Supporting Information

From levulinic acid biorefineries to γ-valerolactone (GVL) using a bi-functional Zr-Al-Beta catalyst

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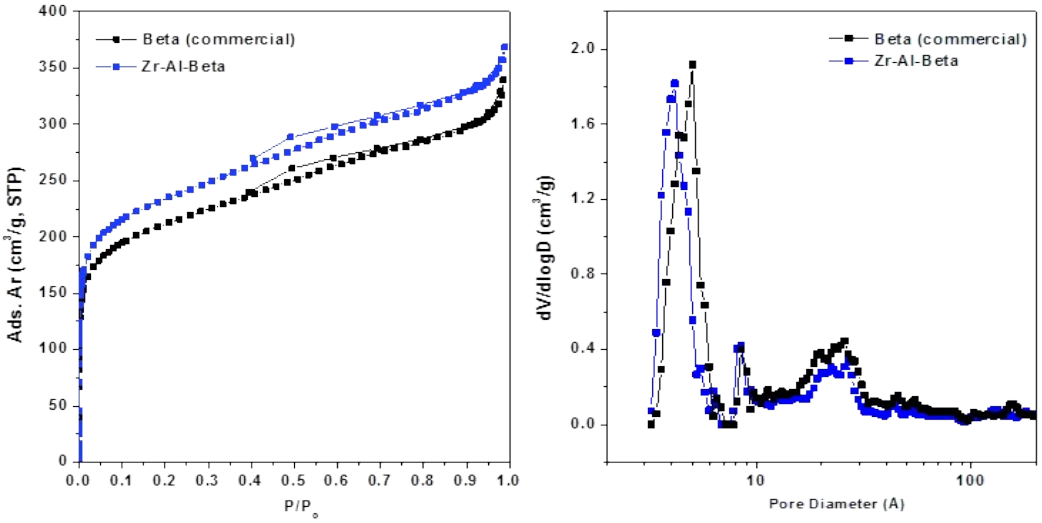


Figure ESI 1. Ar adsorption-desorption isotherms of commercial H-Beta zeolite and Zr-Al-Beta (left side). Pore sizes distribution of commercial H-Beta parent zeolite and Zr-Al-Beta (right side).

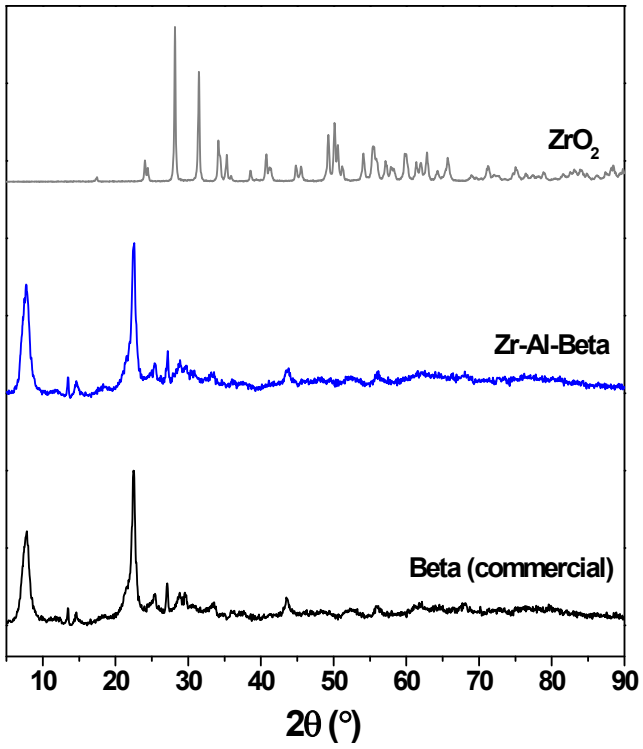


Figure ESI 2. XRD patterns of Zr-Al-Beta, as compared to commercial Beta zeolite and crystalline ZrO_2 (monoclinic phase).

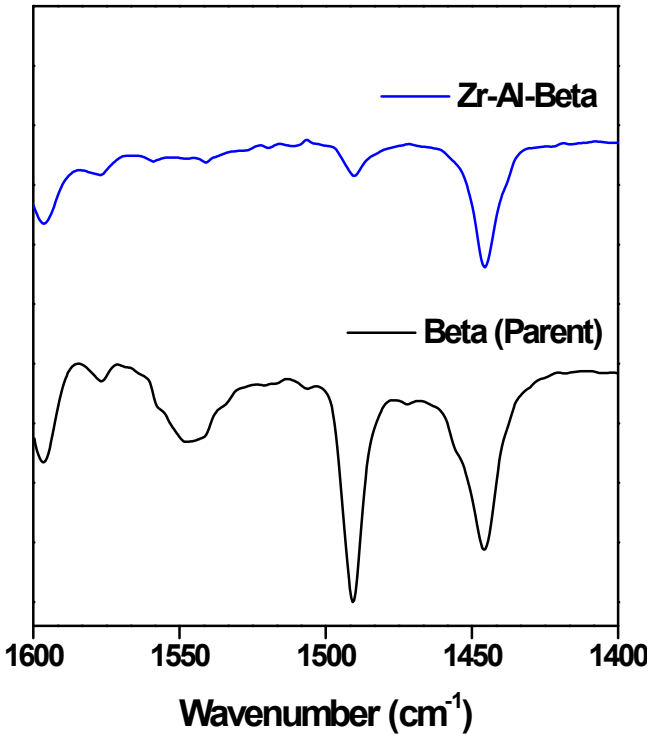


Figure ESI 3. DRIFT signals of adsorbed pyridine on parent (commercial) Beta and Zr-Al-Beta zeolites.

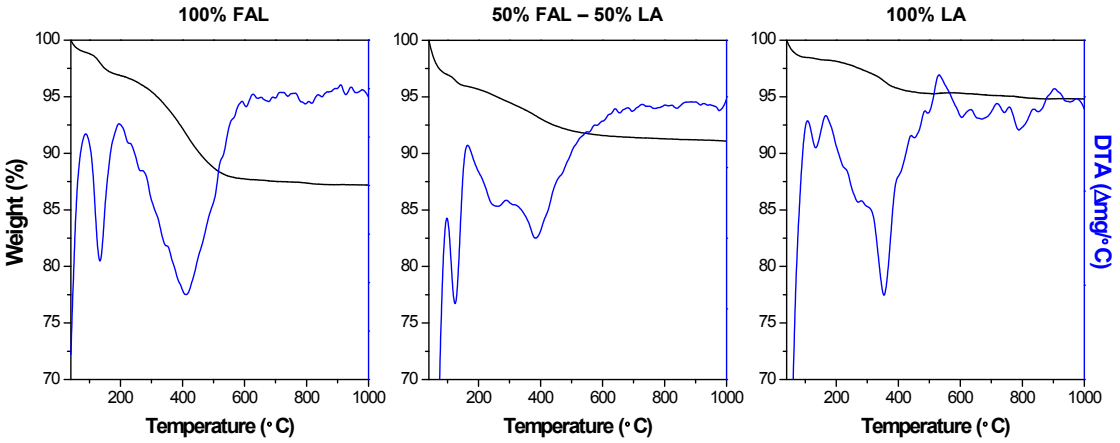


Figure ESI 4. Thermogravimetric analysis of spent Zr-Al-Beta used in the transformation of furfural (left), levulinic acid (right) and mixtures FAL-LA (50 % mol) (middle) into GVL. Reaction conditions: temperature = 170 °C; reaction time = 24 h, catalyst loading = 12.5 $g \cdot L^{-1}$; substrate concentration (FAL/LA) = 0.16 $mol \cdot L^{-1}$; isopropanol volume = 0.04L.

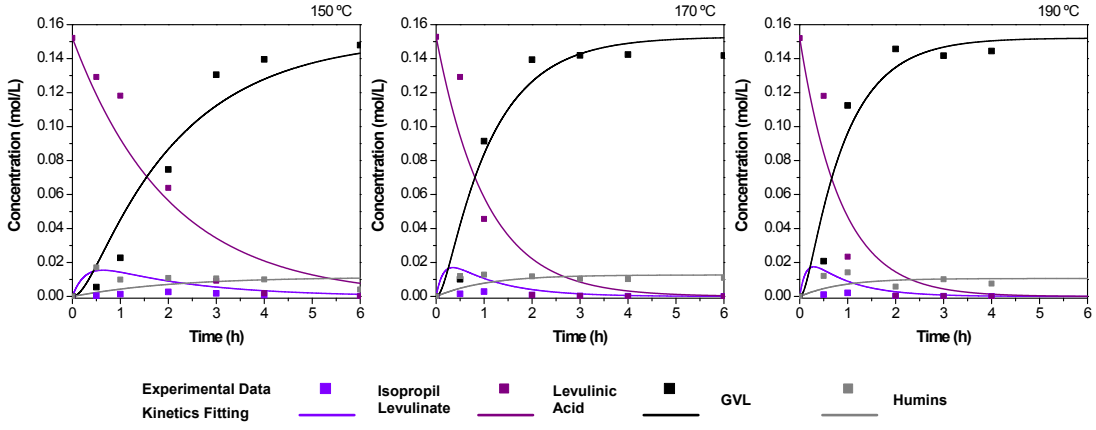


Figure ESI 5. Experimental (symbol) and modelled (solid lines) concentration of the compounds involved in the process of LA transformation into GVL in isopropanol over Zr-Al-Beta catalyst. Reaction conditions: temperature = 150 - 170 - 190 °C; catalyst loading = 12.5 $g \cdot L^{-1}$; levulinic acid concentration = 18 $g \cdot L^{-1}$; isopropanol volume = 0.04L.

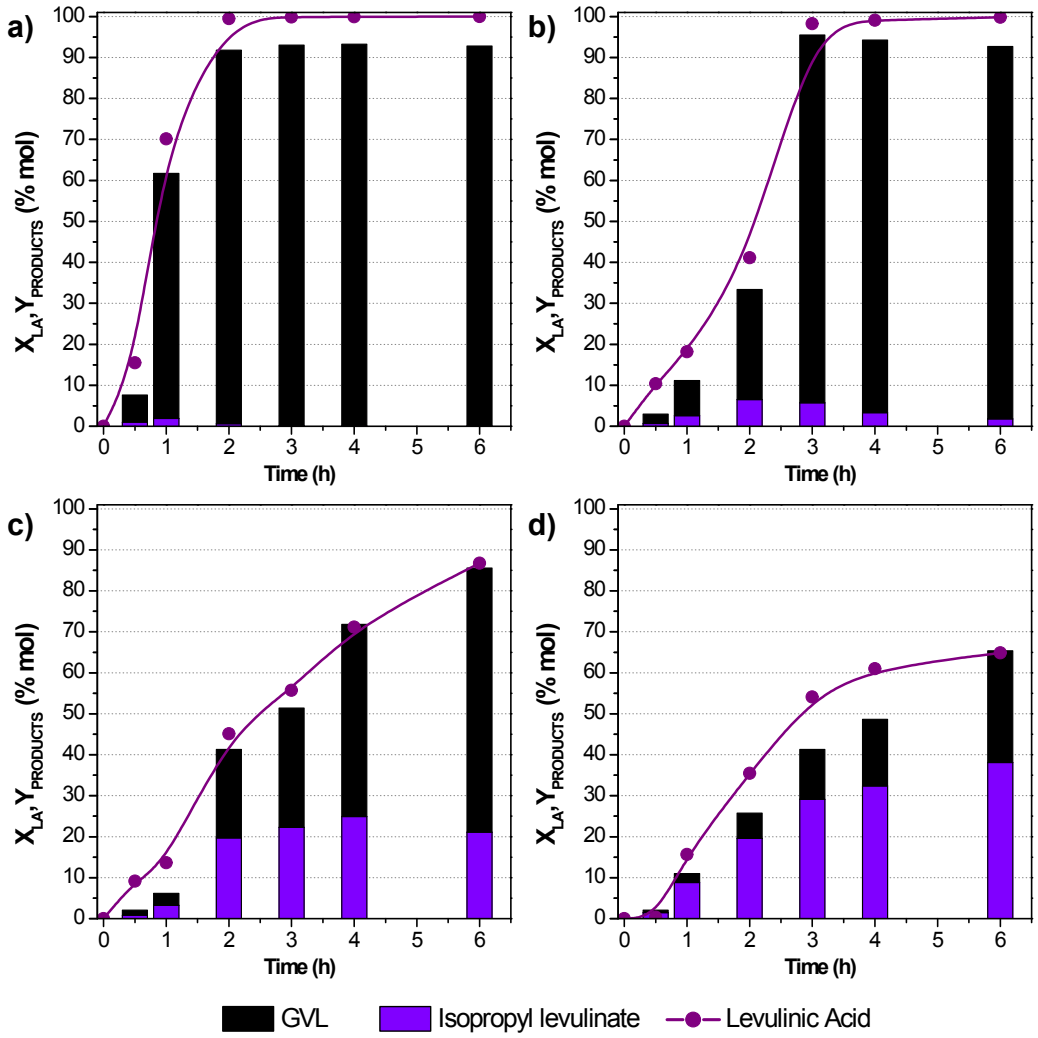
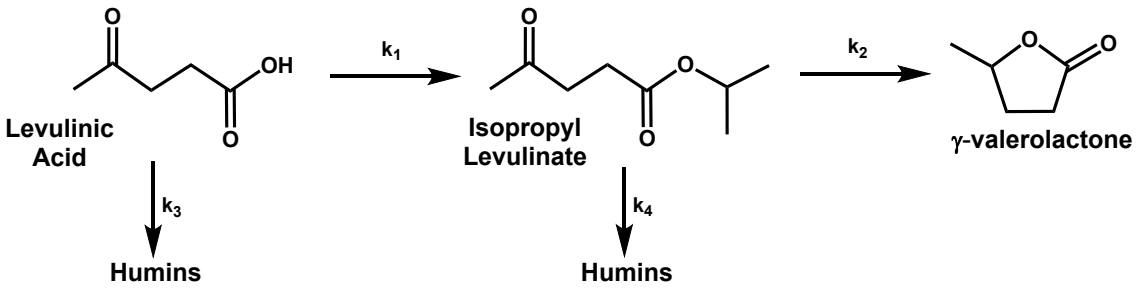


Figure ESI 6. Levulinic acid conversion and products distribution for the initial concentration study. Reaction conditions: temperature = 170 °C, catalyst loading = 12.5 g·L^{-1}; levulinic acid concentration = (a) 18, (b) 63, (c) 152, (d) 300 g·L^{-1}; isopropanol volume = 0.04 L.



Scheme ESI 1. Proposed reaction network for the transformation of LA into GVL in isopropanol. Humins: degradation products.