

Supporting Information

Enhanced activity of immobilized lipase by phosphonium-based ionic liquids used in the supports preparation and immobilization process

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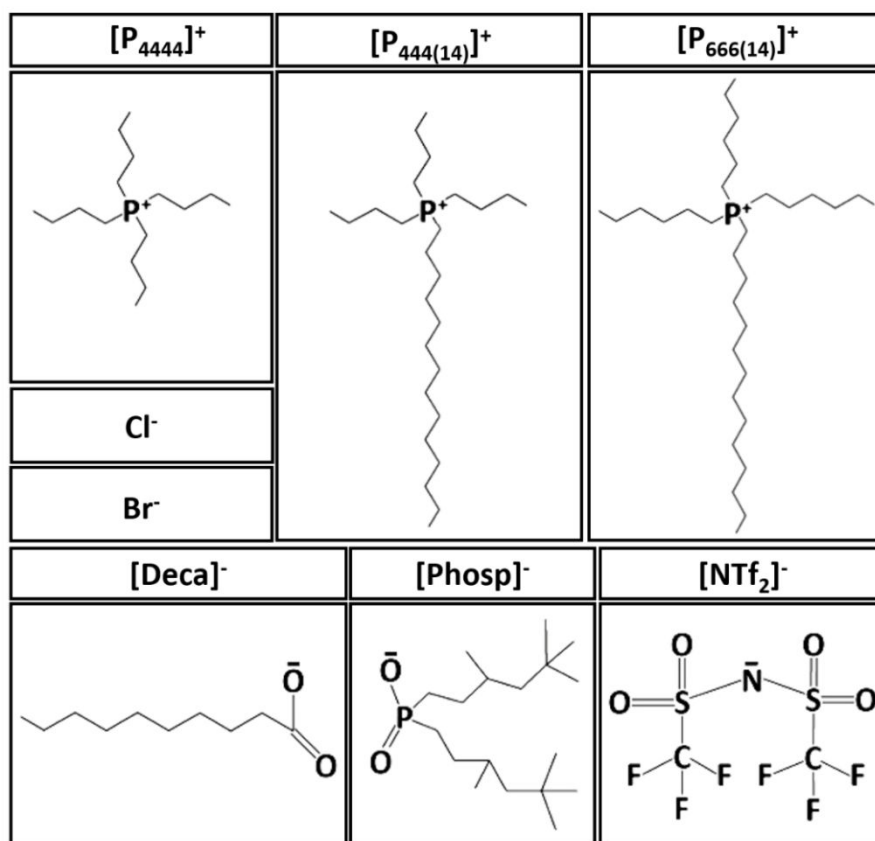


Figure S1. Chemical structures of the IL cations and anions used in this work.

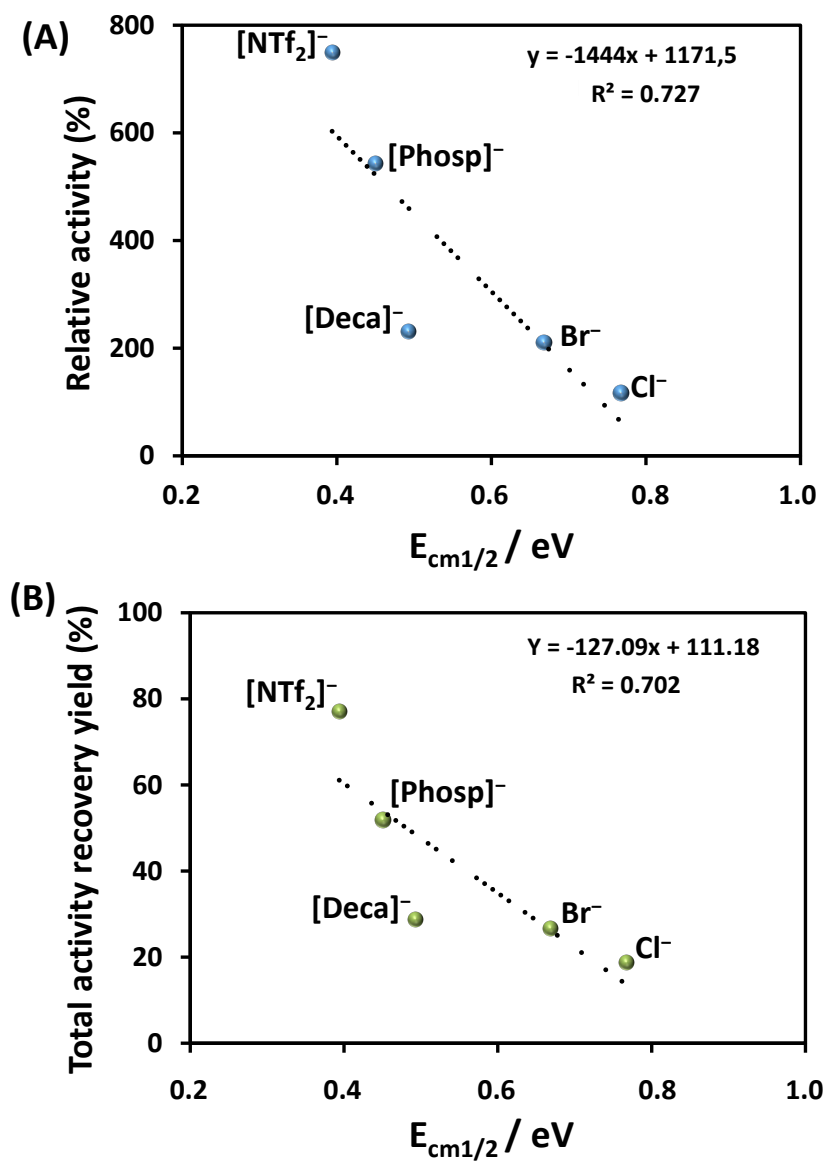


Figure S2. Relative cation–anion interaction energies ($E_{cm,1/2}$) as a function of (A) relative activity and (B) total activity recovery yield of lipase in presence of ILs.

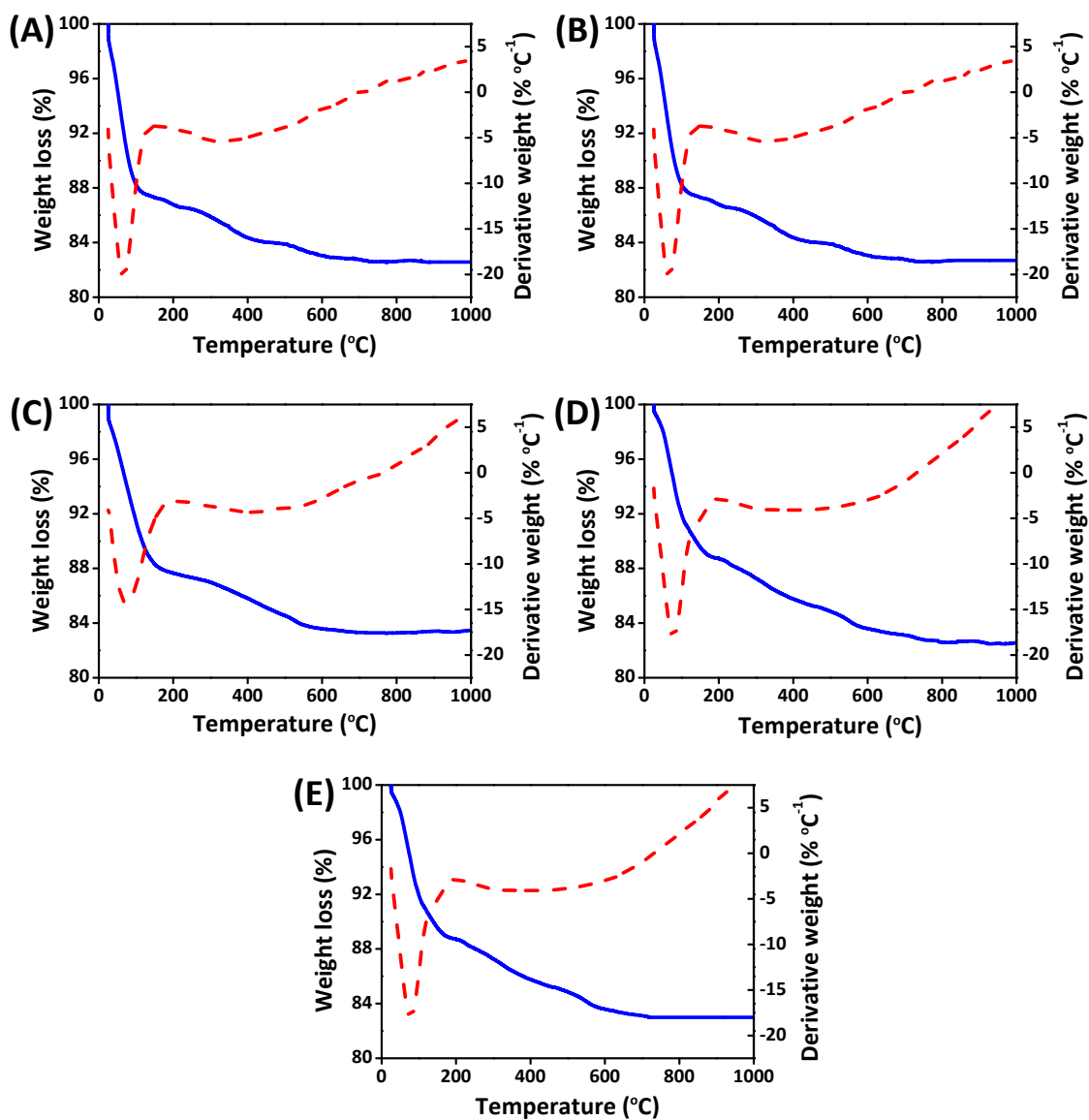


Figure S3. TGA (—) DTA (---) curves: (a) Silica-Control, (b) Silica-[P₆₆₆₍₁₄₎][NTf₂], (c) IB-Control, (d) IB-[P₆₆₆₍₁₄₎][NTf₂], and (e) PA-[P₆₆₆₍₁₄₎][NTf₂].

Table S1. Initial and relative activities and total activity recovery yield.

Biocatalyst	Inicial activity (U g⁻¹)	Relative activity (%)	Total activity recovery yield (%)
IB-Control	236.5 ± 9.3	100 ± 4.4	31.6 ± 2.2
IB-[P ₄₄₄₄]Cl	107.4 ± 4.9	45.4 ± 3.1	13.7 ± 1.7
IB-[P ₄₄₄₍₁₄₎]Cl	122.7 ± 5.0	51.8 ± 3.1	18.5 ± 1.8
IB-[P ₆₆₆₍₁₄₎]Cl	146.9 ± 6.4	62.0 ± 3.1	18.8 ± 1.7
IB-[P ₆₆₆₍₁₄₎]Br	190.3 ± 6.7	80.4 ± 4.2	26.7 ± 1.6
IB-[P ₆₆₆₍₁₄₎][Deca]	230.7 ± 8.9	97.5 ± 4.2	28.8 ± 1.7
IB-[P ₆₆₆₍₁₄₎][Phosp]	337.2 ± 10.4	142.5 ± 4.2	51.9 ± 1.8
IB-[P ₆₆₆₍₁₄₎][NTf ₂]	496.2 ± 14.0	209.8 ± 4.2	77.2 ± 1.9
PA-[P ₄₄₄₄]Cl	172.3 ± 6.7	74.6 ± 3.2	18.8 ± 2.0
PA-[P ₄₄₄₍₁₄₎]Cl	146.3 ± 6.2	62.9 ± 3.2	17.94 ± 2.2
PA-[P ₆₆₆₍₁₄₎]Cl	116.7 ± 5.8	50.2 ± 3.2	16.22 ± 2.6
PA-[P ₆₆₆₍₁₄₎]Br	210.9 ± 8.4	90.6 ± 4.4	26.93 ± 2.0
PA-[P ₆₆₆₍₁₄₎][Deca]	230.9 ± 8.9	99.3 ± 4.4	29.67 ± 2.6
PA-[P ₆₆₆₍₁₄₎][Phosp]	544.0 ± 14.0	234.0 ± 4.4	65.51 ± 2.2
PA-[P ₆₆₆₍₁₄₎][NTf ₂]	750.0 ± 19.9	322.7 ± 4.4	91.09 ± 2.8

Table S2. Denaturation rate and half-life values of the immobilized biocatalysts in relation to cycles.

Cycle Number	Half-life (%)		
	IB-Control	IB-[P ₆₆₆₍₁₄₎][NTf ₂]	PA-[P ₆₆₆₍₁₄₎][NTf ₂]
1	98.54 ± 2.00	98.53 ± 2.08	99.43 ± 2.08
2	91.50 ± 1.99	92.50 ± 2.05	96.50 ± 2.02
3	83.43 ± 1.81	86.40 ± 1.99	94.40 ± 2.01
4	75.34 ± 1.78	81.73 ± 1.76	91.23 ± 2.07
5	67.85 ± 1.68	74.26 ± 1.66	89.50 ± 2.05
6	58.15 ± 1.439	66.05 ± 1.54	85.02 ± 2.04
7	45.56 ± 1.38	59.28 ± 1.52	80.14 ± 2.02
8	–	54.28 ± 1.51	76.37 ± 2.01
9	–	43.62 ± 1.50	73.13 ± 2.00
10	–	–	69.36 ± 2.00
11	–	–	66.03 ± 2.00
12	–	–	62.37 ± 2.04
13	–	–	58.37 ± 1.99
14	–	–	56.21 ± 1.78
15	–	–	54.56 ± 1.66
16	–	–	52.73 ± 1.54
17	–	–	51.86 ± 1.54
18	–	–	47.91 ± 1.52

Denaturation rate IB-Control = 114.00

Denaturation rate IB-[P₆₆₆₍₁₄₎][NTf₂] = 111.65

Denaturation rate PA-[P₆₆₆₍₁₄₎][NTf₂] = 107.48