sp.	3.1.1.4	Y	N	Y
Phospholipase A	Trichoderma reesei or longibrachiatum	Thermomyces sp.	3.1.1.4	Y	Y	Y
Phospholipase B	Aspergillus niger*	Aspergillus sp.	3.1.1.5	Y	Y	N
Phospholipase B	Aspergillus niger*	none	3.1.1.5	Y	N	N
Phospholipase B	Trichoderma reesei or longibrachiatum	Aspergillus sp.	3.1.1.5	Y	Y	N
Phospholipase D	Streptomyces chromofuscus	none	3.1.4.4	N	N	Y
Phospholipase D	Streptomyces cinnamoneus	none	3.1.4.4	Y	N	N
Phytase ***	Aspergillus niger*	Aspergillus sp.	3.1.3.x	Y	N	Y
Phytase ***	Aspergillus niger*	none	3.1.3.x	Y	N	N
Phytase ***	Aspergillus oryzae	Peniophora sp.	3.1.3.x	Y	Y	N
Phytase***	Schizosaccharomyces pombe	Escherichia sp.	3.1.3.x	N	Y	N
Phytase ***	Trichoderma reesei or longibrachiatum	Aspergillus sp.	3.1.3.x	N	Y	N
Phytase***	Trichoderma reesei or longibrachiatum	Buttiauxella sp.	3.1.3.x	N	N	Y
Polygalacturonase or Pectinase	Aspergillus niger*	Aspergillus sp.	3.2.1.15	Y	N	N
Polygalacturonase or Pectinase	Aspergillus niger*	none	3.2.1.15	Y	Y	Y
Polygalacturonase or Pectinase	Rhizopus oryzae ****	none	3.2.1.15	Y	N	N
Polygalacturonase or Pectinase	Trichoderma reesei or longibrachiatum	Aspergillus sp.	3.2.1.15	Y	Y	Y
Protease (incl. milkclotting enzymes)	Actinida chinensis	none	3.4.2x.xx#	Y	N	N
Protease (incl. milkclotting enzymes)	Ananas bracteatus	none	3.4.2x.xx#	Y	N	N
Protease (incl. milkclotting enzymes)	Ananas comosus	none	3.4.2x.xx#	Y	Y	Y
Protease (incl. milkclotting enzymes)	Aspergillus melleus	none	3.4.2x.xx#	Y	N	Y
Protease (incl. milkclotting enzymes)	Aspergillus niger*	Aspergillus sp.	3.4.2x.xx#	Y	N	N
Protease (incl. milkclotting enzymes)	Aspergillus niger*	Calf stomach	3.4.2x.xx#	Y	N	N
Protease (incl. milkclotting enzymes)	Aspergillus niger*	Camel stomach	3.4.2x.xx#	Y	N	N
Protease (incl. milkclotting enzymes)	Aspergillus niger*	none	3.4.2x.xx#	Y	Y	Y
Protease (incl. milkclotting enzymes)	Aspergillus oryzae	none	3.4.2x.xx#	Y	Y	Y
Protease (incl. milkclotting enzymes)	Aspergillus oryzae	Rhizomucor sp.	3.4.2x.xx#	Y	N	Y
Protease (incl. milkclotting enzymes)	Aspergillus sojae	none	3.4.2x.xx#	Y	Y	Y
Protease (incl. milkclotting enzymes)	Bacillus alcalophilus	Bacillus sp.	3.4.2x.xx#	N	N	Y
Protease (incl. milkclotting enzymes)	Bacillus amyloliquefaciens or subtilis	Bacillus sp.	3.4.2x.xx#	Y	Y	Y

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Protease (incl. milkclotting enzymes)	Bacillus amyloliquefaciens or subtilis	none	3.4.2x.xx#	Y	Y	Y
Protease (incl. milkclotting enzymes)	Bacillus amyloliquefaciens or subtilis	Thermus sp.	3.4.2x.xx#	Y	N	N
Protease (incl. milkclotting enzymes)	Bacillus clausii	Bacillus sp.	3.4.2x.xx#	N	N	Y
Protease (incl. milkclotting enzymes)	Bacillus clausii	none	3.4.2x.xx#	Y	N	Y
Protease (incl. milkclotting enzymes)	Bacillus halodurans or lentus	Bacillus sp.	3.4.2x.xx#	N	N	Y
Protease (incl. milkclotting enzymes)	Bacillus halodurans or lentus	none	3.4.2x.xx#	N	N	Y
Protease (incl. milkclotting enzymes)	Bacillus licheniformis	Bacillus sp.	3.4.2x.xx#	N	N	Y
Protease (incl. milkclotting enzymes)	Bacillus licheniformis	Nocardiopsis sp.	3.4.2x.xx#	Y	Y	N
Protease (incl. milkclotting enzymes)	Bacillus licheniformis	none	3.4.2x.xx#	Y	Y	Y
Protease (incl. milkclotting enzymes)	Bacillus stearothermophilus	none	3.4.2x.xx#	Y	N	Y
Protease (incl. milkclotting enzymes)	Calf stomach	none	3.4.2x.xx#	Y	N	N
Protease (incl. milkclotting enzymes)	Carica papaya	none	3.4.2x.xx#	Y	Y	Y
Protease (incl. milkclotting enzymes)	Cryphonectria or Endothia parasitica	Cryphonectria sp.	3.4.2x.xx#	Y	N	N
Protease (incl. milkclotting enzymes)	Cryphonectria or Endothia parasitica	none	3.4.2x.xx#	Y	N	N
Protease (incl. milkclotting enzymes)	Ficus glabrata	none	3.4.2x.xx#	Y	Y	Y
Protease (incl. milkclotting enzymes)	Fusarium venenatum	Fusarium sp.	3.4.2x.xx#	Y	N	Y
Protease (incl. milkclotting enzymes)	Geobacillus caldoproteolyticus	none	3.4.2x.xx#	Y	N	Y
Protease (incl. milkclotting enzymes)	Goat stomach	none	3.4.2x.xx#	Y	N	N
Protease (incl. milkclotting enzymes)	Kid stomach	none	3.4.2x.xx#	Y	N	N
Protease (incl. milkclotting enzymes)	Kluyveromyces lactis	Calf stomach	3.4.2x.xx#	Y	N	N
Protease (incl. milkclotting enzymes)	Lamb stomach	none	3.4.2x.xx#	Y	N	N
Protease (incl. milkclotting enzymes)	Ox stomach	none	3.4.2x.xx#	Y	N	N
Protease (incl. milkclotting enzymes)	Pig pancreas	none	3.4.2x.xx#	Y	N	Y
Protease (incl. milkclotting enzymes)	Rhizomucor miehei	none	3.4.2x.xx#	Y	N	Y
Protease (incl. milkclotting enzymes)	Rhizopus niveus	none	3.4.2x.xx#	Y	N	N
Protease (incl. milkclotting enzymes)	Trichoderma reesei or longibrachiatum	Trichoderma sp.	3.4.2x.xx#	Y	N	Y
Protein glutaminase	Chryseobacterium proteolyticum	none	3.5.1.xx**	Y	N	N
Pullulanase	Bacillus acidopullulyticus	none	3.2.1.41	Y	N	N
Pullulanase	Bacillus brevis	none	3.2.1.41	Y	N	N
Pullulanase	Bacillus licheniformis	Bacillus sp.	3.2.1.41	Y	N	Y
Pullulanase	Bacillus subtilis	Bacillus sp.	3.2.1.41	Y	N	N
Pullulanase	Klebsiella planticola	none	3.2.1.41	Y	N	N
Pullulanase	Trichoderma reesei or longibrachiatum	Hormoconis sp.	3.2.1.41	Y	Y	N
Sulfhydryl oxidase	Bacillus subtilis	Saccharomyces sp.	1.8.3.2	Y	N	Y
Tannase	Aspergillus niger*	none	3.1.1.20	Y	Y	N

principal enzyme	host organism	donor organism	iub	food	feed	tech
Transglutaminase	Streptoverticillium mobaraense	none	2.3.2.13	Y	Y	N
Urease	Lactobacillus fermentum	none	3.5.1.5	Y	N	N
Xaa-Pro dipeptidase	Escherichia coli	Alteromonas sp.	3.4.13.9	N	N	Y
Xylanase	Aspergillus niger*	Aspergillus sp.	3.2.1.8	Y	Y	N
Xylanase	Aspergillus niger*	none	3.2.1.8	Y	Y	N
Xylanase	Aspergillus oryzae	Aspergillus sp.	3.2.1.8	Y	N	N
Xylanase	Aspergillus oryzae	Thermomyces sp.	3.2.1.8	Y	Y	N
Xylanase	Bacillus amyloliquefaciens or subtilis	Bacillus sp.	3.2.1.8	Y	Y	Y
Xylanase	Bacillus amyloliquefaciens or subtilis	none	3.2.1.8	Y	N	N
Xylanase	Bacillus amyloliquefaciens or subtilis	Pseudoalteromonas sp.	3.2.1.8	Y	N	N
Xylanase	Bacillus licheniformis	Bacillus sp.	3.2.1.8	Y	N	Y
Xylanase	Disporotrichum dimorphosporum	none	3.2.1.8	Y	N	N
Xylanase	Humicola insolens	none	3.2.1.8	Y	Y	N
Xylanase	Penicillium funiculosum	none	3.2.1.8	Y	Y	N
Xylanase	Penicillium or Talaromyces emersonii	none	3.2.1.8	Y	N	N
Xylanase	Trichoderma reesei or longibrachiatum	Actinomadura sp.	3.2.1.8	N	Y	N
Xylanase	Trichoderma reesei or longibrachiatum	none	3.2.1.8	Y	Y	N
Xylanase	Trichoderma reesei or longibrachiatum	Trichoderma sp.	3.2.1.8	Y	Y	Y
Xylanase	Trichoderma viride	none	3.2.1.8	Y	N	Y

Notes:

\_\_\_ Those enzymes which do not have an IUB number are enzyme complexes, where the listed activity is the result of the sum of many single active enzyme proteins

\* The Aspergillus niger group covers strains known under the names A. aculeatus, A. awamori, A. ficuum, A. foetidus, A. japonicus, A. phoenicis, A. saitoi, A. tubingensis and A. usamii.

\*\* Presently, there is no specific IUB number for protein-glutaminase. However, the enzyme belongs to the hydrolases acting on linear amides.

\*\*\* Includes 3-, 4- and 6-phytase.

\*\*\*\* Rhizopus oryzae is also known under other synonyms such as Rhizopus arrhizus, Rhizopus delemar and Rhizopus japonicus

@ There is no general IUB number for aminopeptidases. But all these enzymes fall under the 3.4.11.x category

# There is no general IUB number for proteases. But all these enzymes fall under the 3.4.2x category



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