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Supporting information

Chemoselective synthesis of propionic acid from biomass and lactic acid over cobalt catalyst in aqueous media

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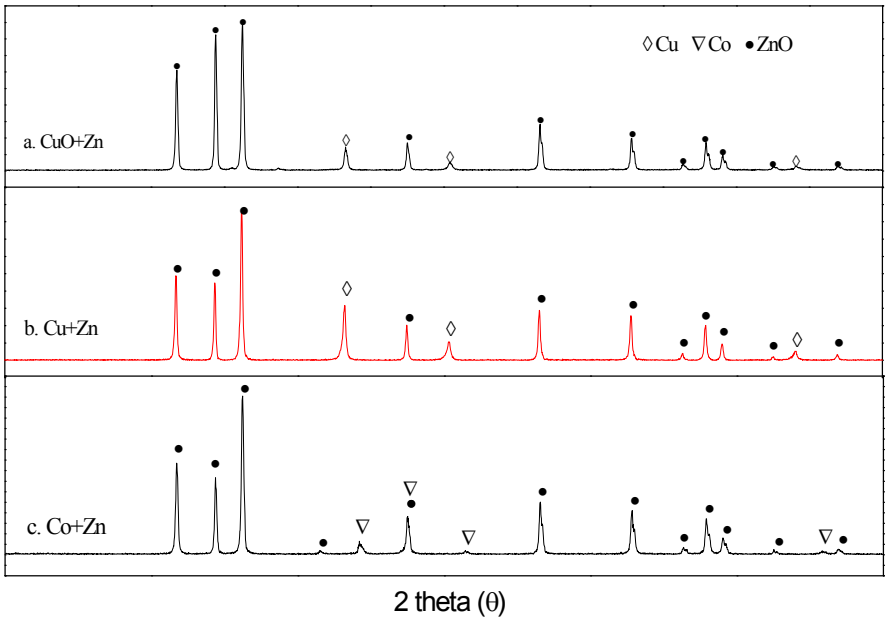

Figure SI-1. XRD patterns of solid residue after reaction (catalyst 5 mmol, Zn 25 mmol, H_2O 7.5 mL, 250 °C, 2 h).

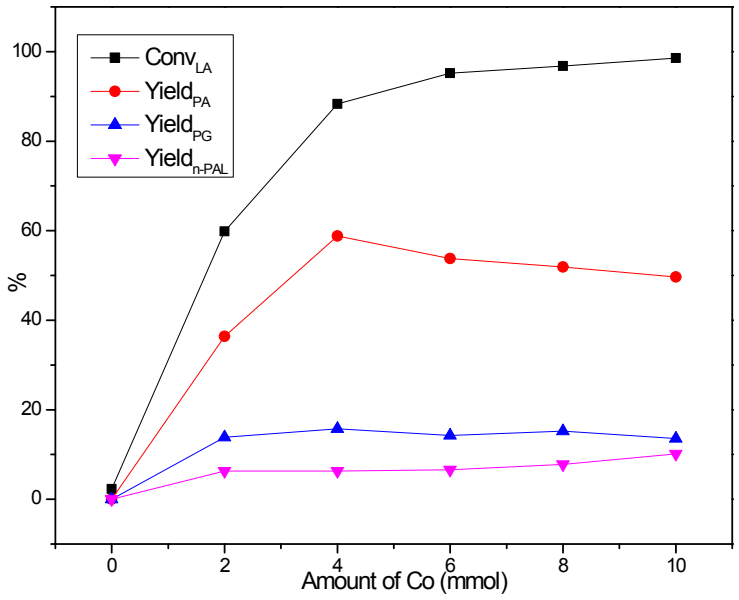

Figure SI-2. Effect of Co loading (LA 1.5 mmol, Zn 10 mmol, H_2O 7.5 mL, 250 °C, 2 h).

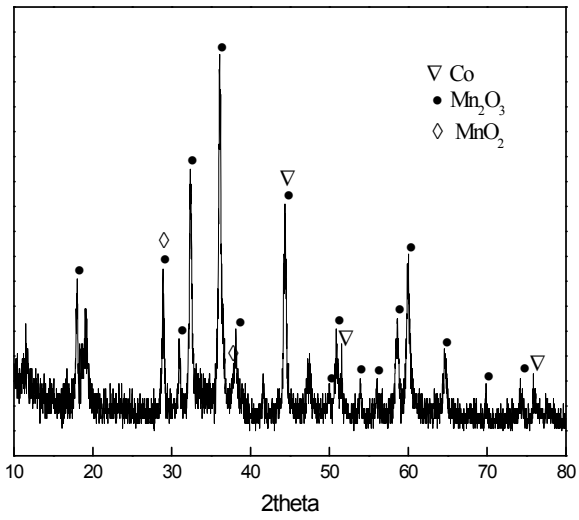

Figure SI-3. XRD patterns of precipitates with Mn (Co 5 mmol, Mn 10 mmol, H_2O 7.5 mL, 250 ^oC, 2 h).

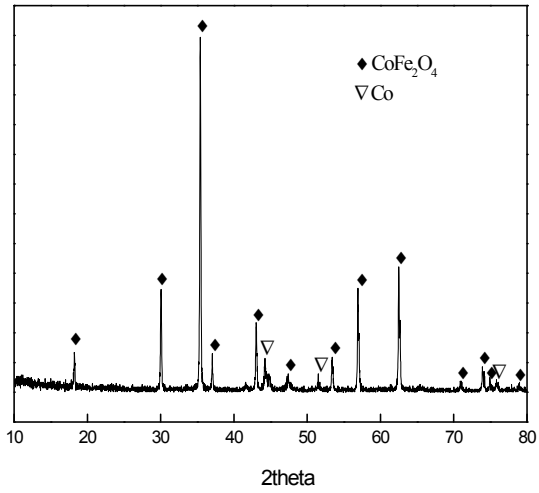

Figure SI-4. XRD patterns of precipitates with Fe (Co 5 mmol, Fe 10 mmol, H_2O 7.5 mL, 250 ^oC, 2 h).

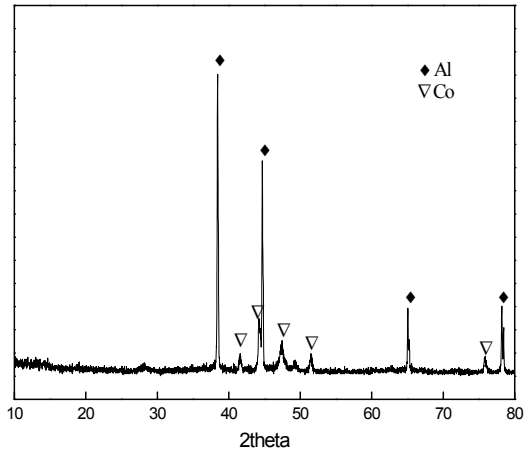

Figure SI-5. XRD patterns of precipitates with Al (Co 5 mmol, Al 10 mmol, H_2O 7.5 mL, 250 ^oC, 2 h).

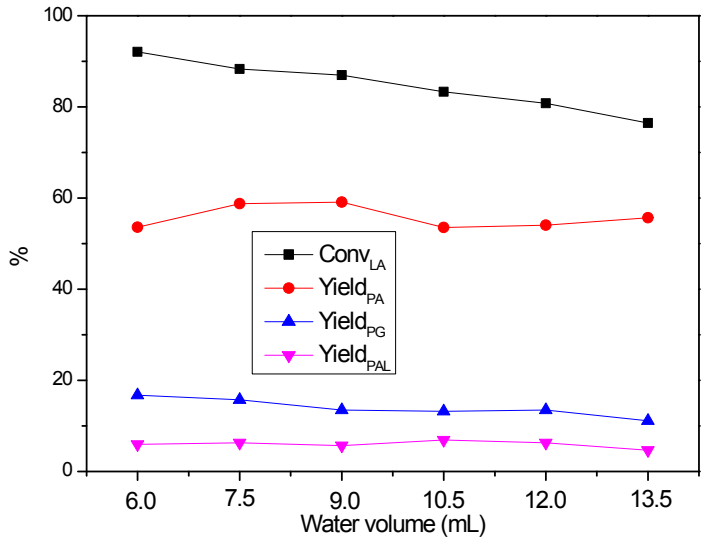

Figure SI-6. Effect of water volume (LA 1.5 mmol, Zn 10 mmol, Co 4 mmol, 250 ^{o}C, 2 h).

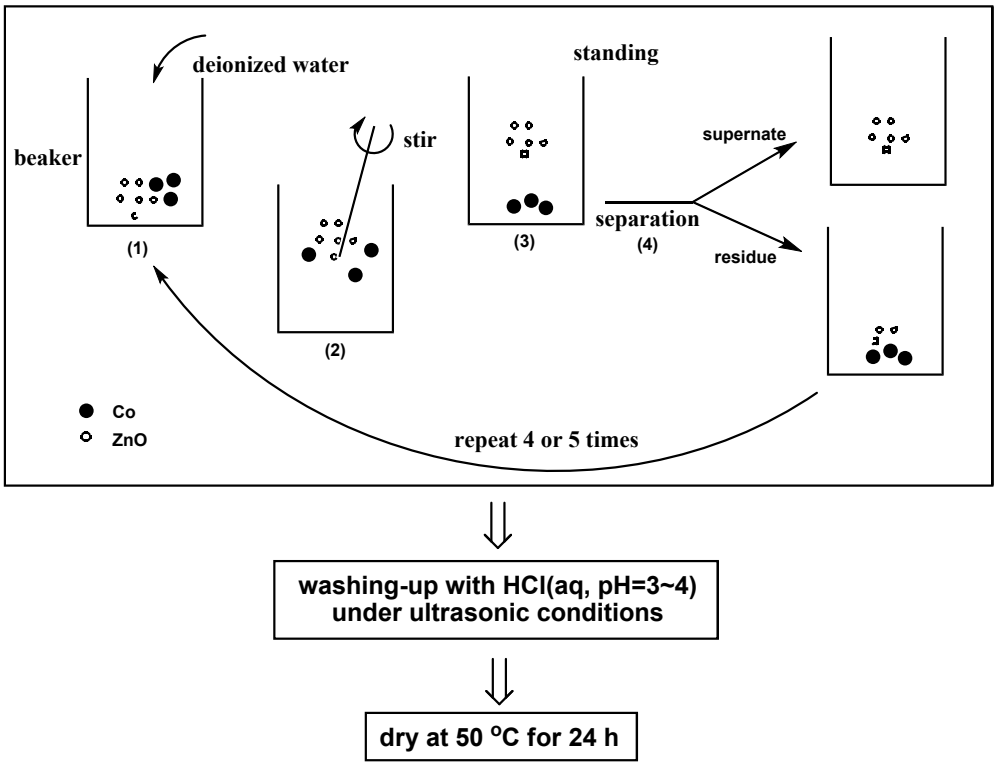

Figure SI-7. Recovery process of Co catalyst from the solid residues.

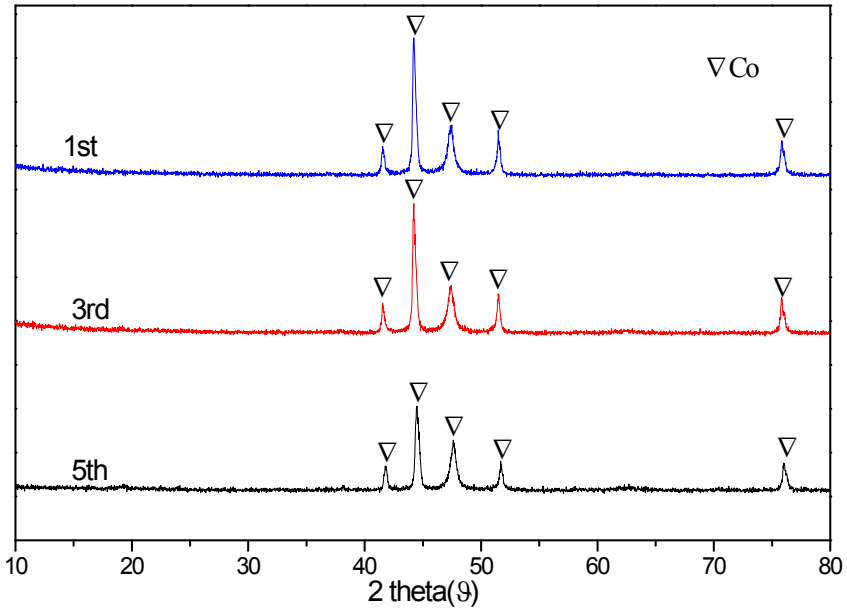

Figure SI-8. XRD patterns of recycled Co (LA 1.5 mmol, Zn 10 mmol, Co 4 mmol, H_2O 7.5 mL, 250 °C, 2 h).

Table SI-1. Effect of Co loading. [a]

Entry	Co loading (mmol)	LA conv.（%）	Yield (%)			Total
			PA	PG	NPA	
1	0	2.3	0	0	0	0
2	2	59.8	36.4	13.9	6.3	56.6
3	4	88.3	58.8	15.8	6.3	80.9
4	6	95.2	53.8	14.3	6.6	74.7
5	8	96.8	51.9	15.2	7.8	74.9
6	10	98.6	49.7	13.6	10.2	73.5

[a] Reaction conditions: LA 1.5 mmol, Zn 10 mmol, H_2O 7.5 mL, 250 °C, 2 h.

Table SI-2. Effect of reductants. [a]

Entry	Reductant	LA conv.（%）	Selectivity（%）			Total yield (%)
			PA	PG	NPA	
1	Zn	88.3	66.6	17.9	7.1	80.9
2[b]	Al	83.7	63.0	2.6	1.4	56.2
3	Fe	9.6	61.4	12.5	0	7.1
4	Mn	3.5	25.7	5.7	0	1.1

[a] Reaction conditions：LA 1.5 mmol, reductant 10 mmol, Co 4 mmol, H_2O 7.5 mL, 250 °C, 2 h. [b] Part of Al was oxidized, but oxides was not detected by XRD.

Table SI-3. Effect of amount of Zn. [a]

Entry	Amount (mmol)	LA conv.（%）	Yield（%）			Total
			PA	PG	NPA	
1	5	68.2	42.1	6.1	2.2	50.4
2	10	88.3	58.8	15.8	6.3	80.9
3	15	92.1	53.0	21.8	7.6	82.4
4	20	96.4	40.3	31.1	14.5	85.9
5	25	96.8	30.9	47.3	17.8	96.0

[a] Reaction conditions：LA 1.5 mmol, Co 4 mmol, H_2O 7.5 mL, 250 °C, 2 h.

Table SI-4. Effect of water volume. [a]

Entry	Water volume (mL)	LA conv.（%）	Yield（%）			Total
			PA	PG	NPA	
1	6.0	92.1	53.6	16.7	6.0	76.3
2	7.5	88.3	58.8	15.8	6.3	80.9
3	9.0	86.9	59.1	13.5	5.7	78.3
4	10.5	83.3	53.6	13.2	6.9	73.7
5	12.0	80.8	54.0	13.5	6.3	73.3
6	13.5	76.5	55.7	11.1	4.7	71.5

[a] Reaction conditions：LA 1.5 mmol, Zn 10 mmol, Co 4 mmol, 250 °C, 2 h.

Table SI-5. Recyclability of Co catalyst. [a]

Entry	Catalyst	Yield of PA（%）
1	fresh	58.8
2	reuse 1	60.6
3	reuse 2	57.9
4	reuse 3	56.0
5	reuse 4	58.7

[a] Reaction conditions：LA 1.5 mmol, Zn 10 mmol, Co 4 mmol, H_2O 7.5 mL, 250 °C, 2 h.