Supporting Information

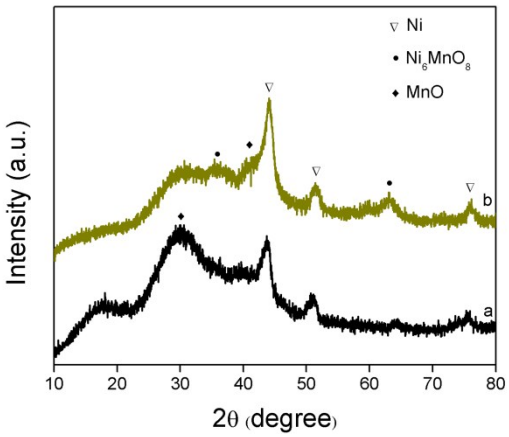

Figure S1. XRD diffraction patterns of the as-prepared $MnO@Al_2O_3@C/Ni$-500 (a) and $MnO@Al_2O_3@C/Ni$-900 (b).

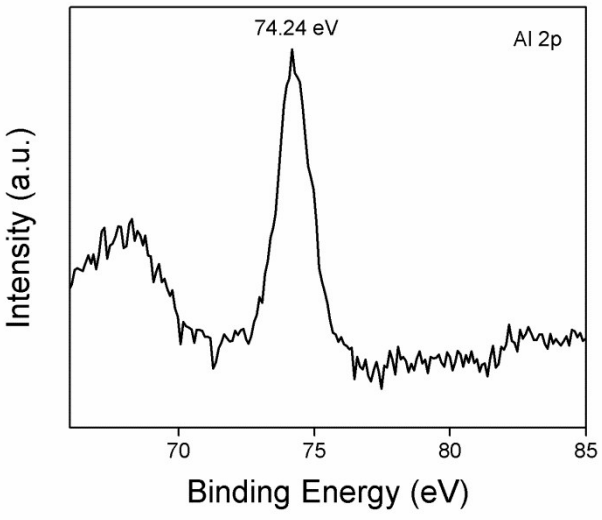

Figure S2. XPS Al 2p spectra of $MnO@Al_2O_3@C/Ni$-500 nanoflakes.

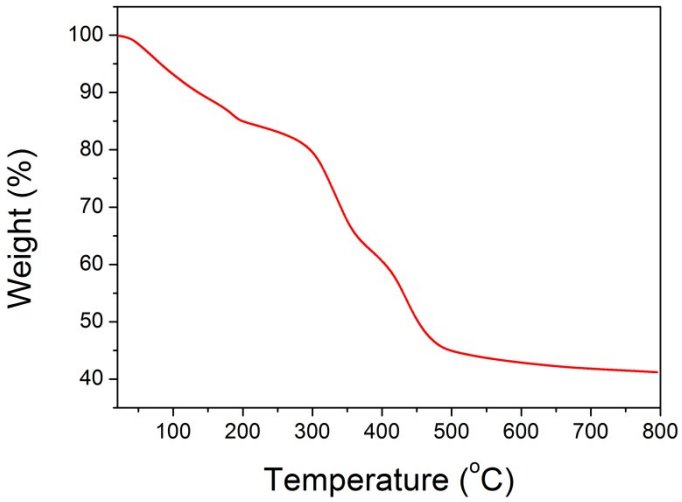

Figure S3. TGA curve of MnO_2@NiAl-LDH@PDA-Ni^{2+}.

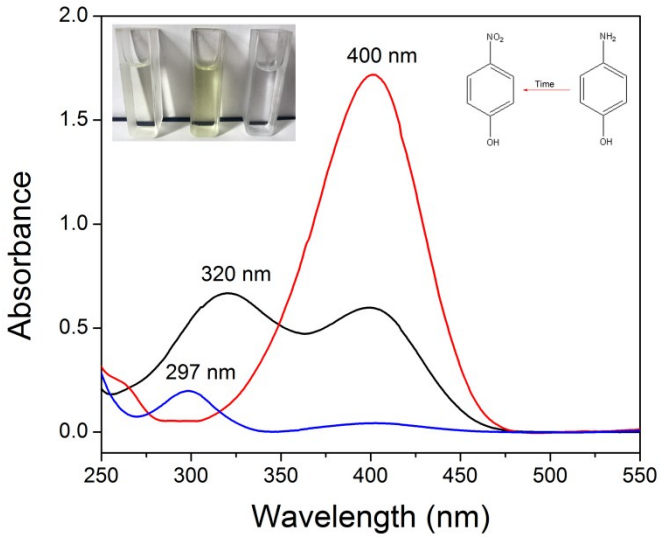

Figure S4. UV-vis absorption spectra of 4-NP (red line), 4-nitrophenolate (black line), and 4-AP (blue line).

Table S1. The ICP data of MnO@Al_2O_3@C/Ni with different calcination temperature before and after catalytic reaction.

Catalysts	Ni (μg.mg^{-1})
MnO@Al_2O_3@C/Ni-500	342.47
MnO@Al_2O_3@C/Ni-700	631.59
MnO@Al_2O_3@C/Ni-900	633.44

Table S2. A full comparison of MnO@Al_2O_3@C/Ni nanoflakes catalysis activity and test

condition with other nickel and noble metal catalysts.

Catalyst	Type	K($\times10^{-3}s^{-1}$)	κ($\times10^{-3}mg^{-1}s^{-1}$)	Reference
MnO@Al_2O_3@C/Ni-700	nanoflakes	5.37	13.7	This work
MnO@Al_2O_3@C/Ni-500	nanoflakes	4.81	7.61	This work
MnO@Al_2O_3@C/Ni-900	nanoflakes	1.55	2.44	This work
Ni/p (AMPS)	Hydrogel	0.9	0.15	1
Ni/MC-550	Nanotube	1.51	338	2
Ni/SiO_2	Core-shell	2.8	0.94	3
RGO-Ni	Nanosheets	0.25	0.04	4
C-Ni/400	Core-shell	5.9	142	5
C-Ni/500	Core-shell	21.7	523	5
C-Ni/600	Core-shell	18.6	449	5
Ni/SNTs	Nanotube	9.9	31	6
Ni (modified)	Nanoparticles	2.4	0.80	7

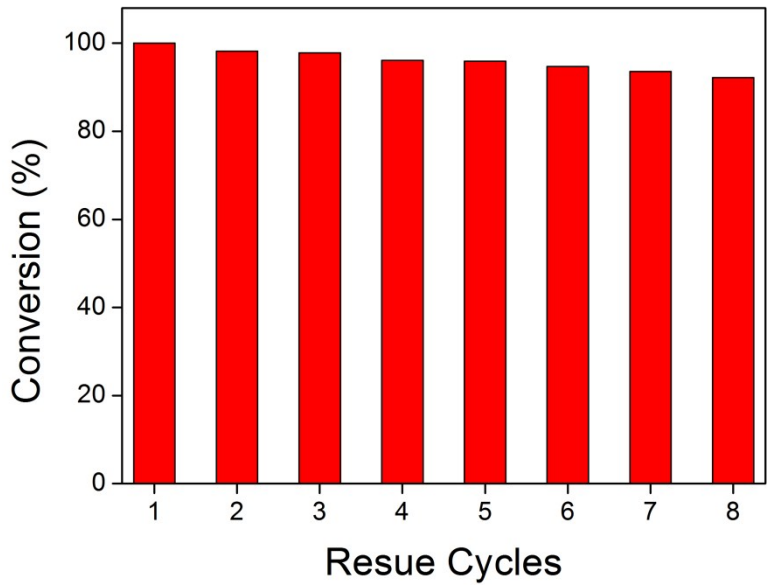

Figure S5. The reusability of MnO@Al_2O_3@C/Ni as the catalyst for the reduction of 4-NP with $NaBH_4$.

Table S3. Isotherm parameters for the adsorption of BHb protein on the MnO@Al_2O_3@C/Ni-700.

T(℃)	Langmuir model			Freundich model		
	K_d(mg/mL)	Q_m(mg/g)	R^2	K_F(mg/g)	n	R^2
700	0.039	1684.00	0.9866	831.94	1.6358	0.9738

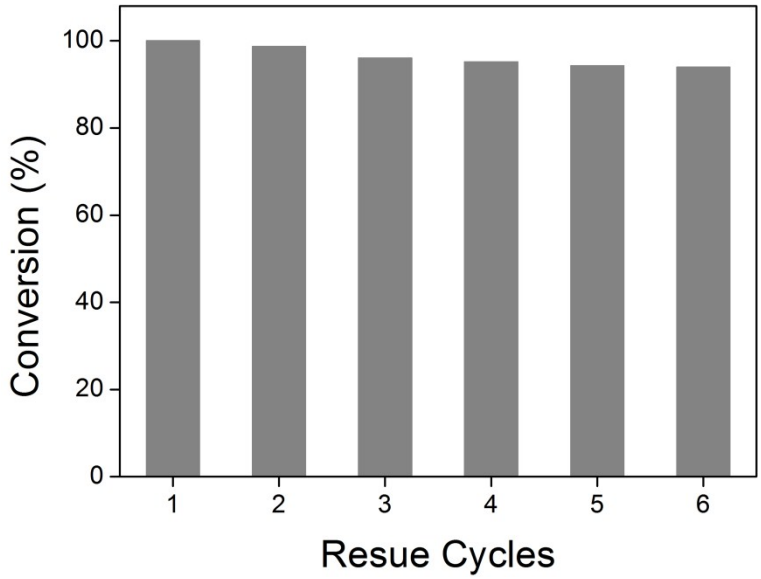

Figure S6. The reusability of BHb protein on the MnO@Al_2O_3@C/Ni-700.

Table S4. Properties of different adsorbents for BHb capture.

Adsorbent	Capacity (mg g^{-1})	Reference
MnO@Al_2O_3@C/Ni-700	1684.0	This work
$CoFe_2O_4$@Si-IDA-Cu^{2+}NPs	1812.3	8
CNTs/Fe_3O_4@CuSilicate	302.3	9
Cu-IDA-silica-coated Fe_3O_4	418.6	10
Fe_3O_4@PVBC@IDA-Ni MNPs	1988	11
Ni-MNPs	1054.3	12

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