

Table 10.2 Activation parameters for activity of psychrophilic enzymes (P) as compared to those of their mesophilic counterparts (M)

Enzyme	Type	Temp (°C)	ΔG^\ddagger (kJ mol ⁻¹)	ΔH^\ddagger (kJ mol ⁻¹)	$T\Delta S^\ddagger$ (kJ mol ⁻¹)	Reference
Amylase	P	10	57.7	34.7	-23.0	D'Amico et al. (2003)
	M		58.5	46.4	-12.1	
Cellulase	P	4	71.6	46.2	-25.4	Garsoux et al. (2004)
	M		78.2	65.8	-12.4	
Chitobiase	P	15	59.5	44.7	-14.8	Lonhienne et al. (2001b)
	M		63.5	71.5	+8.0	
Endonuclease	P	5	62.8	33.4	-29.4	Altermark et al. (2007)
	M		67.9	74.0	+6.1	
Lysozyme	P	25	45.1	31.9	-13.2	Sotelo-Mundo et al. (2007)
	M		46.2	49.4	+3.2	
Subtilisin	P	15	62.0	36.0	-26.5	Davail et al. (1994)
	M		66.0	46.0	-20.2	
Xylanase (bacteria)	P	10	54.0	21.0	-33.0	Collins et al. (2003)
	M		60.0	58.0	-2.0	
Xylanase (yeast)	P	5	52.3	45.3	-7.0	Petrescu et al. (2000)
	M		54.6	49.9	-4.7	

Altermark B, Niiranen L, Willassen NP, Smalas AO, Moe E (2007) Comparative studies of endonuclease I from cold-adapted *Vibrio salmonicida* and mesophilic *Vibrio cholerae*. FEBS J 274:252–263

Collins T, Meuwis M-A, Gerday C, Feller G (2003) Activity, stability and flexibility in glycosidases adapted to extreme thermal environments. J Mol Biol 338:419–428

D'Amico S, Marx J-C, Gerday C, Feller G (2003) Activity-stability relationship in extremophilic enzymes. J Biol Chem 278:7891–7896

Davail S, Feller G, Narinx E, Gerday C (1994) Cold adaptation of proteins. Purification, characterization, and sequence of the heat labile subtilisin from the Antarctic psychrophile *Bacillus* TA 41. J Biol Chem 269:17448–17453

Garsoux G, Lamotte-Brasseur J, Gerday C, Feller G (2004) Kinetic and structural optimisation to catalysis at low temperatures in a psychrophilic cellulase from the Antarctic bacterium *Pseudoalteromonas haloplanktis*. Biochem J 384:247–253

Lonhienne T, Zoidakis J, Vorgias E, Feller G, Gerday C, Bouriotis V (2001b) Modular structure, local flexibility and cold-activity of a novel chitobiase from a psychrophilic Antarctic bacterium. J Mol Biol 310:291–297

Petrescu I, Lamotte-Brasseur J, Chessa J-P, Ntarima P, Claeysens M, Devreese B, Marino G, Gerday C (2000) Xylanase from the psychrophilic yeast *Cryptococcus adeliae*. Extremophiles 4:137–144

Sotelo-Mundo RR, Lopez-Zavala AA, Garcia-Orozco KD, Arvizu AA, Velazquez-Contreras EF, Valenzuela-Soto EM, Rojo-Dominguez A, Kanost MR (2007) The lysozyme from insect (*Manduca sexta*) is a cold-adapted enzyme. Protein Pept Lett 14:774–778