

*Electronic Supplementary Information (ESI)*

**MPV Reduction of Ethyl Levulinate to  $\gamma$ -Valerolactone by  
Biomass-derived Chitosan-Supported Zr Catalyst**

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Table S1 ICP detection of catalysts.

Catalysts	Chitosan-Zr	Recovered chitosan-Zr	Chitosan-Ru	Chitosan-Co	Chitosan-Ni	Chitosan-Hf	Chitin-Zr
Metal content (wt %)	6.0	5.7	6.14	5.82	5.40	5.1	5.2

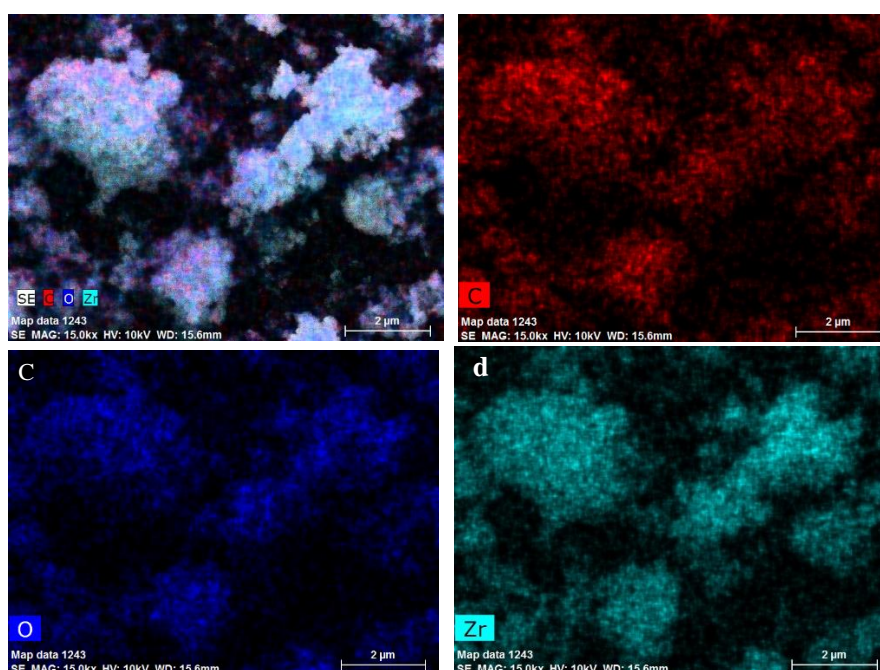


Fig. S1 EDS mapping of the distribution of C, O, Zr element in chitosan-Zr.

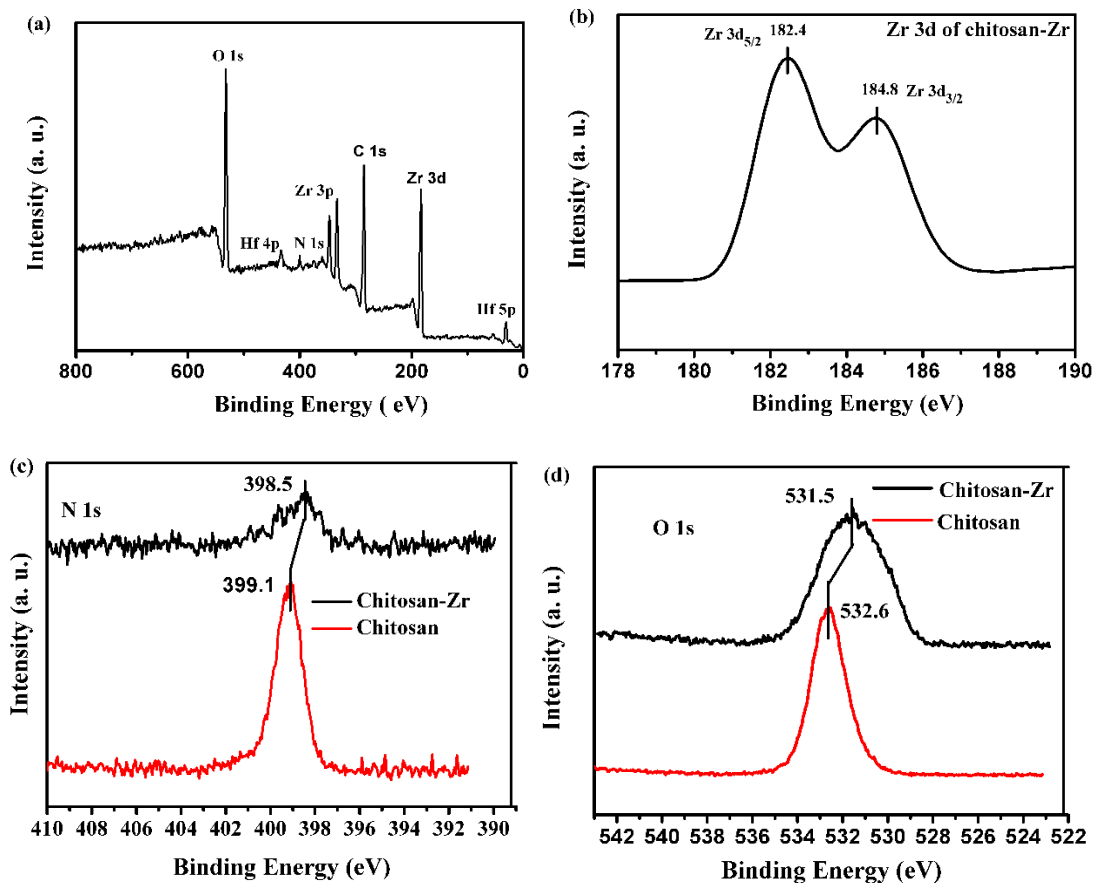


Fig. S2 XPS detection. (a) XPS survey scan. (b) Zr 3d spectrum of chitosan-Zr. (c) N 1s spectra of chitosan-Zr and chitosan. (d) O 1s spectra of chitosan-Zr and chitosan.

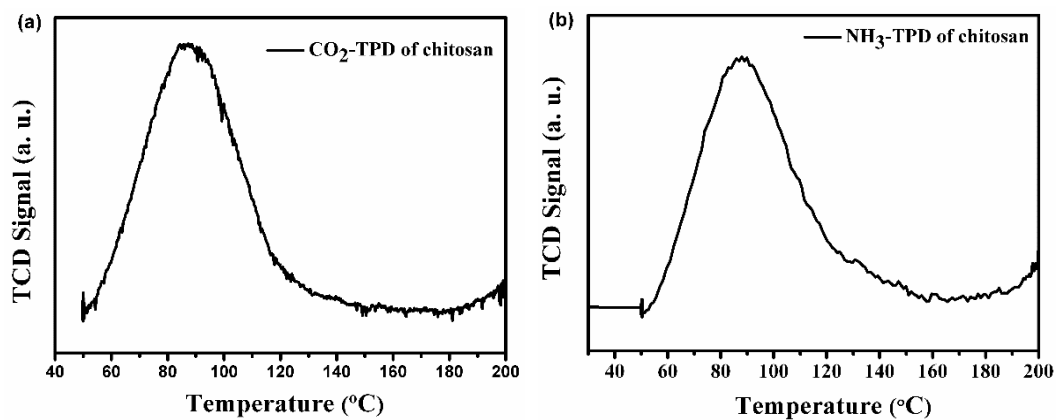


Fig. S3 CO<sub>2</sub>-TPD and NH<sub>3</sub>-TPD of chitosan.

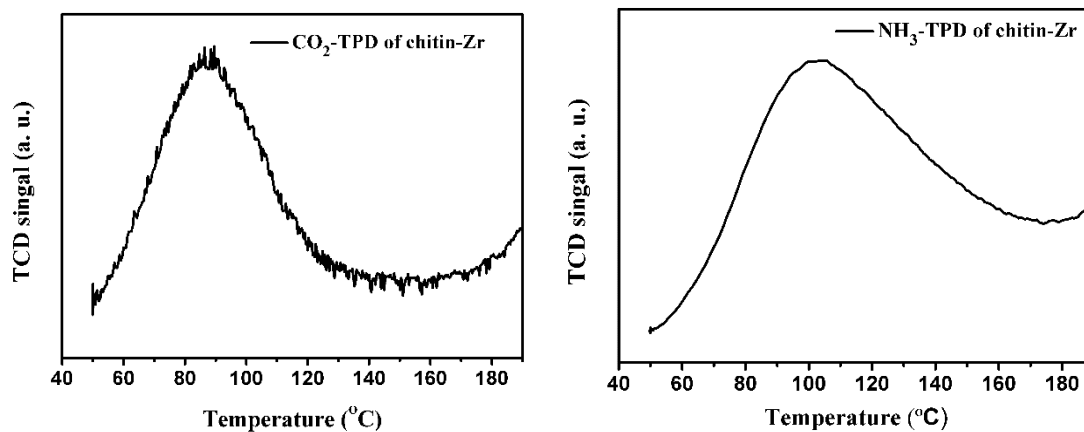


Fig. S4  $\text{CO}_2$ -TPD and  $\text{NH}_3$ -TPD of chitin-Zr.

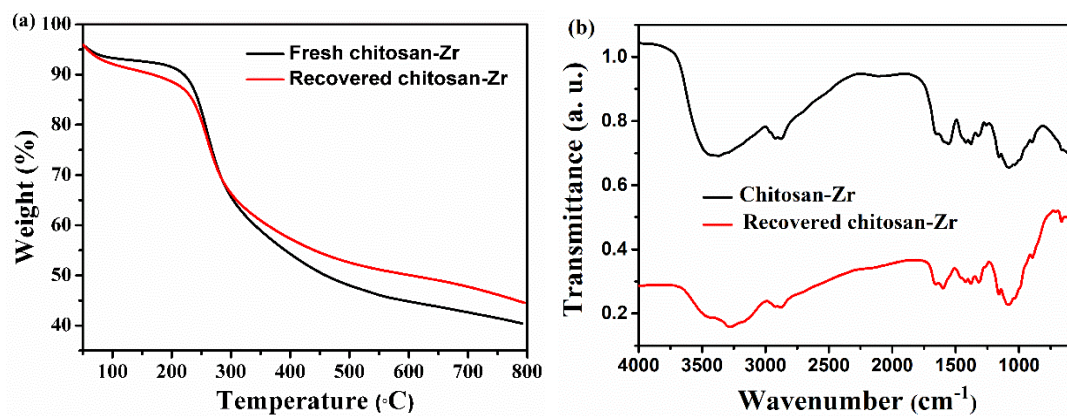


Fig. S5 (a) TG and (b) FT-IR Analysis of the fresh-prepared and recovered Zr-chitosan.

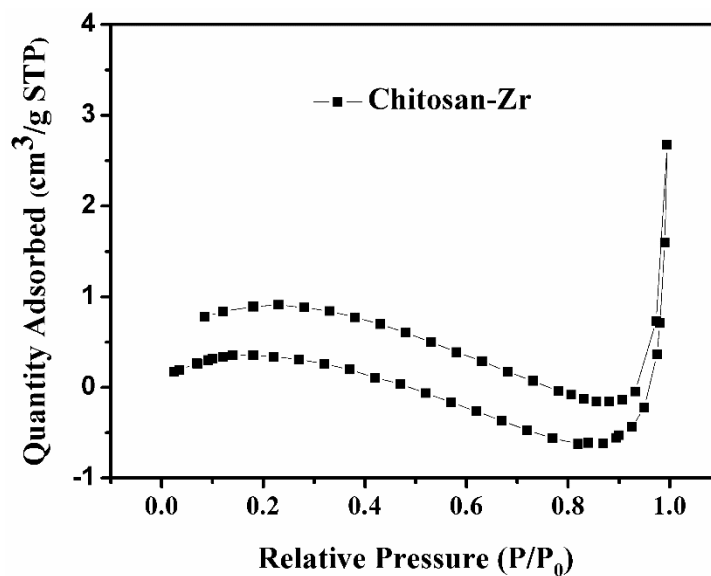


Fig. S6.  $\text{N}_2$  adsorption-desorption isotherm for chitosan-Zr.

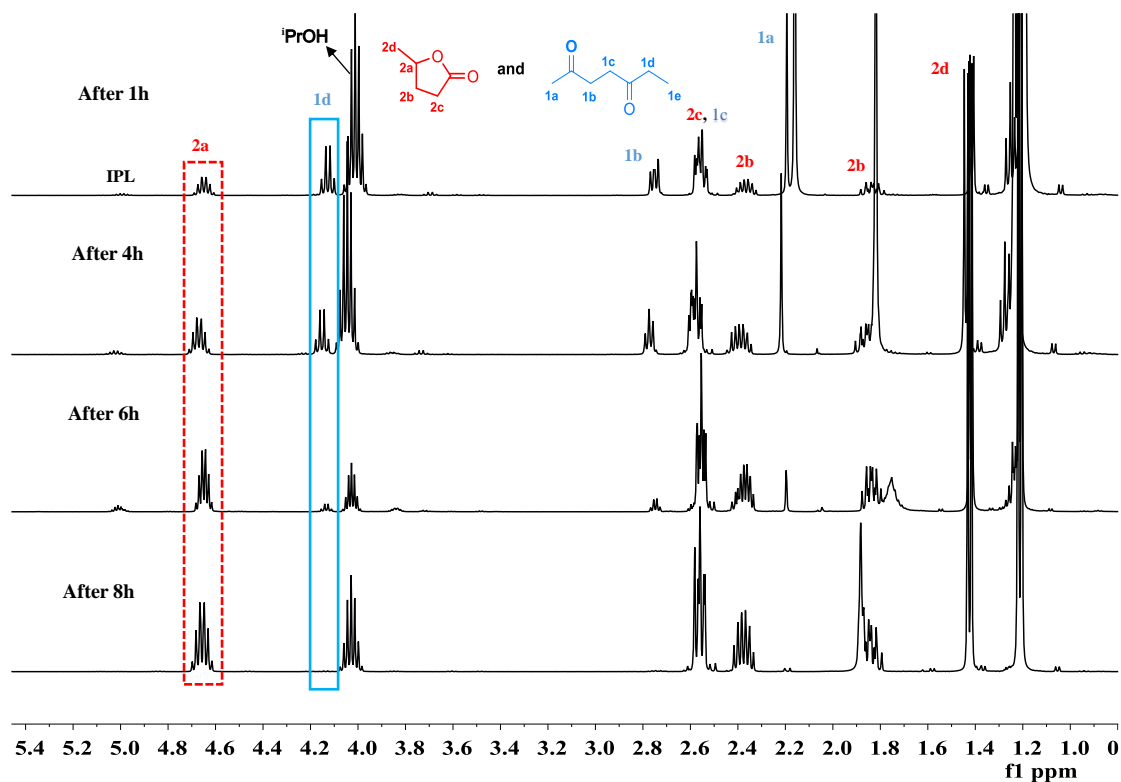


Fig. S7 Overlay of the  $^1\text{H}$  NMR spectra obtained for the reduction of EL to GVL. Conditions: 0.25 mmol EL, 15 mol% chitosan-Zr, 1 mL isopropanol, 160  $^\circ\text{C}$  ( $\text{CDCl}_3$ , 500 MHz).

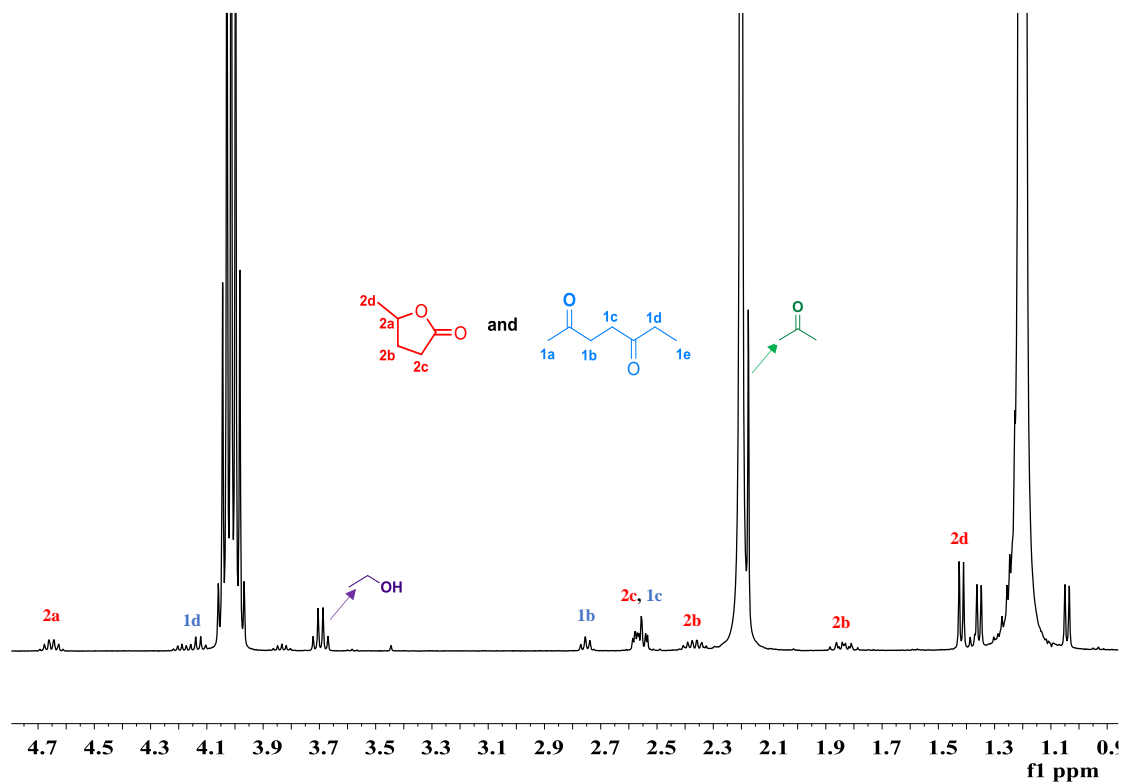


Fig. S8  $^1\text{H}$  NMR spectra for the reaction mixture of EL to GVL conversion. Conditions: 0.25 mmol EL, 15 mol% chitosan-Zr, 1 ml isopropanol, 160  $^\circ\text{C}$  and 2 h ( $\text{CDCl}_3$ , 500 MHz).