

Table S1. Comparison biochemical properties of free and immobilized *Tl*LacA and others laccases

Strain/ Laccase name/substrate	MW (kDa)	Support	Optimal Temperature (°C)		Thermal stability (Relative activity %)		Optimal pH		K_m (μ M)		V_{max} (μ Mmin ⁻¹)		K_{cat} (s ⁻¹)		k_{cat}/K_m (s ⁻¹ μ M ⁻¹)		Storage stability (Residual activity %/Time)		Reusabilit y (Relative activity %/ Cycles reuse)	Reference
			Free	Imm	Free	Imm	Free	Imm	Free	Imm	Free	Imm	Free	Imm	Free	Imm	Free	Imm	Imm	
<i>Chaetomium</i> sp. /-/**	68	-	60	-	85 %, 50 °C, 90 min	-	3.0	-	10.2	-	-	-	-	-	-	-	-	-	-	[57]
<i>G. australe</i> /Galacc-F/*	48	-	55	-	-	-	6.0	-	164.137	-	-	-	273	-	1.663	-	-	-	-	[52]
<i>G. luxurians</i> /GGL/*	64	-	55-65	-	63 %, 50 °C, 60 min 52 %, 60 °C, 240 min	-	2.2	-	539	-	-	-	-	-	-0.140 140 (s ⁻¹ mM ⁻¹)	-	-	-	-	[59]
<i>P. variable</i> /PvL/*	84	-	50	-	50 %, 50 °C, 60 min	-	4.8	-	203	-	40	-	-	-	-	-	80 / 1 day ^b	-	-	[51]
<i>T. polyzona</i> WRF03/TpL/*	66	-	65	-	42.92 %, 50 °C, 120 min	-	4.5	-	8.66	-	1429	-	-	-	-	-	-	-	-	[49]
<i>T. harzianum</i> S7113/LacA/*	63	-	50	-	50 %, 40 °C, 180 min	-	3.0	-	100 0.100 mM	-	0.603	-	-	-	-	-	-	-	-	[77]
<i>T. trogii</i> S0301/Lac 37 II/*	56	-	60	-	50 %, 60 °C, > 360 min 50 %, 70 °C, > 120 min	-	2.7	-	16.1	-	-	-	2.977	-	184.9	-	-	-	-	[67]
<i>Thielavia</i> sp./-/**	70	-	70	-	-	-	5.0	-	23.7	-	-	-	4.14	-	0.1743	-	-	-	-	[48]
<i>C. fabianii</i> /-/*	52	calcium alginate gel beads copper alginate gel beads	60 40	- 50	- -	- -	6.0 6.0	-	78 32 0.078 mM 0.032 mM	- 91 0.091 mM	0.00698 0.015 15.0 mMmin ⁻¹	6.98 mMm ⁻¹ 0.00561 5.61 mMm ⁻¹	- - -	- -	- -	- -	74 / 21 days ^b 62 / 21 days ^b 67 / 21 days ^b	55/ 4 ^a 60 / 4 ^a	-	[10]
<i>M. thermophila</i> /-/*	-	carbon nanotube membrane	70	70	26.66 %, 50 °C, 240 min 1.86 %, 60 °C, 240 min	72.93 %, 50 °C, 240 min 23.12 %, 50 °C, 240 min	3.0	3.0	-	-	-	-	-	-	-	-	-	-	95 / 10 (25 °C, pH 4.5)	[61]
<i>T. pubescens</i> /Tplac/*	68	chitosan beads	50	60	-	-	4.5	5.0	-	-	-	-	-	-	-	-	15 / 30 days ^a	40 / 30 days ^a	≥ 60 / 6 ^a	[50]

<i>T. versicolor/</i> _***	-	copper alginate gel beads	-	-	-	-	-	2210 2.21 mM	560 0.56 mM	0.00543 5.43 mMmin ⁻¹	0.04464 44.64 mMmin ⁻¹	-	-	-	-	46.18/ 15 days ^b (pH 5)	66.19 / 15 days ^b (pH 5)	21.5 / 5 NR	[81]	
<i>Bacillus</i> sp. MSK-01/-/*	-	copper alginate gel beads	85	75	50 %, 70 °C, inactive	50 %, 70 °C, 240 min	8.0	10	-	-	-	-	-	-	-	-	> 90 / 15 days ^b	100 / 4	(75 °C, pH 8)	[26]
<i>T. harzianum</i> HZN10/-/*	-	calcium alginate gel beads		50	-	-		5.0	-	-	-	-	-	-	-		75/8 days ^b	36/ 6 ^a		
	-	copper alginate gel beads	50	50	-	-	5.0	5-6	500 0.5 mM	-	-	-	-	-	-	45/8 days ^b	33 /8 days ^b	51/ 6 ^a		[60]
		sol gel		50	-	-		4-7	-	285 U/mg	500 U/mg	-	-	-	-		90 /8 days ^b	82 /6 ^a		
<i>T. terrestris</i> Co3Bag1/TiLacA/*	70	copper alginate gel beads	65	70	50 %, 60 °C, 82.9 min 50 %, 70 °C, 50.3 min	50 %, 60 °C, 191.5 min 50 %, 70 °C, 117.2 min	3.0	3.0	260	450	3.57 U/mg	2.86 U/mg	13.73	6.35	0.053	0.0141	36.4/12 days ^b (pH 3)	86.1/12 days ^b (pH 3)	95 / six cycles (60 °C, pH 3)	This study

Imm:immobilized enzyme

* ABTS substrate; ** 2,6-DMP substrate

^(a) optimal temperature and pH

^(b) 4 °C

NR: No registered