Supplementary material

Promoter effect of Pt on Zr catalysts to increase the conversion of furfural to γ-valerolactone using batch and continuous flow reactors: influence of the way of the incorporation of the Pt-sites

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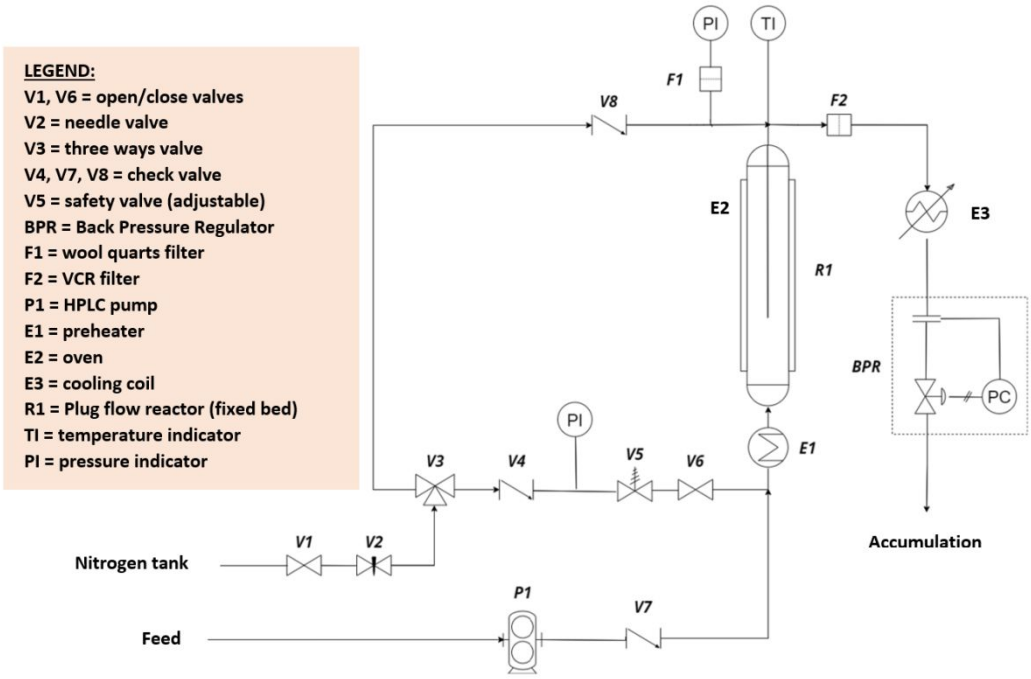

Figure S1. Scheme of the liquid-phase continuous reactor used.

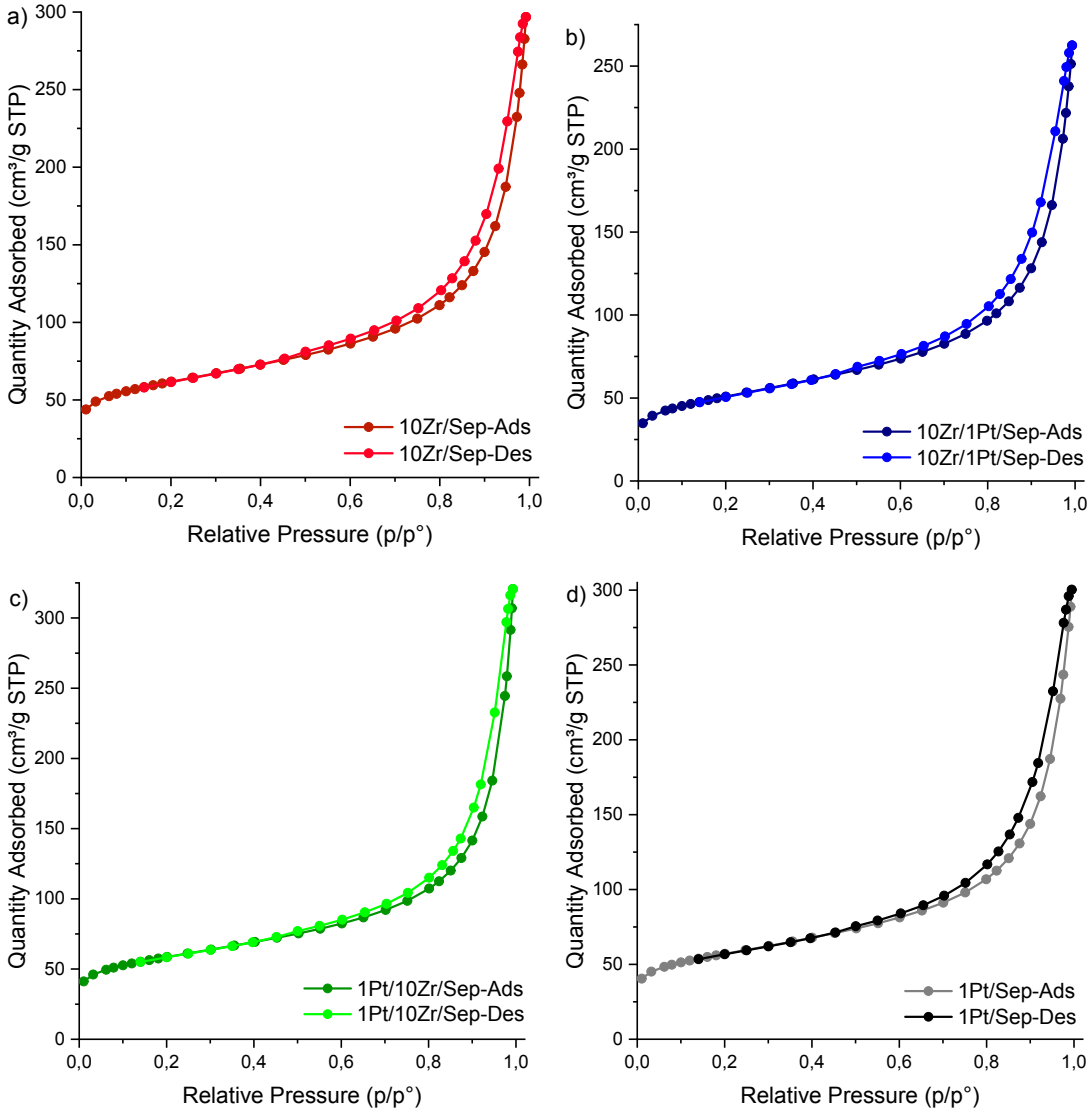

Figure S2. N_2 adsorption/ desorption isotherms of 10Zr/Sep (a), 10Zr/1Pt/Sep (b), 1Pt/10Zr/Sep (c) and 1Pt/Sep (d).

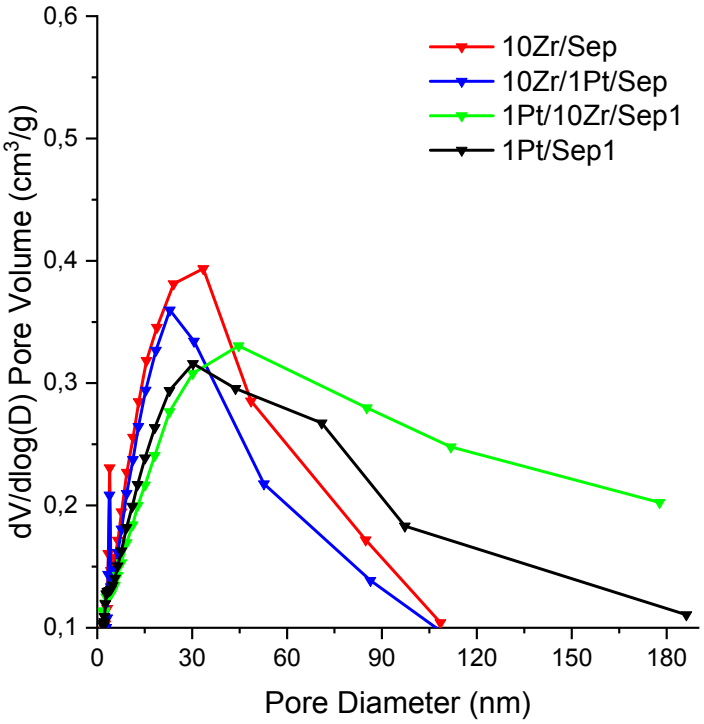

Figure S3. Pore distribution curves of 10Zr/Sep (red), 10Zr/1Pt/Sep (blue), 1Pt/10Zr/Sep (green) and 1Pt/Sep (black).

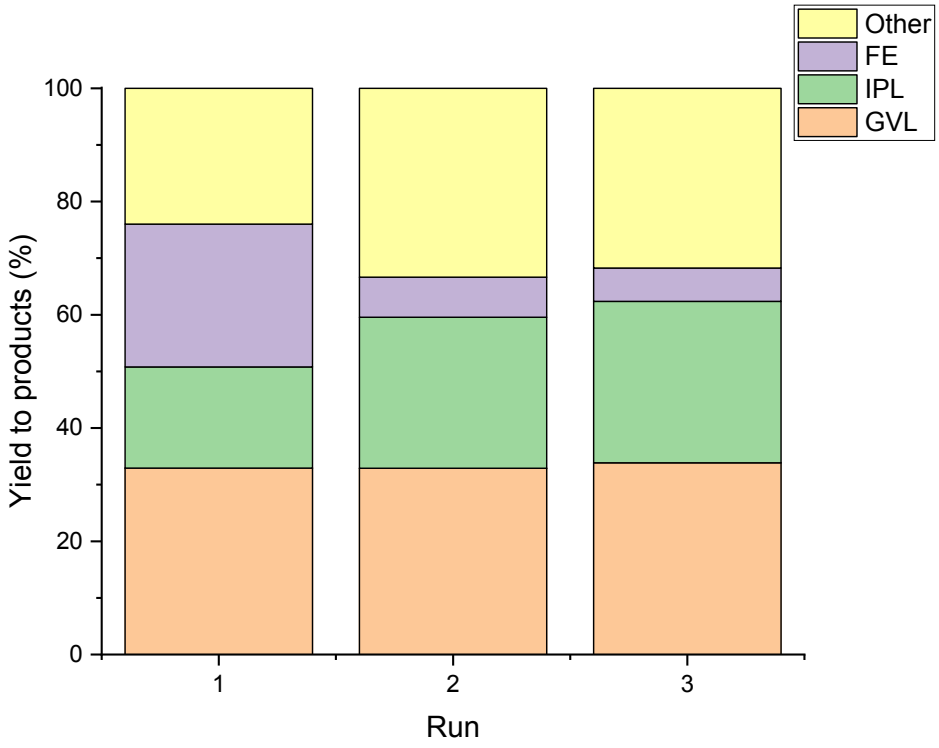

Figure S41. Re-use testing of mixture of 1Pt/Sep and 10Zr/Sep to produce GVL from FF in one-pot. Reaction conditions: Batch, 5 mL of 2-propanol, 0.25 mmol of FF, 0.05 g of each catalyst, 8 h at 180 ^{o}C.

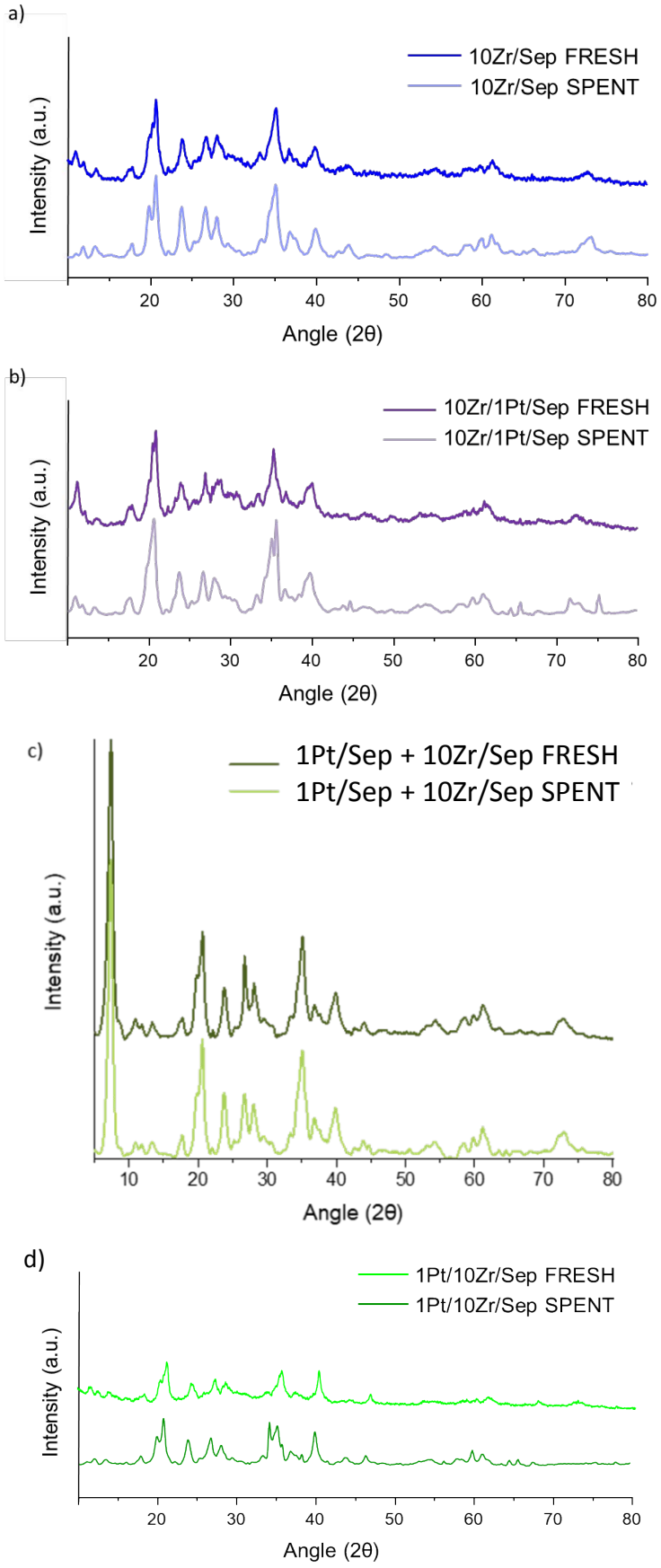

Figure S5. XRD patterns of catalyst before (fresh) and after (spent) reaction: (a) 10Zr/Sep, (b) 10Zr/1 Pt/Sep, (c) 1Pt/Sep + 10Zr/Sep and (d) 1Pt/10Zr/Sep.

The graph presented in Figure S6 displays the trend in furfural conversion and selectivity in the products of the cascade reaction from FF to GVL, using all Pt and Zr catalysts introduced in this work (continuous regime) which include 10Zr/Sep, 10Zr/1Pt/Sep, 1Pt/Sep + 10Zr/Sep. Each test was conducted at 180°C, with a contact time of 10 minutes while using a furfural solution with a concentration of 67mM and a mass of catalyst between 0.42/0.52 g.

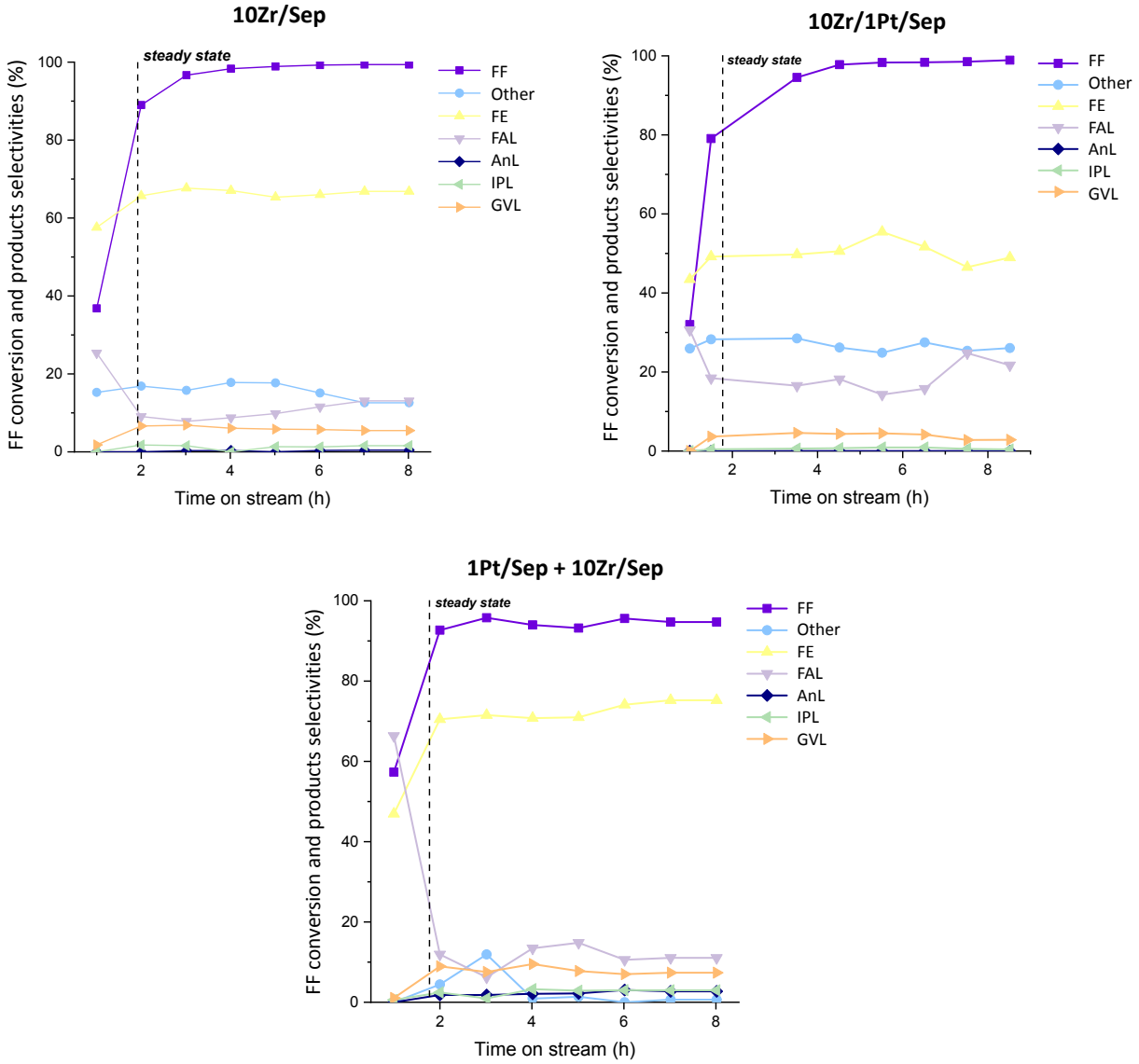

Figure S6. Furfural conversion and product selectivities (%) as a function of time (h) over 8h on 10Zr/Sep, 10Zr/1Pt/Sep, 1Pt/Sep + 10Zr/Sep. Reaction conditions: [FU]=67mM, τ=10 min, T=180 °C, m_{cat} between 0.42 and 0.52 g.

Table S1. Space time yield (STY) to FE and GVL on the different catalysts or mixtures in continuous experiments. Reaction conditions: [FF] = 67 mM, τ=10 min, T = 180 °C, m_{cat} = 0.5 g, considering steady state at time on stream of 7 h.

Catalyst	STY FE (10^{-3} g_{FE} g_{cat}^{-1} h)	STY GVL (10^{-3} g_{GVL} g_{cat}^{-1} h)
10Zr/Sep	6.5	0.34
10Zr/1Pt/Sep	5.0	0.23
1 Pt/10Zr/Sep	6.5	0.19
1Pt/Sep + 10Zr/Sep	7.6	0.60