Electronic Supplementary Information (ESI) – Catalytic Fast Pyrolysis over Zeolites, Yildiz *et.al.*

Table ESI-1. Process parameters and calculated data based on the provided information in selected *in situ* studies.

Process parameters				Calculated data					
Reactor (T, °C)	**Catalyst (Si/Al ratio)**	**Catalyst-to-biomass ratio [g·g^{-1}]**	**WHSV [h^{-1}]**	**Catalyst to-total liquid [g·g^{-1}][1]**	**Catalyst-to-organics [g·g^{-1}][1]**	**% decrease in organics[2]**	**% decrease in O content of organics[2]**	**% increase in HHV of organics[2]**	**Reference**
BFB (500 °C)	H-ZSM-5 (N/A)	-	2	3	-	-	-	24.3	42 [3]
CFB (468 °C)	FCC (N/A)	22	-	-	-	76.5	-	-	13 [4]
CFB (421 °C)		3.5	-	-	-	50.4	-	-	
CFB (402°C)	ZSM-5 based FCC (10 wt% USY) (N/A)	18	-	-	-	42.9	-	-	
CFB (402 °C)		4.3	-	-	-	17.2	-	-	
CFB (405 °C)		2.9	-	-	-	32.1	-	-	
BFB (475 °C)	FCC (2.67)	-	2	1.23	3.62	72.9		-	96
	ZSM-5 (3.03)			1.08	2.07	52.7		-	
	ZSM-5 (7.78)			0.99	1.87	47.5		-	
BFB (500 °C)	CaY (N/A)	-	-	1.21	2.14	68.5	75.6	27.4	97
	β-zeolite (N/A)			1.25	3.31	79.6	80.1	4.4	
CSB (450 °C)	H-ZSM-5 (24)	-	-	0.01	0.04	48.1	66.2	37.9	78 [5]
BFB (500 °C)	ZSM-5 (11.5)	-	1.3	2.14	3.85	66.1	75.5	25.3	54
	ZSM-5 (25)			2.20	4.27	69.5	78.7	25.5	
	ZSM-5 (140)	-	2.3	0.74	1.04	28.8	40.5	15.5	
			3.1	0.55	0.73	25.4	36.6	14.3	
			4.3	0.37	0.47	16.9	26.0	10.8	

Table ESI-1. *Continued.*

Process parameters				Calculated data					
Reactor (T, °C)	**Catalyst (Si/Al ratio)**	**Catalyst-to-biomass ratio [g·g^{-1}]**	**WHSV [h^{-1}]**	**Catalyst to-total liquid [g·g^{-1}][1]**	**Catalyst-to-organics [g·g^{-1}][1]**	**% decrease in organics[2]**	**% decrease in O content of organics[2]**	**% increase in HHV of organics[2]**	**Reference**
CFB (500 °C)	ZSM-5 (N/A)	7	-	0.19	0.31	49.2	72.7	46.9	98 [4]
EF (500 °C)	H-ZSM-5 (23)	0.11	-	0.27	0.42	44.9	48.6	-0.4	79
		0.4		1.10	2.22	61.9	63.6	-2.8	
		1		3.02	6.71	68.4	70.8	1.3	
	Na-Y (5.2)	0.11	-	0.24	0.39	40.0	38.0	-16.5	
		0.4		1.13	2.80	69.7	69.0	-15.6	
		1		2.63	6.99	69.7	72.4	-2.6	
	H-Y (5.1)	1	-	2.24	4.17	49.2	54.2	4.0	
	Mg-Y (5.1)			3.03	9.09	76.7	79.2	6.7	
	Ca-Y (5.1)			3.62	10.9	80.5	83.5	12.8	
BFB (500 °C)	H-ZSM-5 (30) Cat. A	0.17	1.1	0.41	0.96	62.2	84.4	4.2	104
	H-ZSM-5 (30) Cat. B	0.13		0.31	0.78	63.1	83.4	70.4	
EF (500 °C)	Na_2CO_3	0.02	-	0.04	0.09	8.6	34.8	22.5	105
		0.05		0.11	0.23	9.0	42.6	26.6	
		0.11		0.30	0.80	45.5	75.6	36.8	
		0.25		0.89	2.50	60.8	77.4	29.0	

[1] Valid for batch operations only. [2] Compared to the non-catalytic value obtained from the same setup in the same study. [3] Experimental run time was taken as 2 h. [4] Continuous operation (*i.e.* the catalyst is circulated through a reaction/regeneration loop). [5] Biomass flow rate was taken as 240 g/h, for a 5 h run. N/A: not available; BFB: bubbling fluidized bed; CFB: circulating fluidized bed; EF: entrained flow; HHV: higher heating value, calculated based on Milne formula: HHV = 338.2*C + 1442.8*(H-(O/8)) [MJ/kg].

Table ESI-2. Process parameters and calculated data based on the provided information in selected *ex situ* studies.

Process parameters					Calculated data					
Primary reactor (T, °C)	**Secondary reactor (T, °C)**	**Catalyst (Si/Al ratio)**	**Catalyst-to-biomass ratio [g·g^{-1}]**	**WHSV [h^{-1}]**	**Catalyst to-total liquid [g·g^{-1}][1]**	**Catalyst-to-organics [g·g^{-1}][1]**	**% decrease in organics[2]**	**% decrease in O content of organics[2]**	**% increase in HHV of organics[2]**	**Reference**
BFB (400 °C)	BFB (440 °C)	H-Beta (25)	0.13	-	0.28	0.35	10.1	12.9	2.7	92
			0.25		0.61	0.85	28.5	34.6	10.3	
			0.5		1.5	2.4	50.1	55.9	16.1	
			0.99		3.8	9.5	74.8	80.4	31	
BFB (550 °C)	PB (500 °C)	ZSM-5 (N/A)	-	1.1	4.6	35.3	88.2	94.5	48.7	93 [3]
BFB (550 °C)	PB (500 °C)	ZSM-5 (50)	-	1	8.2	31.6	-	-	-	94 [3]
BFB (550 °C)	FB (500 °C)	H-ZSM-5 (N/A)	-	1.1	7.1	30.0	85.1	97.6	54.2	95
		Na-ZSM-5 (N/A)			7.7	32.9	86.5	98.1	53.8	
		Y-zeolite (N/A)			7.2	159.5	97.2	99.3	42.2	
		Activated alumina (N/A)			6.9	57.8	92.3	97.9	47.7	
EF (500 °C)	FB (500 °C)	Na_2CO_3/γ-Al_2O_3 (N/A)	1	-	3.1	10.6	80.1	92.6	78.0	80
BFB (500 °C)	FB (470 °C)	H-ZSM-5 (N/A)	-	3	0.54	-	-	-	41.3	3
BFB (475 °C)	FB (500 °C)	HZSM-5 (N/A)	-	0.1	0.23	0.46	-	-	-	99
		Ga/HZM-5 (N/A)		0.2	0.39	0.99	-	-	-	
		HY (N/A)		0.1	0.22	0.37	-	-	-	
FPR (500 °C)	FB (400 °C)	%5 Ru/TiO_2	-	0.1	0.20	0.59	46.2	-	-	100

Table ESI-2. *Continued.*

Process parameters					Calculated data					
Primary reactor (T, °C)	**Secondary reactor (T, °C)**	**Catalyst (Si/Al ratio)**	**Catalyst-to-biomass ratio [g·g^{-1}]**	**WHSV [h^{-1}]**	**Catalyst to-total liquid [g·g^{-1}][1]**	**Catalyst-to-organics [g·g^{-1}][1]**	**% decrease in organics[2]**	**% decrease in O content of organics[2]**	**% increase in HHV of organics[2]**	**Reference**
BFB (500 °C)	BFB (500 °C)	H-ZSM-5/SiO_2 (30)	0.117	-	1.60	3.91	65.1	82.6	64.7	101
		HZSM-5/Clay (30)	0.096		1.28	3.33	67.2	85.1	73.7	
BFB (450-475 °C)	BFB (425-450 °C)	H-ZSM-5 (N/A)	-	2.5	1.22[4]	3.36	76.7	93.0	53.8	102
BFB (550 °C)	FB (500 °C)	H-ZSM-5 (N/A)	-	2	2.35	7.77	75.9	-	-	103
BFB (500 °C)	BFB (500 °C)	H-ZSM-5 (30) Cat. B	0.11	1.1	0.31	0.81	69.2	88.0	77.0	104
EF (500 °C)	FB (500 °C)	10% Na_2CO_3/y-Al_2O_3	1	-	2.82	7.52	47.8	76.5	36.2	105
		20% Na_2CO_3/y-Al_2O_3			2.99	5.81	32.5	73.8	41.1	

[1] Valid for batch operations only. [2] Compared to the non-catalytic value obtained from the same setup in the same study. [3] Experimental run time is taken as 30 min. based on Ref. 94. [4] Based on the given WHSV value. N/A: not available; BFB: bubbling fluidized bed; CFB: circulating fluidized bed; EF: entrained flow; FPR: undefined fast pyrolysis reactor; FB: fixed bed; PB: packed bed. HHV: higher heating value, calculated based on Milne formula: HHV = 338.2*C + 1442.8*(H-(O/8)) [MJ/kg].