Electronic Supplementary Material (ESI) for Catalysis Science & Technology

A new way to enhance porosity and Y-faujasite percentage of *in-situ* crystallized FCC catalyst

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Supplement Information

Table S1 Chemical composition and properties of the kaolin clay

Index	**Value**
Chemical composition:	
H_2O(wt%)	14.45
Al_2O_3(wt%)	37.36
SiO_2 (wt%)	46.69
Na_2O(wt%)	0.16
K_2O(wt%)	0.24
Fe_2O_3(wt%)	0.40
TiO_2(wt%)	0.28
XRD phases:	
Kaolin (wt%)	86
Quartz (wt%)	0.5
Size distributions:	
D(v,10)(μm)	1.94
D(v,50)(μm)	3.33
D(v,90)(μm)	6.03
D(v,98)(μm)	9.40

Table S2 Properties and composition of the mixed FCC feedstock

	Vacuum gas oil (VGO)	**Vacuum tower bottom (VTB)**
Average molecular weight	418	988
Density ($g \cdot cm^{-3}$, 20℃)	0.8726	0.9182
Solidifying point (℃)	47	–
Carbon residue		7.73
Composition (%)		
Saturated hydrocarbon	75.2	28.8
Aromatics	19.2	39.5
Colloidal hydrocarbons	5.5	30.7
Asphaltine	0.1	1
Elements (%)		
C	86.61	86.97
H	13.77	12.8
S	0.21	0.26
N	0.083	0.37
Basic nitrogen (ppm)	296	1970
Metal contents (ppm)		
Ni	0.2	8
V	<0.1	0.1
Distillation (℃)		
Initial	312	424
10%	400	
50%	454	
90%	515	

Table S3 Chemical composition, physical properties and size distribution of the catalyst CAT-1 and CAT-0

Catalysts	CAT-1	CAT-0
Al_2O_3（wt%）	39.75	38.56
SiO_2（wt%）	53.49	53.92
Fe_2O_3（wt%）	0.16	0.21
La_2O_3（wt%）	5.84	5.57
Na_2O（wt%）	0.33	0.3
Attrition Index (wt %·h^{-1})	2.2	2.0
P.V. (mL·g^{-1})	0.48	0.36
S.A.(m^2·g^{-1})	410	297
Size distribution		
<40μm (V%)	19.6	18.8
40-110μm (V%)	64.7	64.4
>110μm (V%)	15.7	16.8

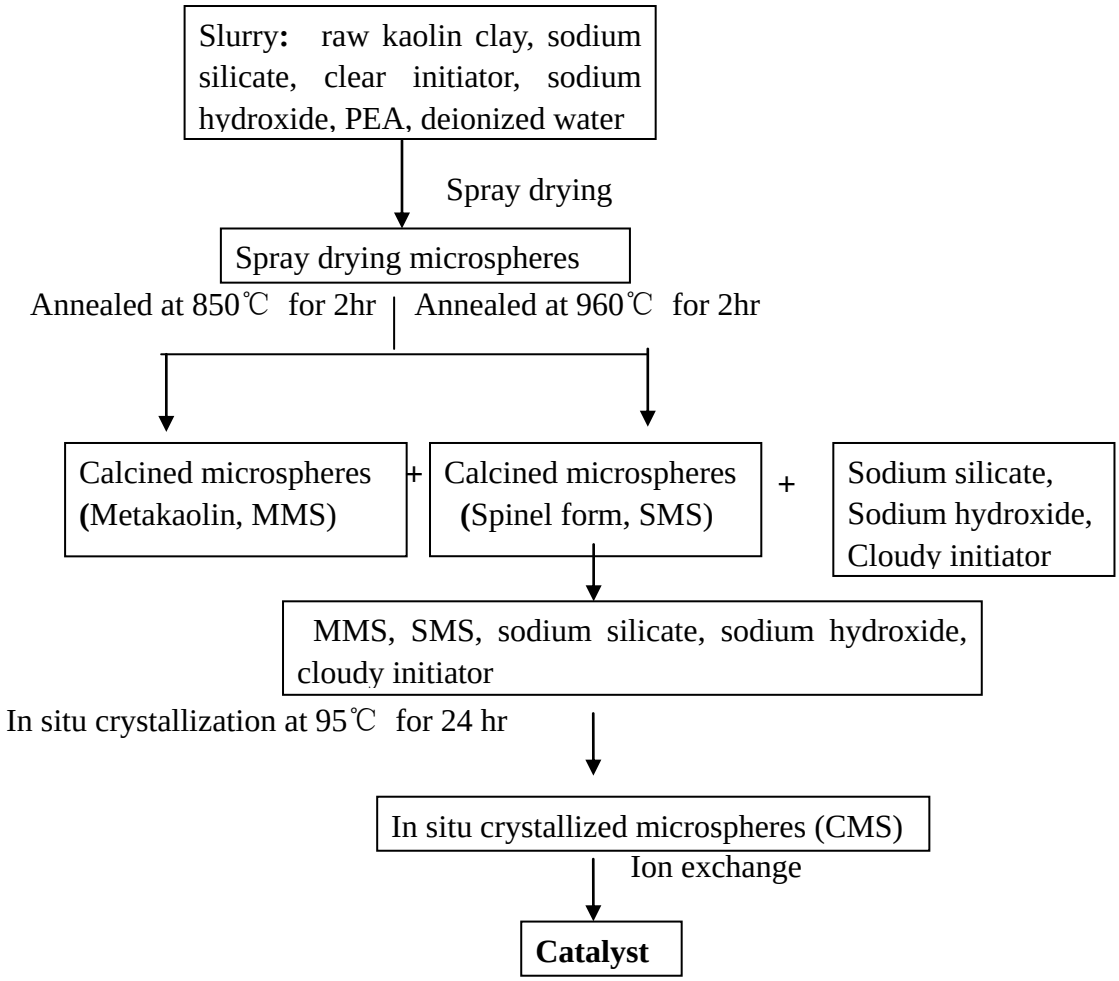

Fig. S1 Schematic diagram of the typical synthesis procedure of the *in-situ* crystallized FCC catalyst.

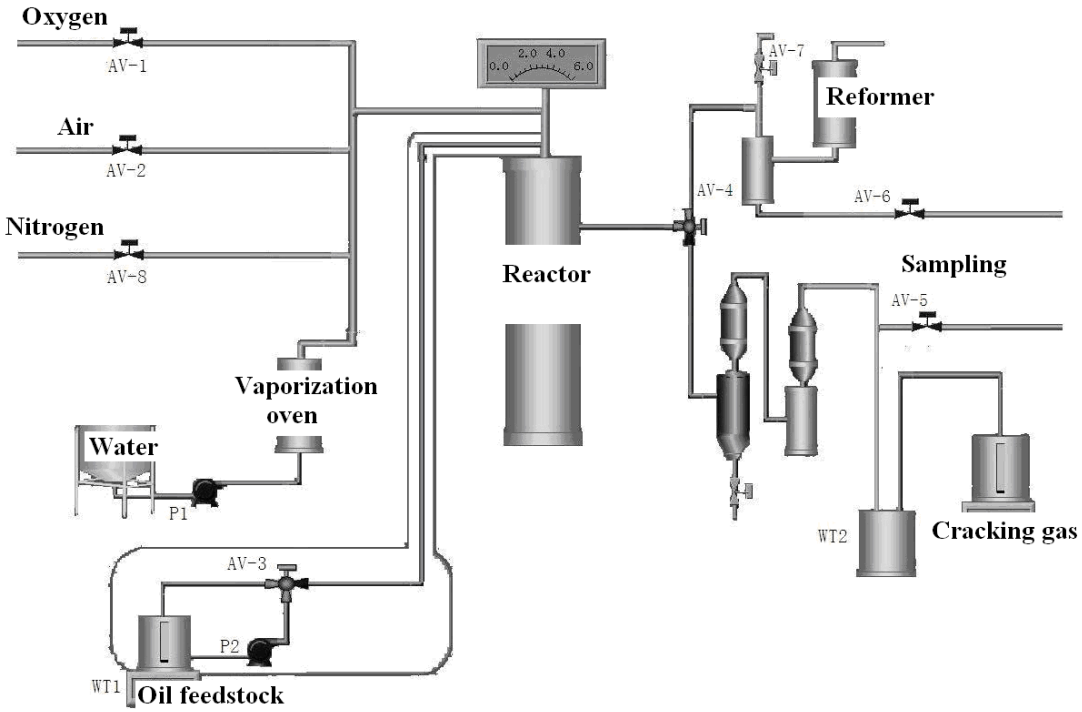

Fig. S2 Schematic diagram of the fixed fluiding bed.

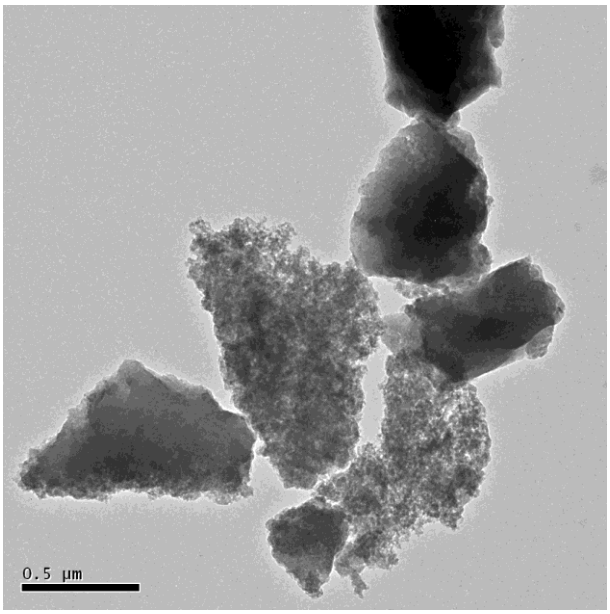

Fig. S3 TEM image of the physically and chemically treated coconut shell.

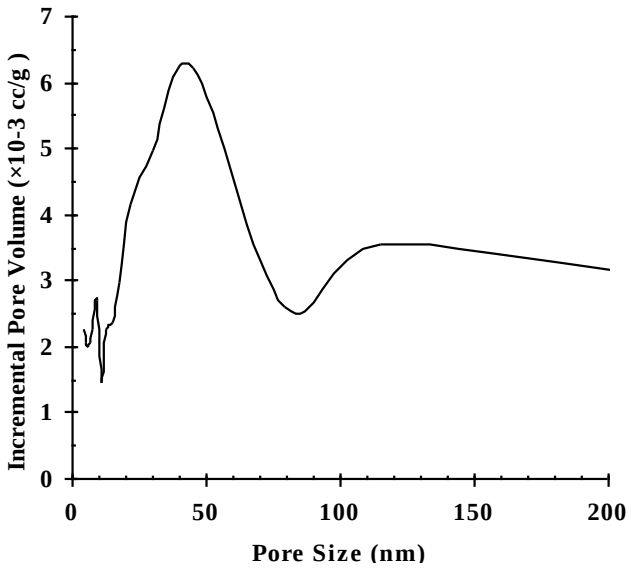

Fig. S4 The pore size distribution of the pretreated coconut shell.

Attrition index testing

Attrition index were determined by "Tube Attrition Tester" as shown in Figure S4. The samples (i.e. micro spheres) to be tested were dried at 350℃ for 30min, then cooled down to room temperature. 10g of microspheres was placed in tube 1 of the tester. The moisture saturated air was compressed in tube 1 at a flowing velocity of 20L·min^{-1}, the microspheres in the tube 1 will fluidize and rub against each other or against the tube surface, producing powder due to attrition. The produced powder was blown into and then dropped down in tube 3 through tube 2. The remained sample in the tube 1 were carefully collected after 4h of running, dried at 350℃ for 30min, then cooled down and weighted as W(g). The attrition index(AI) is expressed as

AI=W(g)/4W(0) x 100%(h^{-1})

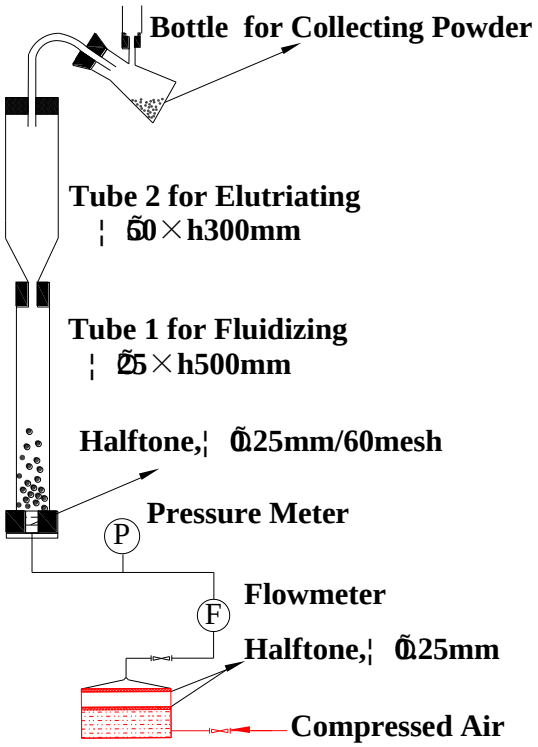

Fig. S5 Tube attrition tester

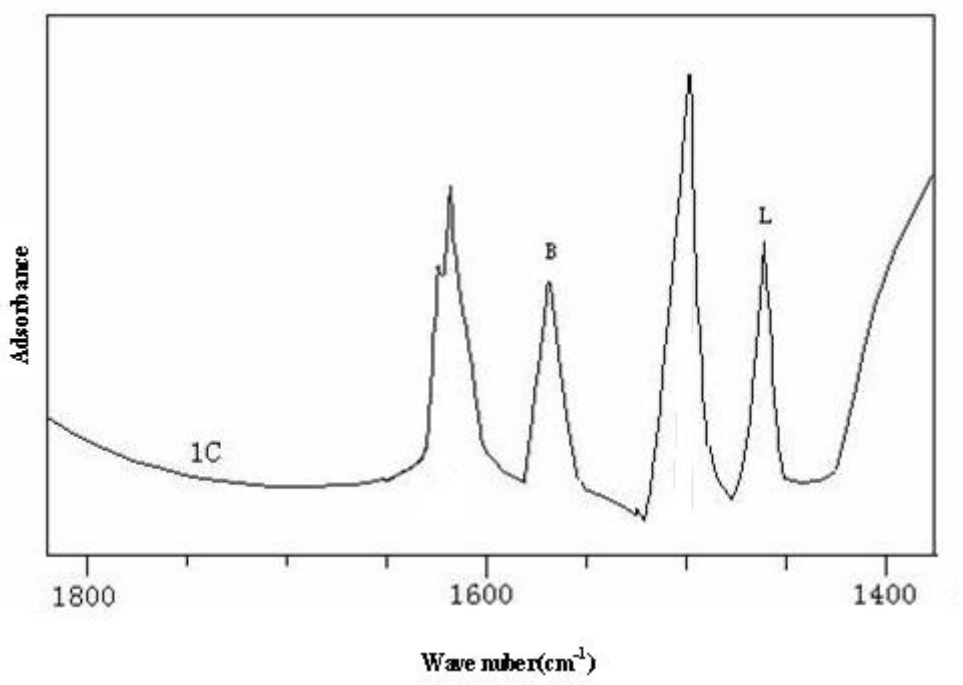

Fig.S6 FT-IR spectra of pyridine adsorbed commercial catalyst CC-15 at 200℃.