The crucial role of clay binders on the performance of ZSM-5 based materials for biomass catalytic pyrolysis

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Supporting information

2. Experimental

2.2 Products characterisation and data treatment

2.2.6 Gas chromatography coupled to mass spectrometry

An external calibration of the GC-MS was carried out using the most representative compounds of each group, which included a total of 13 compounds (acetic acid, diethoxypropane, furfural, phenol, guaiacol, cresol, creosol, syringol, toluene, xylene, trimethylbenzene, naphthalene and levoglucosan), being calibrated using 10 different concentrations. With these standards, a relative area of at least 67% was accurately quantified for the experiments included in this article. The response factors of the remaining compounds were estimated as the average response factor of the corresponding group.

3. Results and discussion

3.2 Pyrolysis of wheat straw using technical catalysts

Table S1. Mass yield of gaseous hydrocarbons obtained in the WS-ac pyrolysis over both pure clays and ZSM-5 based catalysts.

Sample	Light paraffins (wt%·10^{-2})				Light olefins (wt%·10^{-2})		
	CH_4	C_2H_6	C_3H_8	C_4H_{10}	C_2H_4	C_3H_6	C_4H_8
Non-catalytic	34.3	5.6	2.0	0.4	5.5	4.5	0.4
BNT	36.1	6.4	2.1	0.5	6.3	5.0	0.5
ATP	38.7	7.4	2.2	0.6	6.4	4.9	0.5
ZrO_2/n-ZSM-5	33.4	6.7	2.6	1.2	8.5	12.8	2.3
ZrO_2/n-ZSM-5-BNT	41.2	7.7	2.5	1.1	8.3	9.1	2.1
ZrO_2/n-ZSM-5-ATP	61.0	11.8	4.0	2.8	14.7	22.3	4.1

Table S2. Amount (referred to the raw catalyst weight) and elemental composition of the coke deposited over both pure clays and ZSM-5 based catalysts during WS-ac pyrolysis.

Catalyst	%Coke	Ultimate analysis (wt%)			
		C	H	N	O
BNT	5.2	36.0	9.7	0.2	54.2
ATP	10.7	58.9	5.9	1.3	33.9
ZrO_2/n-ZSM-5	12.8	81.2	6.2	1.5	11.1
ZrO_2/n-ZSM-5-BNT	9.3	60.2	11.7	1.1	27.0
ZrO_2/n-ZSM-5-ATP	12.2	57.6	4.8	1.6	36.1