

Table S1: Immobilization of β -galactosidase on Gr@Fe₃O₄ NCs after optimizing all conditions

Enzyme:NCs (mg)	Enzyme activity loaded, X, (U)	Enzyme activity in washes, Y, (U)	Enzyme activity bound on Gr@Fe ₃ O ₄ NCs		Immobilization yield (%), B/A
			Theoretical (X-Y) = A	Actual/Immobilized =B	
10:100	49.12	0.075	49.04	43.84	89.7

Each value represents the mean for three independent experiments performed in duplicates, with average standard deviations, $\leq 5\%$.

Table S2: Kinetic parameters of free and bound β -galactosidase

	K_m (mM)	K_i (mM)	V_{max} (μ moles/min/ml)
Free β-galactosidase	0.48 \pm 0.13	1.27 \pm 0.87	0.05 \pm 0.003
Immobilized β-galactosidase	0.42 \pm 0.07	3.33 \pm 1.22	0.06 \pm 0.005

Each value represents the mean of three independent experiments performed in duplicates, with average standard deviation of $\leq 5\%$.