

Micro-organisms

Current overview of the micro-organisms used by DSM and their applications
2012



I: classical micro-organism; II: homologous or self-cloned GMM (genetically modified micro-organism); III heterologous GMM

Production Micro-organism	I	II	III	Product	Food & Feed	Pharma & Fine Chemicals	Energy, Environment & Biomaterials
<i>Aspergillus niger</i>	●	●		Acid amylase	●	-	
<i>Aspergillus niger</i>			●	Acid lactase	●	-	
<i>Aspergillus niger</i>		●		Asparaginase	●	-	
<i>Aspergillus niger</i>	●			Arabanase	●	-	
<i>Aspergillus niger</i>	●	●		Arabinofuranosidase	●	-	
<i>Aspergillus niger</i>	●			Beta-galactosidase	●	-	
<i>Aspergillus niger</i>		●		Carboxypeptidase	●	-	
<i>Aspergillus niger</i>		●		Fungal lipase	●	-	
<i>Aspergillus niger</i>	●			Glucoamylase	●	-	
<i>Aspergillus niger</i>	●			Glucose oxidase	●	-	
<i>Aspergillus niger</i>	●			Glycosidase	●		
<i>Aspergillus niger</i>	●			Hemicellulase	●	-	
<i>Aspergillus niger</i>			●	Lipase	●	-	
<i>Aspergillus niger</i>	●			Pectinase	●	-	
<i>Aspergillus niger</i>	●	●		Pectin methylesterase	●	-	
<i>Aspergillus niger</i>			●	Peroxidase	●	-	
<i>Aspergillus niger</i>		●		Phospholipase A1	●	-	
<i>Aspergillus niger</i>			●	Phospholipase A2	●	-	
<i>Aspergillus niger</i>		●		Phytase	●	-	
<i>Aspergillus niger</i>		●		Polygalacturonase	●	-	

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<i>Aspergillus niger</i>	●	●		Protease, endo-	●	-	
<i>Aspergillus niger</i>	●	●		Xylanase	●	-	
<i>Aspergillus niger</i>			●	Xylanase, thermostable	●	-	
<i>Aspergillus niger</i> var. <i>awamori</i>			●	Lactoferrin	-	●	
<i>Aspergillus oryzae</i>	●			Fungal amylase	●	-	
<i>Aspergillus oryzae</i>		●		Acid lactase	●	-	
<i>Bacillus amyloliquefaciens</i>	●	●		Alpha-amylase	●	-	
<i>Bacillus amyloliquefaciens</i>			●	Amylomaltase	●	-	
<i>Bacillus amyloliquefaciens</i>	●	●		Beta-glucanase	●	-	
<i>Bacillus amyloliquefaciens</i>	●	●		Neutral protease	●	-	
<i>Bacillus amyloliquefaciens</i>			●	Maltogenic amylase	●	-	
<i>Bacillus amyloliquefaciens</i>	●			Enzyme cocktail			●
<i>Bacillus licheniformis</i>	●	●		Alpha-amylase, thermostable	●	-	
<i>Bacillus licheniformis</i>		●		Protease	●	-	
<i>Bacillus subtilis</i>		●		Bacterial xylanase / beta-glucanase	●	-	
<i>Bacillus subtilis</i>			●	Maltogenic amylase	●	-	
<i>Bacillus subtilis</i>		●		Vitamin B ₂	●	●	
<i>Bifidobacterium animalis</i> spp. <i>lactis</i> ¹	●			Starter culture / Probiotic	●	-	

¹ formerly *Bifidobacterium lactis*

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<i>Blakeslea trispora</i>	●			Beta carotene	●	-	
<i>Brevibacterium linens</i>	●			Starter culture	●	-	
<i>Chryphonectria parasitica</i> ²	●			Rennet	●	-	
<i>Cryptocodinium cohnii</i>	●			Docosahexaenoic acid (DHA)	●		
<i>Disporotrichum dimorphosporum</i>	●			Beta-glucanase	●	-	
<i>Enterococcus faecium</i>	●			Animal Probiotic	●	-	
<i>Escherichia coli</i>			●	Glutaryl-acylase	-	●	
<i>Escherichia coli</i>		●	●	Penicillin/cephalosporin-acylase	-	●	
<i>Escherichia coli</i>			●	Aminopeptidase	-	●	
<i>Escherichia coli</i>		●		Aldolase	-	●	
<i>Escherichia coli</i>			●	L-amidase	-	●	
<i>Escherichia coli</i>		●		Shikimate	-	●	
<i>Escherichia coli</i>			●	Esterase	-	●	
<i>Escherichia coli</i>			●	Nitrilase	-	●	
<i>Escherichia coli</i>			●	Hydantoinase/racemase/carbamoylase		●	
<i>Escherichia coli</i>			●	Phenylalanine-ammonia-lyase	-	●	
<i>Glarea lozoyensis</i>	●			Caspofungin precursor	-	●	
<i>Geobacillus stearothermophilus</i> ³	●			Antibiotic residue tests	●	-	

² formerly *Endothia parasitica*

³ Formerly *Bacillus stearothermophilus*

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<i>Gluconobacter oxydans</i>	●			Vitamin C intermediate	●	●	
<i>Kluyveromyces lactis</i>			●	Chymosin	●	-	
<i>Kluyveromyces lactis</i>	●	●		Neutral lactase	●	-	
<i>Kluyveromyces lactis</i>			●	Lipase	●	-	
<i>Lactobacillus acidophilus</i>	●			Starter culture / Probiotic	●	-	
<i>Lactobacillus delbrueckii</i> ssp <i>bulgaricus</i>	●			Starter culture	●	-	
<i>Lactobacillus rhamnosus</i>	●			Starter culture	●	-	
<i>Lactobacillus casei</i>	●			Starter culture / Probiotic	●	-	
<i>Lactobacillus helveticus</i>	●			Starter culture	●	-	
<i>Lactococcus lactis</i> ssp <i>cremoris</i>	●			Starter culture	●	-	
<i>Lactococcus lactis</i> ssp <i>lactis</i> biovar <i>diacetylactis</i>	●			Starter culture	●	-	
<i>Lactococcus lactis</i> ssp <i>lactis</i>	●			Starter culture	●	-	
<i>Leuconostoc mesenteroides</i> ssp <i>cremoris</i>	●			Starter culture	●	-	
<i>Leptographium procerum</i> ⁴	●			Phosphodiesterase	●	-	
<i>Mortierella alpina</i>	●			Arachidonic acid (ARA)	●	-	
<i>Mucor miehei</i>	●			Rennet	●	-	

⁴ formerly *Verticicladiella procera*

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<i>Mucor miehei</i>	●			Esterase / lipase	●	-	
<i>Penicillium brevicompactum</i>	●			Mycophenolate	-	●	
<i>Penicillium chrysogenum</i>	●			Penicillin-G	-	●	
<i>Penicillium chrysogenum</i>	●			6-Amino penicillanic acid (6-APA)	-	●	
<i>Penicillium chrysogenum</i>			●	7-Aminodesacetoxy-cephalosporanic acid (7-ADCA)	-	●	
<i>Penicillium chrysogenum</i>			●	Pravastatin	-	●	
<i>Pichia pastoris</i>			●	Hydroxy-nitrile-lyase	-	●	
<i>Propionibacterium freudenreichii</i>	●			Starter culture	●	-	
<i>Rasamsonia emersonii</i> ⁵	●			Beta-glucanase	●		
<i>Rhizopus oryzae</i>	●			Fungal lipase	●	-	
<i>Saccharomyces cerevisiae</i>	●			Alcohol yeast	●	-	
<i>Saccharomyces cerevisiae</i>	●			Invertase	●	-	
<i>Saccharomyces cerevisiae</i>			●	Succinic acid			●
<i>Saccharomyces cerevisiae</i>		●		Trienol (= cholesta-5, 7, 24-trienol)	●	●	
<i>Saccharomyces cerevisiae</i>	●			Yeast extract	●	-	
<i>Saccharomyces cerevisiae</i>	●			Wine yeast	●	-	
<i>Schizochytrium</i> sp.	●			Docosahexaenoic acid (DHA)	●		
<i>Schizochytrium</i> sp.	●			Decosahexaenoic acid (DHA) /	●		

⁵ Formerly known as *Talaromyces emersonii*

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				Eicosapentaenoic acid (EPA)			
<i>Sphingomonas</i> sp.	●			Gellan	●		
<i>Streptococcus thermophilus</i>	●			Starter culture	●	-	
<i>Streptomyces clavuligerus</i>	●			Clavulanic acid	-	●	
<i>Streptomyces natalensis</i> ⁶	●			Natamycin	●		
<i>Streptomyces noursei</i>	●			Nystatin	-	●	
<i>Trichoderma longibrachiatum</i> ⁷	●			Hemicellulase	●	-	
<i>Trichoderma reesei</i> ⁸	●			Cellulase	●	-	
<i>Trichoderma reesei</i> ⁶	●			Beta-glucanase	●	-	
<i>Trichoderma reesei</i> ⁶	●			Enzyme cocktail	-	-	●

⁶ Formally: *Streptomyces lydicus*

⁷ Also known as *Trichoderma reesei*

⁸ formerly *Trichoderma longibrachiatum*