Supplementary Information

Magnetic nickel ferrite nanoparticles as highly durable catalyst for catalytic transfer hydrogenation of bio-based aldehydes

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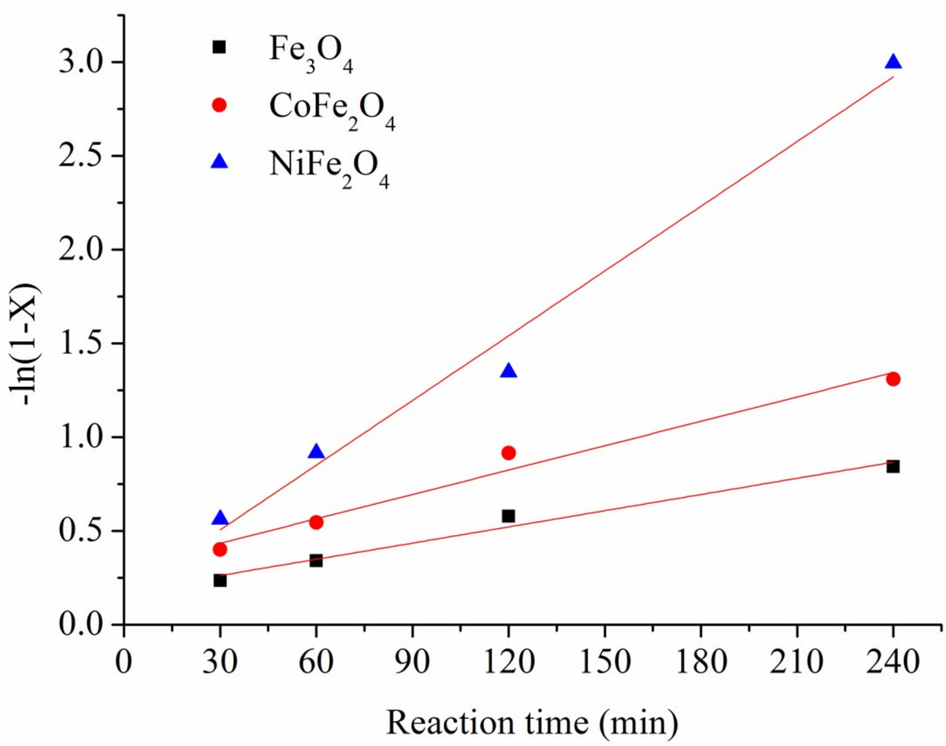

Figure S1. –ln(1-*X*) *v*s. reaction time for Fe_3O_4, $CoFe_2O_4$ and $NiFe_2O_4$. Reaction conditions: FF (2 mmol), catalyst (0.06 g), 2-propanol (10 mL), T = 180 °C, t = 0.5-4 h.

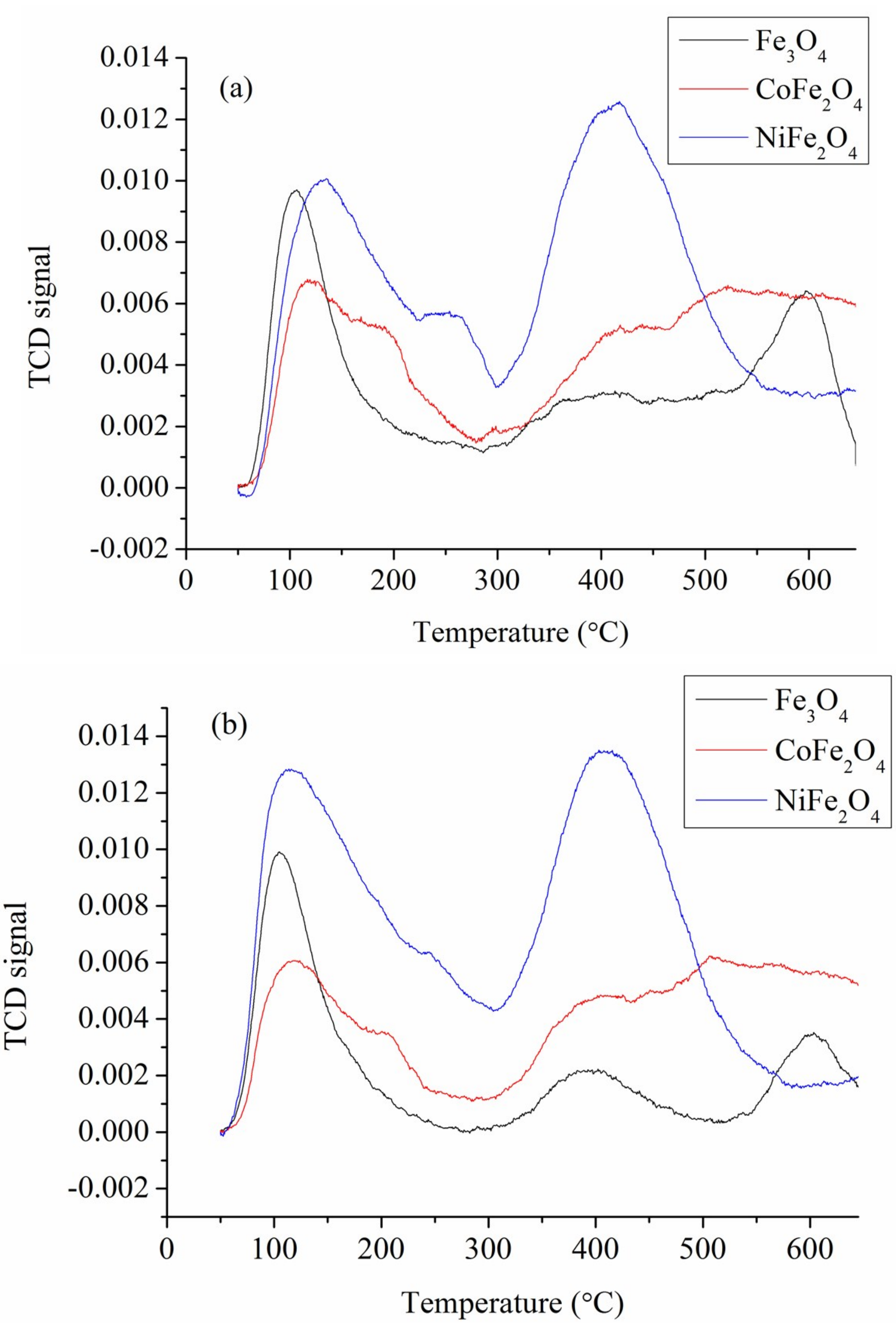

Figure S2. NH_3-TPD (a) and CO_2-TPD (b) profile of different nanoparticle ferrite catalysts.

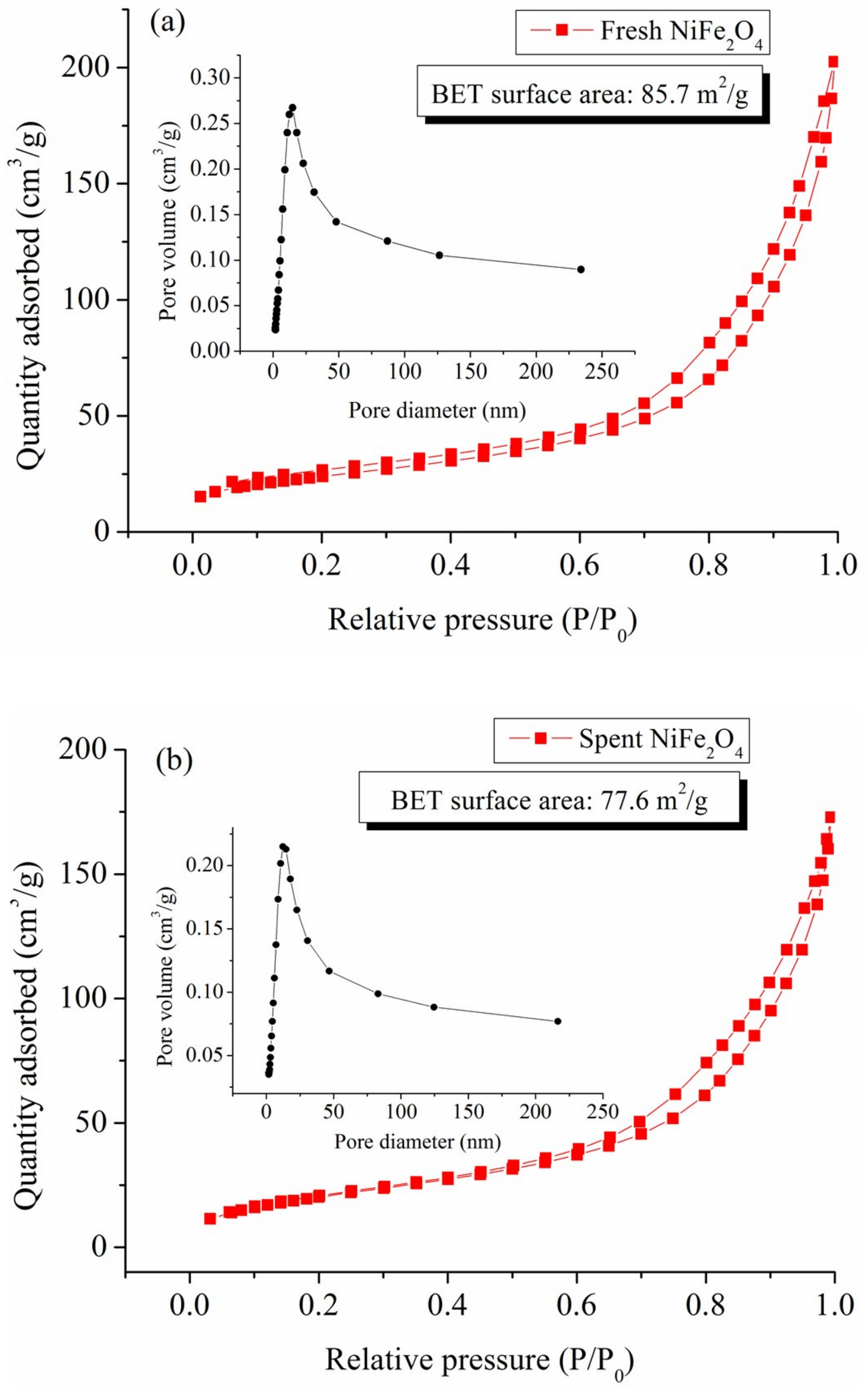

Figure S3. N_2 adsorption-desorption isotherms and pore size distribution of fresh (a) and spent (b) $NiFe_2O_4$ catalyst.

Table S1. Rate constant in CTH of FF to FAOL over different catalyst at 180 °C [a]

Entry	Catalyst	Rate constant (min^{-1})	R^2	Standard error
1	Fe_3O_4	$2.9 \cdot 10^{-3}$	0.97	$3.0 \cdot 10^{-4}$
2	$CoFe_2O_4$	$4.3 \cdot 10^{-3}$	0.97	$4.7 \cdot 10^{-4}$
3	$NiFe_2O_4$	$11.5 \cdot 10^{-3}$	0.98	$9.9 \cdot 10^{-4}$

[a] Reaction conditions: FF (2 mmol), catalyst (0.06 g), 2-propanol (10 mL), T = 180 °C, t = 0.5-4 h.

Table S2. Rate constants, R^2 values and standard errors at different reaction temperatures and calculated activation energy for the CTH of FF over $NiFe_2O_4$ [a]

Temperature (°C)	Rate constant k (min^{-1})	R^2	Standard error	E_a (kJ/mol)	R^2	Standard error
120	$1.6 \cdot 10^{-3}$	0.99	$2.2 \cdot 10^{-5}$	48.2	0.97	0.6
140	$2.7 \cdot 10^{-3}$	0.98	$2.1 \cdot 10^{-4}$			
160	$5.1 \cdot 10^{-3}$	0.99	$1.1 \cdot 10^{-4}$			
180	$11.5 \cdot 10^{-3}$	0.98	$9.9 \cdot 10^{-4}$			

[a] Reaction conditions: FF (2 mmol), catalyst (0.06 g), 2-propanol (10 mL), t = 0.5-4 h.

Table S3. Comparison of the activity of $NiFe_2O_4$ nanoparticles with other heterogeneous catalysts in the CTH of FF to FAOL using alcohols as H-donor

Entry	Catalyst	H-donor	Temp. (°C)	Time (h)	Conv. (%)	Yield (%)	Sel. (%)	E_a (kJ/mol)	Ref.
1	Co-Ru/C	benzyl alcohol	150	12	98	98	100	58	[S1]
2	Ru/C+$DyCl_3$	2-Propanol	180	3	100	97	97	-	[S2]
3	Pd/Fe_2O_3	2-Propanol	150	7.5	66	37	56.1	46.8	[S3]
4	γ-Fe_2O_3@HAP	2-Propanol	180	10	96.2	91.7	95.3	47.69	[S4]
5	Fe-L1/C-800	2-Butanol	160	15	91.6	76.0	83	-	[S5]
6	Ni-Cu/Al_2O_3	2-Propanol	200	4	95.43	95.41	>99	-	[S6]
7	ZrPN	2-Propanol	140	2	98	98	>99	70.5	[S7]
8	$NiFe_2O_4$	2-Propanol	180	6	98.5	94.0	95.4	48.2	This work

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Table S4. The effect of stirring speed on the CTH of FF to FAOL over $NiFe_2O_4$ [a]

Entry	Stirring speed (rpm)	FF conversion (%)	FAOL yield (%)	FAOL selectivity (%)
1	600	96	91	95
2	900	99	94	95
3	1200	99	87	88

[a] Reaction conditions: FF (2 mmol), catalyst (0.06 g), 2-propanol (10 mL), T = 180 °C, t = 6 h.