

Supporting Information

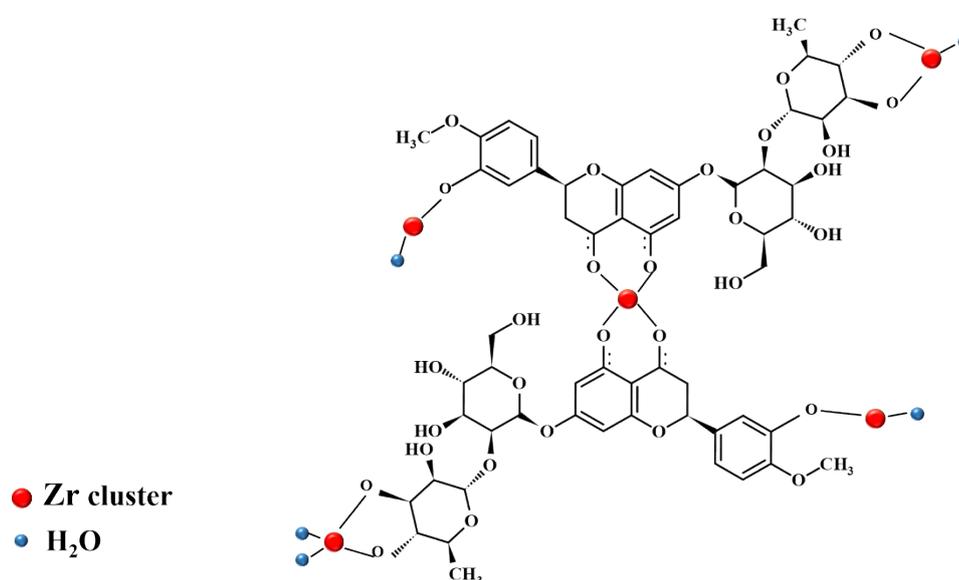
Siyu Sun ^{1,2}, Ying Wan ¹, Zheng Li ¹, Lumen Chao ¹, Yuanyuan Bai ¹, Qunhua Liu ¹, Can Wang ¹, Wen Liu ^{1*} and Peijun Ji^{2*}

¹ China National Pulp and Paper Research Institute

² College of Chemical Engineering, Beijing University of Chemical Technology

Table S1 FTIR spectra data of NES.

	NES (cm ⁻¹)
-OH stretching vibration	3500
C-H stretching vibration	2922
-C=O	1636
Benzene ring skeleton vibration	1600-1300
C-O	1200-1000
C-H	900-600



Scheme S1 Possible structure for Zr-NES_{0.1}.

Table S2 Textural properties of characterization of Zr-NES.

Sample	Surface area (m ² /g) ^a	Pore volume (cm ³ /g) ^b	Average pore size (nm) ^b
NES	25.7	0.013	4.2
Zr-NES _{0.2}	82.7	0.339	17.2
Zr-NES _{0.1}	162.1	0.442	3.3
Zr-NES _{0.05}	22.1	0.057	10.3
ZrO ₂	3.5	0.019	21.7

^a Surface areas were obtained by the method of BET. ^b Pore sizes and pore volumes were estimated by the method of BJH.

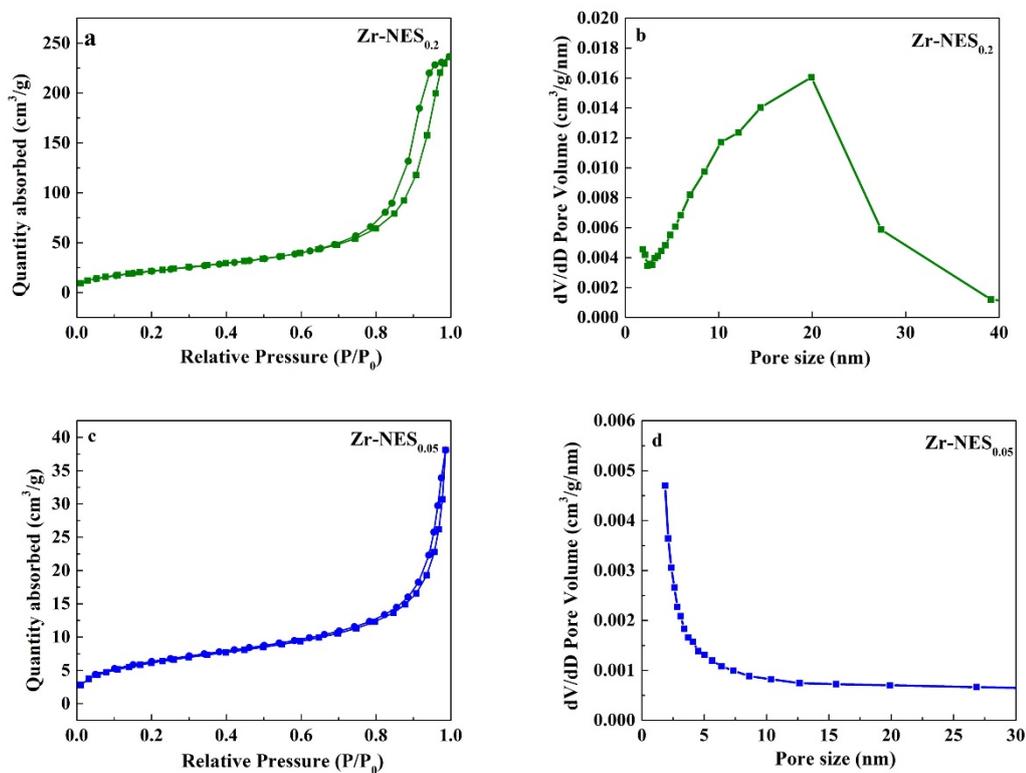


Figure S1. N₂ adsorption-desorption curves and pore diameter distribution of (a, b) Zr-NES_{0.2} and (c, d) Zr-NES_{0.05}.

Table S3 CTH of HMF to BHMF by various Zr-based catalysts.

Catalyst	T(°C)	Time(h)	Reaction conditions ^a	HMF conv. (%)	BHMF yield (%)	TOF ^b (h ⁻¹)	Ref
Zr-FDCA	140	8	2mmol/10mL/0.1g	97	96	1.62	20
ZrPN	140	2	2.5mmol/10mL/0.1g	98	98	3.55	56
Zr-DTPA	140	4	3.9mmol/31mL/0.3g	98	95	1.72	57
Zr-HTC	120	4	3.9mmol/31mL/0.2g	99	99	5.61	35
Zr-chitosan	120	4	0.25mmol/1mL/15mol%	98	94	1.67	58
Zr-LS	100	2	1mmol/10mL/0.1g	97	96	2.01	22
Zr-TA	100	5	1mmol/10mL/0.1g	95	89	0.73	23
Zr-NES _{0.1}	120	2	3.9mmol/31mL/0.1g	99	99	8.50	This work

^aReaction conditions: The reaction conditions represent, respectively, the molar amount of the reactant, the volume of the reaction solution and the mass of the catalyst. i.e. 2mmol/10mL/0.1g represent 2 mmol 5-HMF in 10 ml solvent, 0.1g catalyst.

^b
$$TOF = \frac{\text{mole of BHMF produced}}{\text{mole of Zr}^{4+} \text{ presented in the catalyst} \times \text{reaction time}} (h^{-1})$$
. The mole of Zr⁴⁺ present in the catalyst was determined by ICP-AES.