A Hybrid FCC/HZSM-5 Catalyst for the Catalytic Cracking of a VGO/Bio-Oil Blend in FCC Conditions

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Table S1. Elemental composition, water content and simulated distillation data of the raw black poplar bio-oil

Elemental composition (wt%)	
C	55.1
H	6.3
S	0.4
O	38.6
Water content (wt%)	46.5
Simulated distillation (℃), ASTM D2887	
Initial boiling point (IBP)	35
5 wt%	55
25 wt%	74
50 wt%	154
90 wt%	263
Final boiling point (FBP)	335

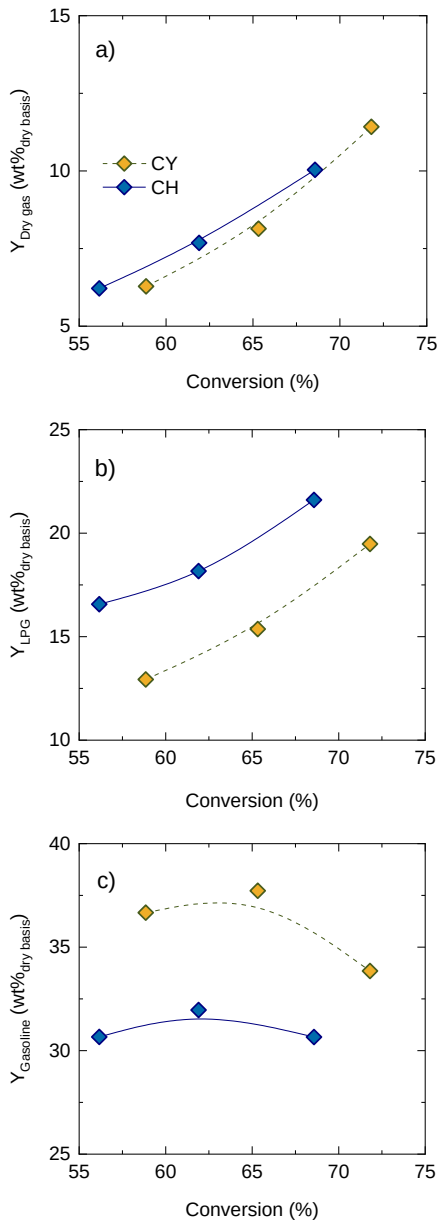

Figure S1. Comparison of the evolution with conversión of the yields of a) dry gas, b) LPGs and c) gasoline in the cracking of the VGO/bio-oil blend using the two different catalysts (C/O, $6g_{cat}g_{feed}^{-1}$; t, 6 s).

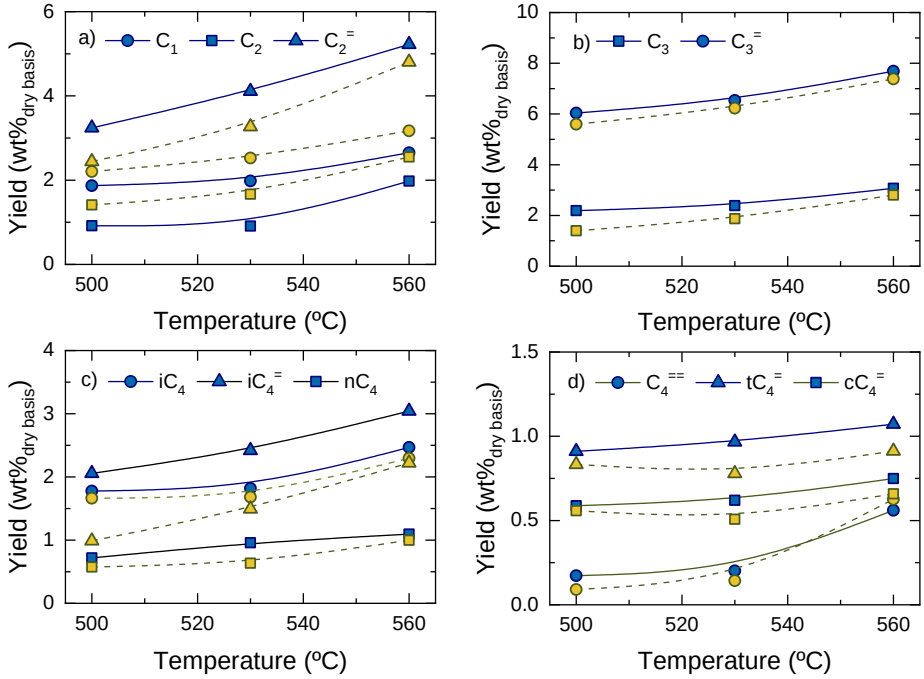

Figure S2. Effect of reaction temperature on the yields of the a) C_1-C_2, b) C_3, c) and d) C_4 gas phase compounds in the catalytic cracking of the VGO/bio-oil blend. (CY, dashed green-yellow trend; CH, continuous blue trend)

Table S2. Comparison of the effect of temperature on the olefinity and iso-olefinity of the C_5-C_6 families in the gasoline fraction produced in the cracking of the VGO/bio-oil blend using the CY and CH catalysts (C/O, $6 g_{cat} g_{feed}^{-1}$; t, 6 s).

	Catalyst	500 ℃	530 ℃	560 ℃
$C_5^=/C_{5\ Total}$	CY	0.47	0.58	0.62
	CH	0.35	0.57	0.68
$C_6^=/C_{6\ Total}$	CY	0.46	0.55	0.58
	CH	0.42	0.63	0.66
$i\text{-}C_5^=/n\text{-}C_5^=$	CY	1.43	1.27	1.11
	CH	1.17	1.03	0.92
$i\text{-}C_6^=/n\text{-}C_6^=$	CY	0.57	0.56	0.44
	CH	0.33	0.30	0.18

Table S3. Comparison of the effect of temperature on the iso-parafinity of the C_5-C_6 families in the gasoline fraction produced in the cracking of the VGO/bio-oil blend using the CY and CH catalysts (C/O, $6g_{cat}g_{feed}^{-1}$; t, 6 s).

	Catalyst	500 ℃	530 ℃	560 ℃
i-C_5/n-C_5	CY	7.54	6.25	5.06
	CH	7.01	6.10	4.25
i-C_6/n-C_6	CY	4.22	3.38	2.64
	CH	2.49	1.65	1.06

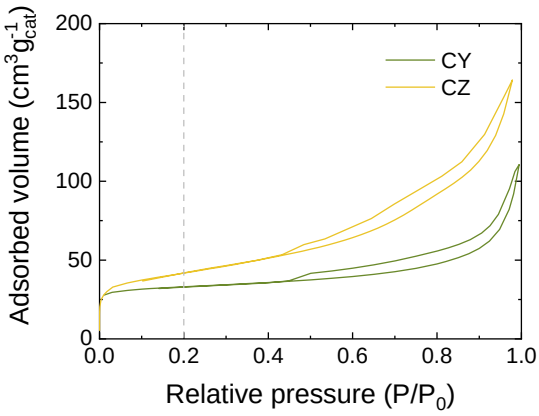

Figure S3. N_2 adsorption-desorption isotherms for the fresh commercial FCC (CY) and HZSM-5 (CZ) catalysts

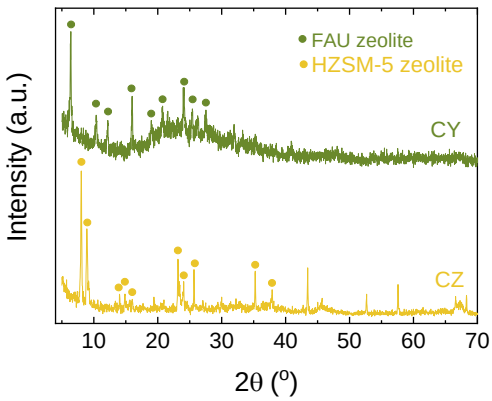

Figure S4. Wide-angle XRD patterns for the fresh commercial FCC (CY) and HZSM-5 (CZ) catalysts

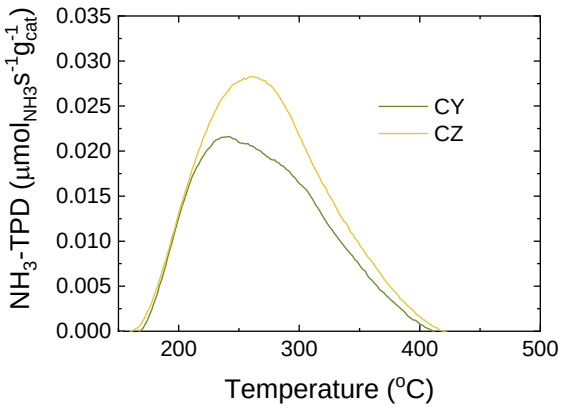

Figure S5. NH_3-TPD curves for the fresh commercial FCC (CY) and HZSM-5 (CZ) catalysts

Table S4. Chemical composition of the raw black poplar bio-oil

Chemical group/compound	**Concentration (wt% dry basis)**	**Formula**
Acids and esters	21.7	
Acetic acid	15.5	$C_2H_4O_2$
Formic acid	2.1	CH_2O_2
Levulinic acid	1.5	$C_5H_8O_3$
Methacrylic acid	1.8	$C_4H_6O_2$
Aldehydes	19.4	
Hydroxyacetaldehyde	7.8	$C_2H_4O_2$
Succinaldehyde	1.9	$C_4H_6O_2$
Benzaldehyde, 3-ethoxy-2-hydroxy	1.0	$C_9H_{10}O_3$
Butanal, 3-methyl	1.1	$C_5H_{10}O$
Syringaldehyde	1.0	$C_9H_{10}O_4$
Cinnamaldehyde, 4-hydroxy-2-methoxy	1.6	$C_{10}H_{10}O_3$
Ketones	16.3	
1-hydroxy-2-propanone	6.5	$C_3H_6O_2$
1,2-cyclopentanedione, 3-methyl	3.8	$C_6H_8O_2$
Acetophenone, 4'-hydroxy-3'-methoxy	2.0	$C_9H_{10}O_2$
2,3-Pentadione	1.0	$C_5H_8O_2$
Acetone	0.7	C_3H_6O
Phenols	5.1	
Phenol	2.6	C_6H_6O
Catechol	0.7	$C_6H_6O_2$
Syringol	0.9	$C_8H_{10}O_3$
Alcohols	9.7	
Cyclopropylcarbinol	6.0	C_4H_8O
Benzyl alcohol	1.6	C_7H_8O
Ethers	2.8	
Sugars	24.1	
Levoglucosan	21.6	$C_6H_{10}O_5$
Non identified	0.9	

Table S5. Physico-chemical properties of the VGO

Density (g cm^{-3})	0.918
Average molecular weight (g mol^{-1})	370.3
Elemental composition (wt%)	
C	85.4
H	11.8
S	2.8
O	-
Chemical composition (wt%)	
Aliphatics	47.2
Aromatics	43.1
Sulfur compounds	9.7
Simulated distillation (℃), ASTM D2887	
Initial boiling point (IBP)	184
5 wt%	367
25 wt%	432
50 wt%	474
90 wt%	533
Final boiling point (FBP)	614