

### Enzyme microorganisms origin used in animal diets

Enzyme	Source
Alpha amylase	<i>Aspergillus oryzae</i> <i>Apergillus niger</i> <i>Bacillus licheniformis</i> <i>Bacillus amyloliquefaciens</i> <i>Bacillus subtilis</i> <i>Bacillus lentus</i> <i>Bacillus stearothermophilus</i> <i>Microbacterium imoeriale</i> <i>Thizopus niveus</i> <i>Rhizopus oryzae</i> <i>Trichoderma reesei</i>
Acid prolyl endopeptidase	<i>Aspergillus niger</i>
Acid protease	<i>Trichoderma reesei</i>
Asparaginase	<i>Aspergillus oryzae</i> <i>Aspergillus niger</i> <i>Bacillus subtilis</i>
Aminopeptidase	<i>Aspergillus oryzae</i>
AMP deminase	<i>Aspergillus melleus</i>
Acylglycerol lipase	<i>Penicilium camemberti</i>
Alpha -L-arabinofuranosidase	<i>Apergillus niger</i>
Alpha glucosidase	<i>Aspergillus niger</i>
Arabanase	<i>Aspergillus niger</i>
Aqualysin 1	<i>Bacillus subtilis</i>
Alpha galactosidase	<i>Aspergillus oryzae</i> <i>Aspergillus niger</i> <i>Saccharomyces cerevisea</i> <i>Trichoderma longibrachiatum</i>
Beta galactosidase (lactase)	<i>Aspergillus niger</i> <i>Kluyvermyces lactis</i> <i>Bacillus circulans</i> <i>Bacillus licheniformis</i> <i>Bacillus subtilis</i> <i>Saccharomyces spp</i>
Beta glucanase	<i>Aspergillus niger</i> <i>Aspergillus aculeatus</i> <i>Bacillus lentus</i>

	<i>Paenibacillus lentus</i> <i>Penicillium funiculosum</i> <i>Trichoderma longibrachium</i> <i>Trichoderma reesei</i>
Beta glucosidase	<i>Penicillium multicolor</i> <i>Aspergillus niger</i>
Beta amylase	<i>Bacillus licheniformis</i>
Beta mannanase	<i>Aspergillus niger</i> <i>Bacillus lentus</i> <i>Paenibacillus lentus</i> <i>Trichoderma longibrachium</i> <i>Trichoderma reesei</i>
Catalase	<i>Aspergillus niger</i>
Cellulase	<i>Talaromyces emersonii</i> <i>Penicillium funiculosum</i> <i>Trichoderma reesei</i> <i>Trichoderma viride</i> <i>Trichoderma longibrachium</i>
Chymotrypsin	<i>Bacillus licheniformis</i>
Cyclomaltodextrin glucanotransferase	<i>Geobacillus stearothermophilus</i>
Chymosin	<i>Kluyveromyces lactis</i>
Endo-1,3(4)- $\beta$ -glucanase	<i>Aspergillus aculeatus</i> <i>Disporotrichum dimorphosporum</i> <i>Talaromyces emersonii</i> <i>Trichoderma reesei</i> <i>Peni-cillium funiculosum</i>
Endo-1,4-beta-xylanase	<i>Peni-cillium funiculosum</i>
Fumonisin esterase	<i>Komagataella phaffii</i> <i>Komagataella pastoris</i>
Glucanase	<i>Streptomyces violaceoruber</i>
Glucoamylase	<i>Aspergillus niger</i> <i>Aspergillus oryzae</i> <i>Rhizopus niveus</i> <i>Rhizopus oryzae</i>
Glucose oxidase	<i>Aspergillus oryzae</i> <i>Aspergillus niger</i>
Glucan 1,3- $\beta$ -glucosidase	<i>Disporotrichum dimorphosporum</i>
Glutaminase	<i>Bacillus amyloliquefaciens</i>
Hemicellulase	<i>Aspergillus aculeatus</i> <i>Aspergillus niger</i> <i>Bacillus lentus</i> <i>Bacillus subtilis</i> <i>Trichoderma reesei</i>
Invertase	<i>Aspergillus niger</i> <i>Saccharomyces sp.</i>

Lactase	<i>Aspergillus niger</i> <i>Aspergillus oryzae</i> <i>Candida pseudotropicalis</i> <i>Saccharomyces sp</i>
Leucyl aminopeptidase	<i>Rhizopus oryzae</i>

Lipase	<i>Aspergillus niger</i> <i>Aspergillus oryzae</i> <i>Candida rugosa</i> <i>Rhizopus oryzae</i>
Lysophospholipase	<i>Aspergillus niger</i>
Maltogenic amylase	<i>Bacillus subtilis</i>
Mucorpepsin	<i>Rhizomucor miehei</i>
Pectin lysae	<i>Trichoderma reesei</i> <i>Aspergillus niger</i>
Pectinase	<i>Aspergillus niger</i> <i>Aspergillus aculeatus</i> <i>Rhizopus oryzae</i>
Pectinestrace	<i>Trichoderma reesei</i> <i>Aspergillus niger</i>
Polygalacturonase	<i>Aspergillus aculeatus</i> <i>Aspergillus niger</i> <i>Trichoderma reesei</i>
Phospholipase A1	<i>Aspergillus oryzae</i>
Phospholipase A2	<i>Trichoderma reesei</i>
Polygalacturonase	<i>Aspergillus niger</i>
Protease	<i>Aspergillus niger</i> <i>Aspergillus oryzae</i> <i>Bacillus subtilis</i> <i>Bacillus licheniformis</i>
Pullulanase	<i>Bacillus subtilis</i> <i>Bacillus licheniformis</i> <i>Bacillus acidopullulyticus</i> <i>Klebsiella pneumonia</i>
Phytase	<i>Aspergillus niger</i> <i>Aspergillus oryzae</i> <i>Trichoderma reesei</i> <i>Penicillium funiculosum</i> <i>Schizosaccharomyces pombe</i> <i>Pseudomonas fluorescens</i>
6- phytase	<i>Aspergillus niger</i>
subtilisin	<i>Bacillus licheniformis</i>
Trypsin	<i>Fusarium veneatum</i>

51	Triacylglycerol lipase	<i>Aspergillus oryzae</i> <i>Apergillus niger</i> <i>Candida cylindracea</i> <i>Candida rugosa</i> <i>Penicillium roqueforti</i> <i>Rhizopus oryzae</i> <i>Rhizopus niveus</i>
52	Urase	<i>Lactobacillus fermentum</i>
53	Xylanase	<i>Aspergillus oryzae</i> <i>Aspergillus acidus</i> <i>Apergillus niger</i> <i>Bacillus licheniformis</i> <i>Bacillus lentus</i> <i>Bacillus pumilus</i> <i>Bacillus subtilis</i> <i>Disporotrichum dimorphosporum</i> <i>penicillum funiculosum</i> <i>Trichoderma citrinoviridae</i> <i>Trichoderma reesei</i> <i>Trichoderma longibrachiatum</i> <i>Talaromyces emersonii</i>
54	6-phytase	<i>Schizosaccharomyces pombee</i> <i>Pichia pastoris/Komagataella</i> <i>pastoris/Komagataella phaffi</i>
55	Zearalenone hydrolase	<i>Escherichia coli</i>

**Reference:**

- 1 Food enzyme application submitted to the Commission within the legal European Commission safety of the food chain version 4, updated on 25 July 2016
- 2 Association of American Feed Control Officials 2016 official Publication
- 3 Food and Drug Administration, Center for Veterinary Medicine
- 4 LIST OF CODEX SPECIFICATIONS FOR FOOD ADDITIVES