

## A REVIEW ON LIPASE IMMOBILIZATION ON HYDROPHOBIC SUPPORTS INCORPORATING SYSTEMATIC MAPPING PRINCIPLES

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## SUPPLEMENTARY MATERIAL

Table S1. Search strategy for locating articles. All searches were undertaken on April 26<sup>th</sup>, 2021.

Bibliographic sources	Search String
Searched terms (2011-2020, Articles)	"interfacial activation*" OR "activation immobilization*" OR "interfacial Immobilization*" OR "interfacial activation immobilization*" OR "interfacial adsorption*" OR "adsorption immobilization*" OR "hydrophobic adsorption*" OR "hydrophobic immobilization*" OR "hydrophobic adsorption immobilization*" OR "hydrophobic support*" OR "Hydrophobic interaction*" AND "lipase*"
Web of Science	Basic search: TOPIC (Core collection: SCI-E, ESCI) <b>644 records</b>
Scopus	Basic search: TITLE-ABSTRACT-KEYWORDS <b>368 records</b>
PubMed	Basic search: ALL FIELDS <b>843 records</b>
SciELO	Basic search: TOPIC (Citation Index) <b>No records</b>
<b>Total records</b>	1855

Table S2. Records eliminated after title/abstract screening.

Categories	Number of publications
Reviews	182
Application of free enzymes in bioprocesses	48
Lipase production without immobilization or immobilized in the whole cell	28
Immobilization of other enzymes ( $\alpha$ -amylase, protease, laccase, among others)	58
Use of lipase for medical processes	36
General studies with free enzymes	329
Use of commercial immobilized enzymes	14
Surface modification of the free lipase	10
Others*	357
<b>Total records</b>	<b>1062</b>

\*In the category "Others": use of constituents as a lipase inhibitor; poly(R)-3-hydroxybutyrate (PHB) studies; vaccine production; general studies on proteins; studies with liposomes; immobilization of other compounds; molecular dynamics simulations with lipase; protease production; use of lipase to agents with functional properties for humans; general studies with microorganisms; synthesis of compounds in general; studies related to diseases in general.

Table S3. Interpretation of Kappa statistic.

<b>Kappa</b>	<b>Interpretation</b>
<0.0	No agreement
0.0 - 0.20	Slight agreement
0.21 – 0.40	Fair agreement
0.41 – 0.60	Moderate agreement
0.61 – 0.80	Substantial agreement
0.81 – 1.00	Almost perfect agreement

Fonte. Okwuashi *et al.*, 2012.

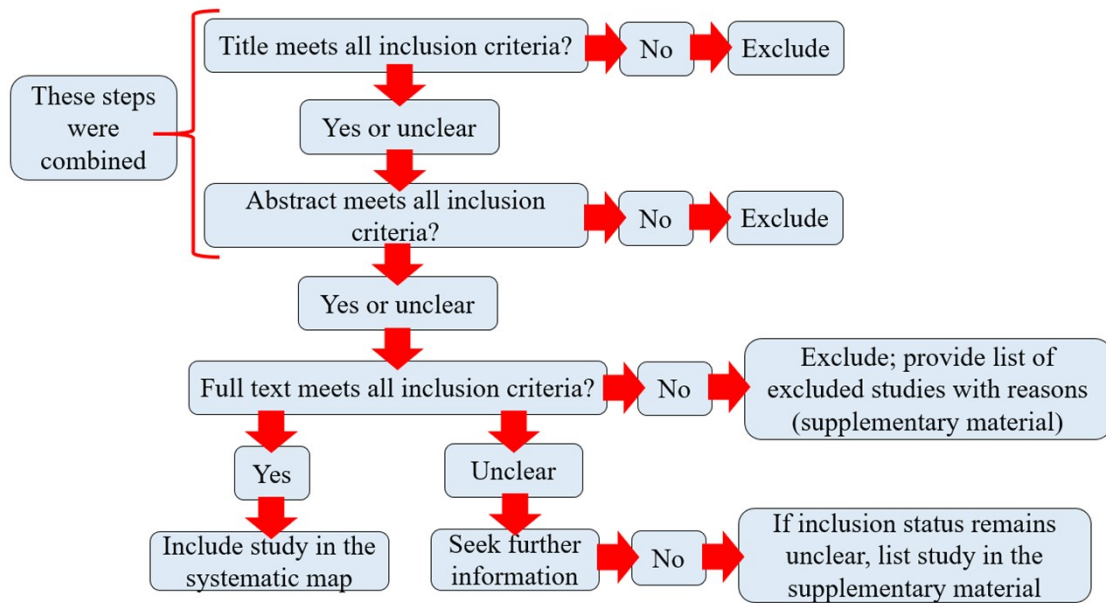


Figure S1. Stages of the literature screening process (Adapted from CEE, 2020; Available at: <http://www.environmentalevidence.org/guidelines/section-6>).

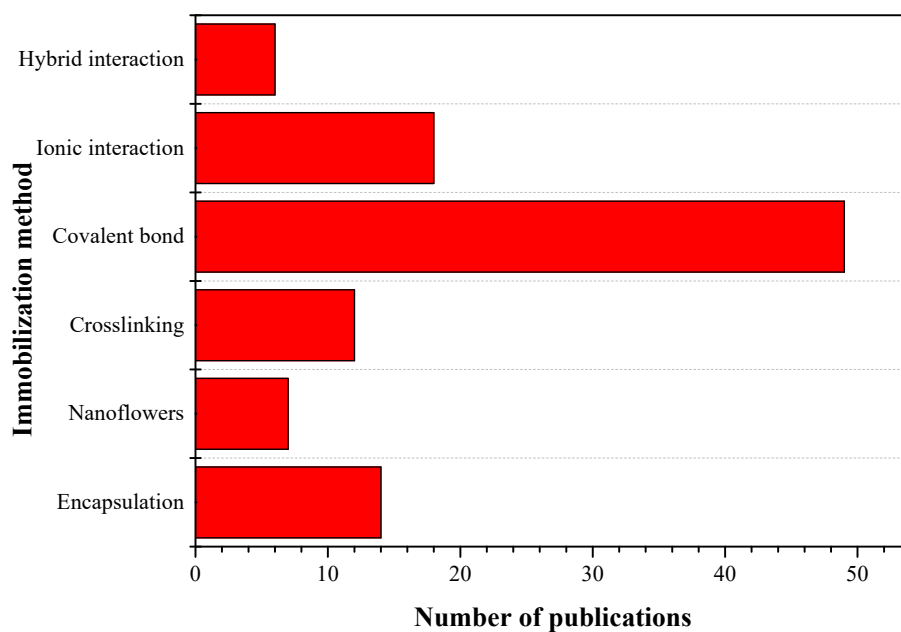


Figure S2. Records eliminated after full-text analysis.

Table S4. Lipases and supports present in our database for systematic mapping analysis.

Lipase source	Support	Reference
TLL	TPEPS-RHS	1
CRL	Lifetech™ ECR8804M; Lifetech™ ECR8804M; PMA-co-DVB	2
BCL	Accurel MP 1000	3
CRL	QCM-D-SAMs	4
CALB	MS-3030; OS; SBA-15	5
CRL	raw-MWCNT	6
CALB	OC; OCGLX	7
PFL	raw-MWCNT; O-MWCNT	8
CSL	PDMS	9
SPL	SBA-15@OA	10
ASL	PSIWP	11
CRL; ROL	Lifetech™ AP1090M; Lifetech™ ECR1030M	12
ANL; RAL; CRL	Celite-535	13
CRL; MJL; CSL	Diaion HP-20	14

BTL2	OS; UndGLXS; OS; OCEPX	15
TLL	Lifetech™ ECR8806M; EC-OD; Lewatit VP OC 1600	16
AOL	DCNT-NF90	17
CVL	OC	18
CRL	G; GO	19
ANL	BFN	20
SHL	PMA-co-DVB	21
CALB	POSS	22
CALB	PTFE	23
CRL	PEG-PS-CR	24
CALB; CCL; PCL; PFL; HPL	ChiS-G	25
rROL	Accurel MP 1000	26
CALB	PS-b-P4VP	27
CALB	OC	28
TLL	GO	29
CALB	MCI GEL CHP20P	30
PPL	Na-bent; Bent-DTAB; Bent-CTAB; Bent-OTAB	31
CALB	PA-M	32
RML	SBA-15; OCEPX	33
TLL; LU	EC-OD	34
CRL	NMC-MoS <sub>2</sub>	35
RML; TLL; CALB; LU	OC; PS/PS; PS-co-DVB/PS-co-DVB	36
BSL	MSN	37

TLL	SiO <sub>2</sub> /HPB-MX	38
CRL	OC	39
CRL	OC; EC-OD	40
BCL	SiO <sub>2</sub> -b-CCDT; SiO <sub>2</sub> -CMC; SiO <sub>2</sub> -HEC	41
GCLI	OC; Diaion HP 2-MG; Diaion HP-20	42
CRL; RML; TLL	OCDVS	43
CRL; CALB; RAL; ASL; HPL; MML; PCL; RNL	P(SAN-DVB)-HPA; P(SAN-DVB)-GMA	44
CRL	Cell-Fe <sub>2</sub> O <sub>3</sub>	45
CALB	P(MMA-co-C); PMMA-Ncell; PES; P(MMA-co-DMAEMA); P(S-co-DVB-co-GMA); P(S-co-DVB); EC-OD; Accurel MP 1000	46
CALB	MCI GEL® CHP20P	47
TLL	OC	48
CALA; CALB; TLL; RML; LU	OC	49
PPL	Chin	50
CALB	EC; EC-EDA; EC-IDA; EC-IDA-Cu <sup>2+</sup>	51
OPEr	SiMAG-Octyl	52
PFL	OC	53
CALB	P(S-co-DVB); Accurel MP 1000	54
CALB	Accurel MP 1000	55
TLL	G	56
SWL	OC; Immobead 150; MCI GEL® CHP20P	57
CRL; ROL	OC	58
YILIP2	D3520; D4020; AB-8; NKA	59

CRL	MNPs-pAcDED-C8; MNPs-pAcDED-C16	60
BCL	MMS	61
BCL_	OS	62
RML; TLL; CALB; PFL	EC-OD	63
RML; AQL; CALB	EC-OD	64
CALB; TLL; LU	EC-OD	65
RML; TLL; CALA; CALB; LU	Lifetech™ ECR1061M; Lifetech™ ECR8804M; Lifetech™ ECR1090M; Lifetech™ ECR1030M; OC	66
CALA; CALB; CRL; TLL; RML; LU	OC; OCDVS; OCGLX	67
RML; TLL; CALA; CALB; LU	Lifetech™ ECR1061M; Lifetech™ ECR8804M; Lifetech™ ECR8806M; Lifetech™ ECR1090M; Lifetech™ ECR1030M	68
TLL1; TLL2; PFL; BTL2; CALB	PHB	69
TLL; RML; LU	MCI GEL® CHP20P; OC	70
CALB	Accurel MP 1000; PMMA/PMMA; PMMA-co-DVB/PMMA-co-DVB; PS-co-DVB/PS-co-DVB	71
BCL	CNF	72
CRL	CN	73
LipA; LipC; LipI.3	Accurel EP100; Accurel MP1000; Celite®545	74
CALB	Lifetech™ ECR8806M; Lifetech™ ECR 8285F	75
CRL	Fe <sub>3</sub> O <sub>4</sub> /AgNPs@OA	76
TLL	PAN	77
PsL; AsL	OS; OGS	78
TLL	Fe <sub>3</sub> O <sub>4</sub> @CA	79
TLL	Fe <sub>3</sub> O <sub>4</sub> /Au@OA	80

CALB	raw-MWCNT; NMWCNT; Fe-MWCNT	81
Lip1, Lip2 and Lip3	OC; EC-OD	82
TLL	PCM; Relizyme™ EA 403/S; Relizyme™ HG 403/S	83
CALB	OSM	84
ASP	OC; EC-OD	85
TLL	OC	86
CALB	OC	87
CALB	Fe <sub>3</sub> O <sub>4</sub> @OA	88
TLL	EC-OD; Lewatit VP OC 1600; Lifetech™ ECR8806F; Lifetech™ ECR1030M	89
CALB	SMMP-octyl; SMMP-octyl-glu	90
CALB	SEPMOD; MMTMOD	91
CALB; RML; LEU	OCGLX; OCGLXR	92
CRL; LipC12	OC; Aga-C8-GLU	93
CRL	SP-PVP; SP-Pst	94
TLL; CALB; RML	Lewatit VP OC 1600; Lifetech™ ECR8806M	95
PHL	PS-co-DVB	96
TLL	PHB; PMA	97
BaL	GO-NH <sub>2</sub> - PMAO	98
CALB	MCI GEL® CHP20P	99
CALA	QCM-D	100
BCL	MAMCP	101
PFL	OS	102



LipB; CALB	PMMA/PMMA; PMMA-co-DVB/PMMA-co-DVB; PS-co-DVB/PS-co-DVB	103
PPL	OS	104
CALB	SBA-15	105
LU	CTA	106
TLL	PMA	107
CRL	GO/ZnO	108
CRL	PMPPH/PAN	109
CALB	Accurel MP 1000; PMMA-co-DVB/PMMA-co-DVB; PS-co-DVB/PS-co-DVB	110
CRL	PS; PhS; OS; ODS	111
CRL	rGO	112
TLL	OS	113
GCLI	PHB	114
AcSL	SBA-15@OA	115
Eversa; Eversa2.0	Lewatit VP OC 1600; EC-OD; Lifetech™ ECR8804M; Lifetech™ ECR1061M	116
CALB	P(S-co-DVB); P(S-co-DVB-co-GMA); P(S-co-DVB-co-PFS); P(S-co-DVB-co-GMA)-BA; P(S-co-DVB-co-PFS)-BA; P(S-co-DVB-co-GMA)-TPh; P(S-co-DVB-co-PFS)-TPh	117
CRLAYS	NKA	118
BBL; FOL	OC	119
CALB	Indion@PA 500	120
PPL	PBA-PAD	121
ROL	BTS; PhS; BTT; HXT; PhT; OC; EC-OD	122

SWL	OC; BTT	123
TLL	APS	124
ANL	UiO-66-PDMS	125
CALB; TLL	OCGLX	126
ANL	OC; EC-OD	127
RML; TLL; CALB; CRL; ROL; PFL; BTL	OC	128
CALB	OC	129
CRL	p-SNPs	130
CRL; ANL; RAL	Celite-535; PE	131
LU; RML; PFL	OC; OCGLX	132
CALA; CALB; TLL; RML; CRL; LU	OC; OCEDA; OCHDA	133
CALA; CALB; TLL; RML; CRL; LU	OC; OCGLU	134
Rrol	RHS; Relizyme™ OD403	135
SHL_ ; CGL; SLL; ZPL; PHL_	OC	136
CALB	Accurel MP1001	137
CALB	OC; UndGLX, OCEPX; OS; UndGLXS; OCEPXS	138
BCL	NWs	139
CALB	MCI GEL CHP20P; Diaion HP-20	140
CRL	Fe <sub>3</sub> O <sub>4</sub> @ZIF-8	141
PFL	PE	142
BCL	Accurel EP 100	143
RML; CRL	OC	144
CALB	EziG Amber	145

CRL	PDLLA	146
CRL	Lifetech™ ECR1030M; Lifetech™ ECR8806M; Lifetech™ ECR8285	147
CRL	PPA	148
TLL; CRL; PFL	OS	149
YLIP2	PGMA-TAIC-EGDMA	150
PsL	OC; EC-OD	151
ArSL	FMD	152
PFL	MCNT	153
PsL	OS	151
BCL	PANF	154
BPL	BCTMAB	155
OTL	BTS	156
CALB	PST-300; PST-14	157
BCL	Accurel EP 100	158
CRL	OS; ODS	159
TLL; RML	EC-OD	160
CSL	PDMS	161
CALB	OC	162
CRL	PVADVBZ	163
CRL	PBAP-PPMM	164
CALB; TLL; RML	OCGLX	165
TLL	MNPs	166
CALA; CALB; RML; TLL; LU	OC	167

RML	OC	168
CALB; RML	OC	169
CALB	OC	170
CALB	OC	171
AFE	EC-OD	172
RML	OC	173
CALB	OC	174
CALB; TLL; RML	OC	175
CALA; CALB; TLL; RML; LU	OC; OVS	176
LipC12	OCA; ODA	177
CALB	Lewatit VP OC 1600	178
CALB	OC	179
CALB	NKA	180
RML	OC	181
CALB; TLL; RML	EC-OD	182
CALB	OC	183
TLL; RML; CALB	OC	184
HyPL	OC	185
CALB; TLL; RML	Lewatit VP OC 1600	186
TLL	EC-OD	187
LU	OC	188
CALB	OS	189
CALA; CALB; RML; TLL; LU	OC	190

MAS1L	XAD1180	191
CALB	OC-SAM; OD-SAM	192
PPL; MJL; CALA; RML; TLL	Diaion HP 2-MG	193
TLL	Diaion HP-20	194
TrLL	DPEG	195
AQL	MNPs	196
RML	OC	197
CALB	EC-OD	198
CRL	OC-EVAL; UnD-EVAL; OD-EVAL	199
BAYCJ01L	Ph-TiO <sub>2</sub>	200
TLL	CNT	201
CRL	MSEP	202
CRL	PGMATrp	203
RML	OC	204
RML; CALB	EC-OD	205
CALB	PTMOS	206
ALL	PhS; OC	207
OTL	OC; Lewatit VP OC 1600	208
CALB; RML; TLL	Lewatit VP OC 1600; EC-OD; Lifetech™ ECR1030M; Lifetech™ ECR8806M; Lifetech™ ECR8804M	209
ANL	ZIF-8; ZIF-8-PDMS	210
PCL	OC-MCF; Ph-MCF	211
CRL	Lifetech™ ECR8806M	212

CRL	PHB	213
LipG9	Accurel MP1000	214
FVL	OC	215
PCGL	OC; PHB; XAD-4	216
CALB	Purolite@ MN102	217
CRL	MSU-H	218
CRL	OSS	219
CRL	MGO	220
ANL	CLA	221
Eversa2.0; CALB	OC	222
CALB	MCI GEL CHP20P	223
CALB	MCM 41	224
CRL	PU	225
PSGL	BTS; PhS; OC; EC-OD; Lewatit VPOC 1600	226
PFL	OCGLX	227
BCL	Chin-PVA	228
RML; TLL	M-Davisil R250	229
CALB; RML	BT-Chin; OC-Chin; OD-Chin	230
CALB	OC-MNP; OD-MNP	231
CRL; CALA	OCGLX	126
TLL; PCL	OC	232
MSL	BTS; PhS; OC	233
PFL	OS	234

PFL	MNPs	235
PsL	EC-OD	236
TLL	MWCNT	237
YILIP2	BC	238
CALA; CALB	OC	239
CALB	MNPs	240
AOL	D3520; NKA	241
TLL; Eversa2.0	OC	242
CSL	PMOs	243
HyPL	PhS; BTS; OC; EC-OD; Lewatit VP OC 1600; MN200	244
CRL	XAD-2; XAD-4; XAD-7; XAD-16; XAD-61; EC-OD	245
TLL; PFL	OS	246
TLL	PMO	247
r27RCL	BT-SBA-15; OC- SBA-15; EC-OD- SBA-15	248
RML; CRL	OC; OCGLX	249
CRL	Fe <sub>3</sub> O <sub>4</sub> @PVBC	250
CALB; TLL; RML	OCGLX	251
YILIP2	D4020; AB-8	252
PPL	Bent-CTAB	253
PsL; AsL	OS; OCGLXS	254
BCL	NKA	255
BCL	NKA	256
CRL	OC	257

Pf2001Δ60	OC	258
CCL	OC	259
CALA; CALB; CRL; RML	OC	260
CALB	Accurel MP 1000	261
CALB	SPRIN actisorb; SPRIN liposorb	262

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