Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Enzyme-functionalised, core/shell magnetic nanoparticles for selective pH-triggered sucrose capture

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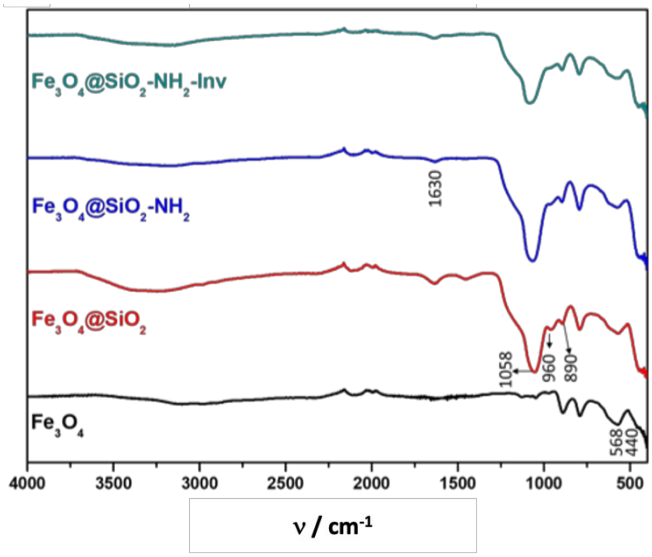

Figure S1. FT-IR spectra of the synthesised nanomaterials.

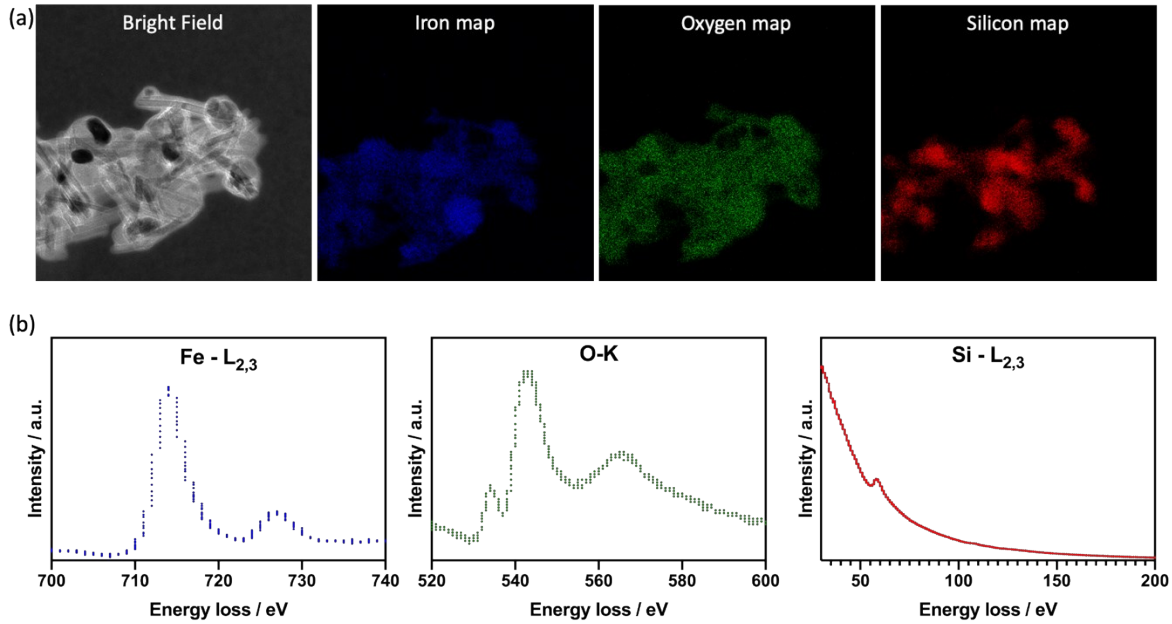

Figure S2. (a) ESI-TEM analysis on Fe_3O_4@SiO_2 NPs: bright field (top left) and elemental mapping of iron (blue), oxygen (green) and silicon (red) atoms. **(b)** EEL spectra corresponding to the selected image, indicating iron (blue), oxygen (green) and silicon (red) atoms.

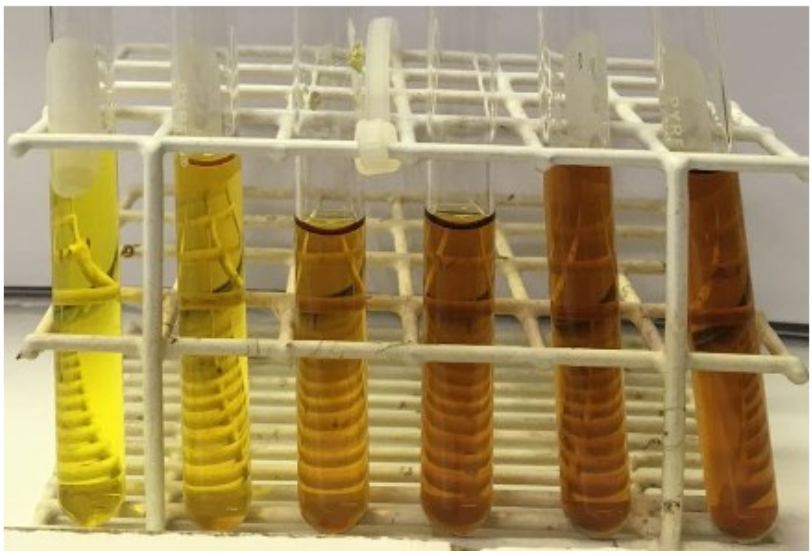

Figure S3. Photo images of the target enzyme activity test when increased sucrose concentration, from left to right, no invertase (blank, yellow) and to the highest sucrose concentration (the most intense brown).

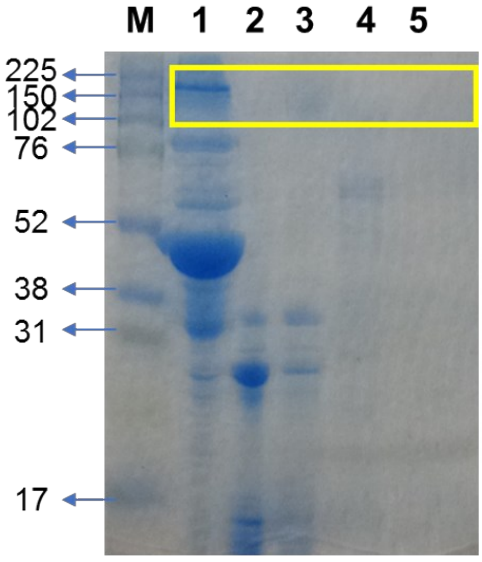

Figure S4. SDS-PAGE gel image illustrating different stages of invertase purification. M - full-range rainbow MW marker (Amersham, GE Healthcare), 1 - extracted invertase, 2 - Superdex 200 eluate, 3 - DEAE-cellulose eluate, 4 and 5 - CM-sepharose eluates. Invertase is observed as a band between 100-200 kDa (yellow rectangle).

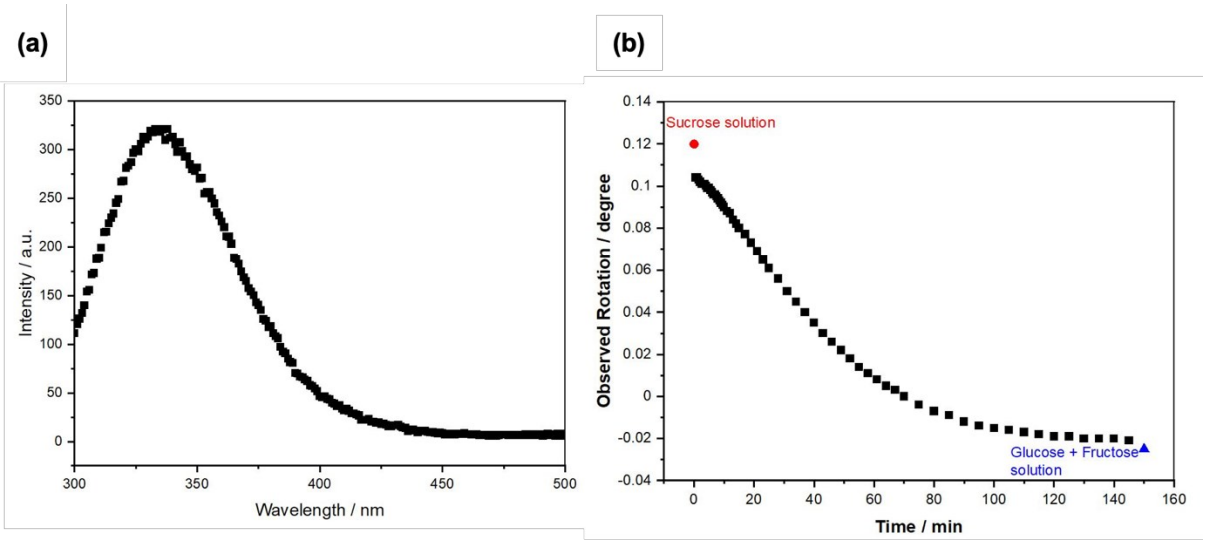

Figure S5. (a) Fluorescence spectrum of invertase at 0.15 mg mL^{-1} in sodium acetate buffer 40 mmol L^{-1}. **(b)** Polarimetry of sucrose solution (20 mg mL^{-1}) incubated with invertase (0.15 mg mL^{-1}), in sodium acetate buffer 40 mmol L^{-1} (pH 4.8).

Table S1. Comparison between the enzymatic activity of invertase immobilized on different nanoparticles

Nanoparticle	K_M / mM	V_{MAX} / µM min^{-1} mg $enzyme^{-1}$	pH	Temperature / °C	Reference
Free Invertase	67.7	50.4	4.8	50	This study
Fe_3O_4@SiO_2-NH_2	98.3	97			
Free Invertase	65.7	153.2	5	25	1
PVIgMNP*	97.1	55.07			
Free Invertase	65.7	153.2	5	25	2
PAMAM-SPION**	92	40.8			
Free Invertase	61.3	170.7	5	35	3
Chitosan-MNPs***	81	60.8			
Free Invertase	65.7	1670	4.5	55	4
Chitosan NPs	205.7	1830[a]			

*Polyvinylimidazole grafted iron oxide nanoparticles

**Polyamidoamine dendrimer grafted superparamagnetic iron oxide nanoparticles

***Chitosan coated γ-Fe_2O_3 magnetic nanoparticles

[a]U mL^{-1}

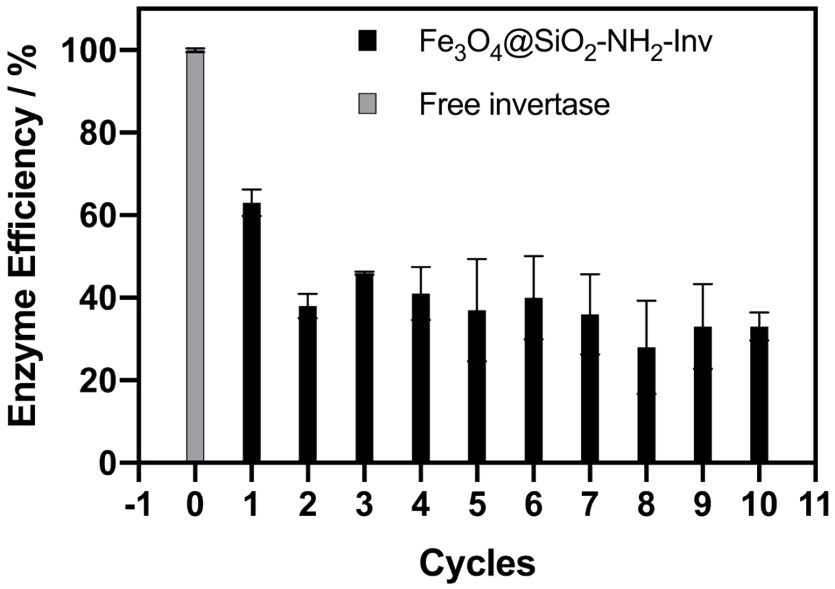

Figure S6. Enzyme efficiency evaluation before and after immobilization onto $Fe_3O_4@SiO_2$-NH_2-Inv using the enzyme activity test.

References

1. K. Uzun, E. Çevik, M. Şenel, A. Baykal, *Bioprocess and Biosystems Engineering*, 2013, 36, 1807–1816.
2. K. Uzun, E. Çevik, M. Şenel, M. H. Sözeri, A. Baykal, M. F. Abasıyanık, M. S. Toprak, *Journal of Nanoparticle Research*, 2010, 12, 3057–3067.
3. P. P. Waifalkar, S. B. Parit, A. D. Chougale, S. C. Sahoo, P. S. Patil, P. B. Patil, *Journal of Colloid and Interface Science*, 2016, 482, 159-164.
4. S. G. Valerio, J. S. Alves, M. P. Klein, R. C. Rodrigues, P. F. Hertz, *Carbohydrate Polymers*, 2013, 92, 462-468.