

Enzyme	Origin	T _{opt} /°C	pH _{opt}	Stability	Refs
α-Amylase	<i>Bacillus licheniformis</i>	76	5-8	Requires calcium for stability	[244]
(engineered)	<i>Bacillus licheniformis</i>	90-95	4-8	Stable at 85-90°C t _{1/2} (95°C): 25-100 min	[245, 246]
<i>Multifect AA 21L®</i>	<i>Bacillus licheniformis</i> (engineered)	N/A	5.5-5.8	Does not require calcium	Genencor
	<i>Bacillus</i> sp. ANT-6	80	10.5		[247]
<i>Termamyl®</i>	<i>Bacillus</i>	82-86	5.7-6.0	Calcium-independent	Novozymes
<i>/Liquozyme®</i>	<i>stearothermophilus</i>				
	<i>Bacillus</i>	100	8	t _{1/2} (100 °C): 3 h	[248]
	<i>thermooleovorans</i>			calcium-independent	
	<i>Pyrococcus furiosus</i>	100	5-6	Calcium-independent	[249]
				t _{1/2} (98 °C): 13 h	
	<i>Pyrococcus woesei</i>	100	5.5	Stable at 70-90°C for >6 h	[250]
				t _{1/2} (110 °C): 4-5 h	
				Slightly stabilized by Ca ²⁺	
	<i>Thermococcus</i>	75-85	5.0-5.5	N/A	[251]
	<i>hydrothermalis</i>				
<i>Valley "Ultra-thin™"</i>	N/A	105	4.5		[252], Diversa
β-Amylase	<i>Thermotoga maritima</i>	95	5	t _{1/2} (90°C): ~30 min	[253]
	<i>Thermoanaerobacterium</i>	75	5.5	Stable for 2 h at 70°C	[254]
	<i>thermosulfurigenes</i>			Stability enhances with substrate or Ca ²⁺	
Amylomaltase	<i>Pyrobaculum aerophilium</i>	95	6.7		[86]
	IM2				
	<i>Thermus aquaticus</i>	75	5.5-6.0	t _{1/2} (80 °C): 24 h	[87, 97]

Amylopullulanase	<i>Desulfurococcus mucosus</i>	85	5	$t_{1/2}$ (85°C): 50 min	[173]
	<i>Geobacillus thermoleovorans</i>	80	~7	$t_{1/2}$ (100°C): 2 h (1,4-activity), 3.5 h (1,6-activity); Ca^{2+} independent	[216]
	<i>Pyrococcus furiosus</i>	100-120	5.5	Ca^{2+} enhances thermoactivity and thermostability	[255]
	<i>Thermococcus hydrothermalis</i>	80-100 105-115 (Ca^{2+})	5.0-5.75	N/A	[256]
	<i>Thermococcus litoralis</i>	90-100	5.5	Ca^{2+} enhances thermoactivity and thermostability	[255]
Branching enzyme	<i>Aquifex aeolicus</i>	80	7.5	70% activity after 2 h at 90°C	[257]
	<i>Rhodothermus obamensis</i>	65	6.0-6.5	$t_{1/2}$ (80 °C): 16 h	[169]
	<i>Thermococcus kodakaraensis</i> KOD1	70	7	Stable at 90°C (for several h)	[258]
CGTase	<i>Anaerobranca gottschalkii</i>	65	6-9	Needs Ca^{2+} and high substrate conc for stability	[259]
	<i>alkalophilic Bacillus</i>	60	6	N/A	[218]
	(engineered) <i>Bacillus circulans</i>			$t_{1/2}$ (60°C): 9-56 min	[260]
	<i>Bacillus stearothermophilus</i> ET1	80	6.0	Stability enhanced by Ca^{2+} $T_m=81^\circ C$	[261]
4-α-	<i>Thermoanaerobacterium thermosulfurigenes</i>	80-85 ^C 90-95 ^H	4.5-7.0 ^C 4.0-4.5 ^H	Calcium and starch enhances stability $t_{1/2}$ (100°C): 30 min	[262]
	<i>Thermococcus kodakaraensis</i>	80 85-90 (Ca^{2+})	5.5-6.0	$t_{1/2}$ (100°C): 20 min	[263]
	<i>Thermotoga maritima</i>	70	7-8	$t_{1/2}$ (80 °C): 3 h	[264]

Glucanotransferase					
	<i>Pyrococcus kodakaraensis</i>	100	6-8	90% activity after 30 min at 100°C	[265]
Glucoamylase	<i>Clostridium thermosaccharolyticum</i>	70	5	90% activity after 6 h at 70°C; Ca ²⁺ -independent	[266]
	<i>Sulfolobus solfataricus</i>	90	5.5-6.0	N/A	[85]
	<i>Thermoanaerobacterium thermosaccharolyticum</i>	40-65	4.0-5.5	Stable at optimum temp for 8 h	[267]
	<i>Thermomyces lanuginosus</i>	70	5	t _{1/2} (60°C): 7.3 h t _{1/2} (70°C): 30 min	[268, 269]
α-Glucosidase	<i>Pyrococcus furiosus</i>	105-115	5-6	t _{1/2} (98°C): 48 h	[270]
	<i>Thermococcus hydrothermalis</i>	100	5.5	N/A	[271]
Maltogenic α-amylase Novamyl®	<i>Bacillus stearothermophilus</i>	62	5	N/A	[220], Novozymes
Maltosyl transferase	<i>Thermotoga maritima</i>	85-90	6.5	Stable at 80°C for 2 h	[272]
Pullulanase	<i>Anaerobranca gottschalkii</i>	70	8	t _{1/2} (70°C): 22 h Ca ²⁺ -independent	[273]
	<i>Fervidobacterium pennavorans</i>	85	6.0	t _{1/2} (80°C): 2 h t _{1/2} (90°C): 5 min	[274]
	<i>Pyrococcus woesei</i>	100	6.0	t _{1/2} (110°C): 7-20 min	[275]
	<i>Rhodothermus marinus</i>	80°C	6.5-7.0	t _{1/2} (85°C): 30 min	[276]
	<i>Thermococcus hydrothermalis</i>	95°C	N/A	t _{1/2} (95°C): > 8 h t _{1/2} (105°C): 60 min	[222]
	<i>Thermotoga maritima</i>	90	5.9	t _{1/2} (90°C): 3.5 h	[277]

N/A: not available; ^C Cyclization; ^H Hydrolysis