Supplementary Information

Recovery of Rare Earth Elements (Nd, Dy) from Discarded Hard Disk Magnets using EDTA Functionalised Chitosan

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Figure SF1. Workflow of the experimental procedure utilised to establish the proposed REE recovery route.



Figure SF2. Schematic detail fo the roasting cycle for initial magnets



Figure SF3. (a) SEM micrograph of cryomilled powder along with particle size distribution; (b) Size distribution of cryomilled powder particles, (c) High magnification SEM micrograph of rare earth magnet powder along with elemental maps of major constituent elements.



Figure SF4. Mechanism of functionalisation of chitosan through EDTA.



Figure SF5. Chelation mechanism for (a) EDTA, and (b) chitosan.

Table ST1.	Adsorption	yield for	Nd and	Dy o	obtained	through	ICP-MS	analysis	for	various
process para	meters.									

Temperature	pH	Adsorption Time	Adsorption	Adsorption yield	
		(hrs.)	yield for Nd	for Dy (%)	
			(%)		
		12	11.57	9.72	
		18	32.65	29.87	
	pH = 1	24	65.77	53.14	
		36	56.27	45.24	
		48	31.19	28.90	
		12	12.57	11.26	
		18	34.82	30.26	
	pH = 3	24	70.69	63.74	
		36	63.39	52.54	
		48	34.36	31.80	
Room Temperature		12	13.51	14.81	
		18	37.29	33.95	
	pH = 5	24	81.25	72.29	
		36	75.71	62.53	
		48	39.55	44.64	
		12	10.25	7.36	
		18	29.83	26.98	
	pH = 7	24	62.46	50.31	
		36	51.63	43.16	
		48	29.64	27.42	
		12	15.27	12.71	
	pH = 1	18	39.43	35.16	
		24	67.97	70.54	
		36	45.67	47.14	
		48	34.30	32.90	
	pH = 3	12	26.82	21.90	
		18	43.71	37.68	
		24	78.36	70.60	
		36	64.89	51.90	
		48	39.51	37.10	
Elevated Temperature	pH = 5	12	29.05	25.39	
(50°C)		18	47.38	38.72	
		24	85.36	76.98	
		36	73.40	61.08	
		48	42.42	43.29	
		12	11.30	7.90	

	18	38.73	34.26
pH = 7	24	81.47	69.62
ľ	36	68.29	60.79
	48	38.43	34.94



Figure SF6. Comparative FTIR analysis of chitosan in acidic medium (H₂SO₄) for 24 hours at various pH values.



Figure SF7. Comparative analysis of fraction adsorbed of Nd and Dy at pH = 5 and T = 50 °C and various times for adsorption.



Figure SF8. Comparative analysis of fraction adsorbed of Fe at different conditions of temperature, time, and pH of the solution.



Figure SF9. Adsorption isotherms of (a) Nd and (b) Dy on EDTA-functionalised chitosan at different temperatures along with their respective Langmuir model fits.



Figure SF10. $\ln K_{d \text{ vs.}} \frac{1}{T}$ plots for Nd and Dy for $C_e = 1$. The slope gives the enthalpy, and the intercept gives the entropy of the adsorption process.