Support Information

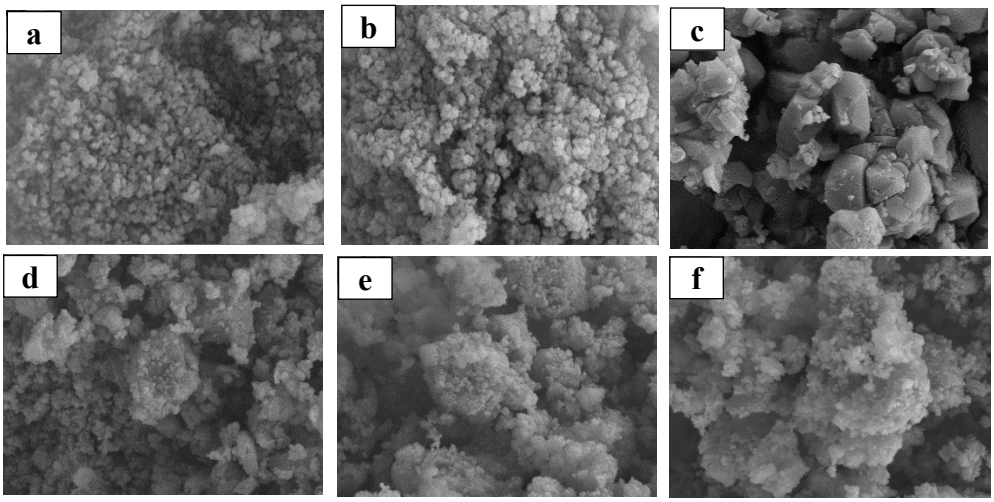
S1. XRF

Composition of samples is calculated by XRF. The Si/Al molar ratio of ASA-0.4, ASA-2 and USY are 0.4, 2.0 and 12.3, respectively.

Support Table 1 Chemical analysis of samples

Samples	$n_{(Si/Al)}$
ASA-2	2.0
ASA-0.4	0.4
USY	12.3

S2. SEM



Support Fig. 1 SEM images of catalysts: (a) ASA-2, (b) ASA-0.4, (c) USY, (d) NiW/USY-ASA-0.4/2, (e) NiW/USY-ASA-2, (f) NiW/USY-ASA-0.4

The morphology of ASA, USY and catalysts is investigated by SEM and displayed in Support Fig. 1. As shown in Support Fig. 1-a and b, no crystal form or other specific morphology are found on ASA-2 and ASA-0.4, and both them only

occur in amorphous state which is agglomerates by particles of different sizes. By comparison, Support Fig. 1-c clearly demonstrates the typical discrete Y zeolite crystallites. The morphology of catalysts is shown in Support Fig. 1-d, e and f, all the catalysts have similar morphology. The agglomerated ASA particles evenly disperse on the USY with some crystal planes of USY exposed. The results are consistent with the conclusion of XRD, it indicates that the mixing of two component ASA with different Si/Al ratio cannot affect the morphology of the catalysts, and the dispersion state of ASA on USY is similar.

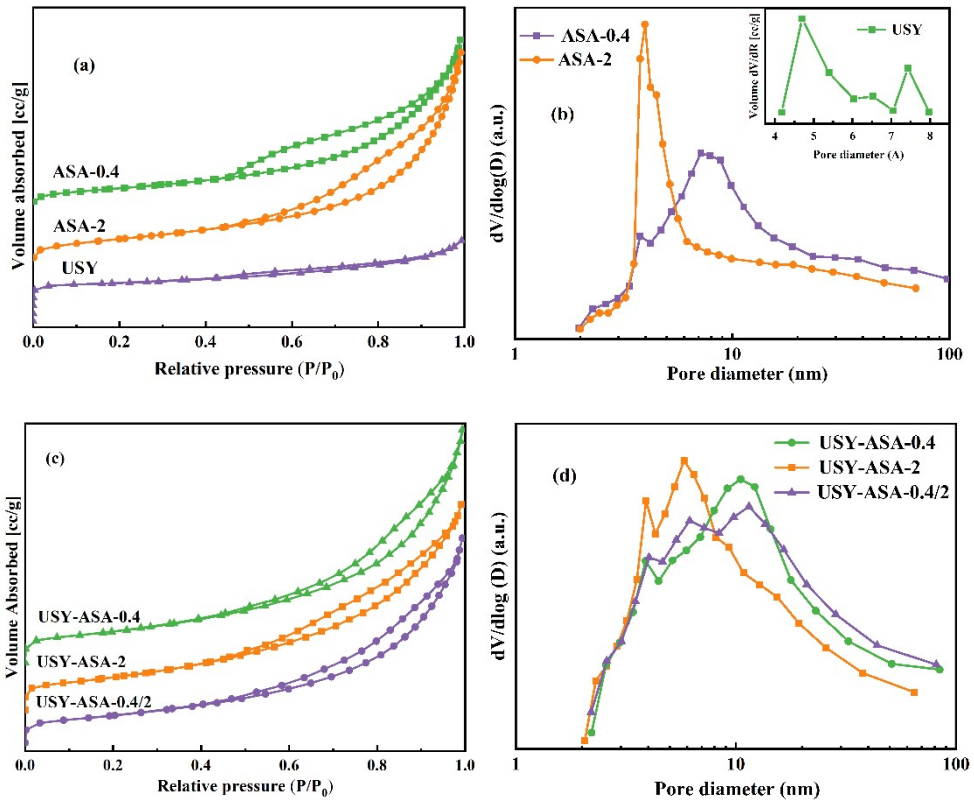
S3. N_2 adsorption-desorption

The adsorption-desorption isotherm and pore size distribution (PSD) of power and supports were shown in Support Fig. 2. From the adsorption isotherm curves of type Ⅳ and the hysteresis loops of type H-Ⅲ[1] (Support Fig. 2-a), it can be observed that both ASA-2 and ASA-0.4 are characterized by slit-shaped mesoporous structure[2]. The mesoporous of ASA-0.4 is richer than that of ASA-2, because the former displays larger hysteresis loop area than that of the latter[3]. A steep increase in adsorption volume for the USY occurs at relative pressure $P/P_0 <$ 0.01, indicating the characteristic of microporous materials with H-IV hysteresis loops[4].

Support Fig. 2-b is the PSD of mesopore-ASA and micropore-USY calculated by the BJH and MP models, respectively. Ignoring the false peak at 3-4nm of ASA caused by the tension effect in the desorption process[5], it can be seen that the most probable pore diameter of ASA-0.4 is larger than that of ASA-2, this is due to the high Si/Al ratio is beneficial to the formation of small pores[6]. The most probable pore of USY is 4.7Å, belonging to the microporous range.

There are remaining micropores of USY on all of the supports not blocked by aluminum sol or ASA, due to a rapid growth of adsorption volume in the isotherms at relative pressure $P/P_0 < 0.01$ (in Support Fig. 2-c). Moreover, type Ⅳ isotherms and H-IV hysteresis loops mean there are uniform slit mesopores in all supports. Because some unstable amorphous structures of the ASA collapse after extrusion, resulting in a decrease in the mesoporous content in samples, the area of hysteresis loops of supports is significantly reducing compared with ASA. The PSD of supports are shown in Support Fig. 2-d, the most probable apertures of USY-ASA-0.4 support and USY-ASA-2 support are 6nm and 10nm, respectively, both

are present in USY-ASA-0.4/2 support.



Support Fig. 2 N_2 absorption-desorption isotherms (power-a; supports-c) and pore size distribution (power-b; supports-d)

Support Table 2 Texture properties of samples

Samples	Surface area	Pore volume /mL·g^{-1}			d_{mean}	V_{meso} content
	/m^2·g^{-1}	V_{tatal}	V_{micro}	V_{meso}	/nm	/%
ASA-2	334	1.11	0.14	0.97	5.7	82
ASA-0.4	451	1.54	0.19	1.35	6.8	88
USY	871	0.50	0.31	0.19	1.3	38
USY-ASA-0.4/2	354	0.87	0.14	0.73	9.9	84
USY-ASA-2	407	0.88	0.17	0.71	8.6	81
USY-ASA-0.4	407	0.99	0.19	0.80	9.7	81

The surface areas of the samples are listed in Support Table 2, where V_{total} (volume of total pores), V_{micro} (volume of micropores), V_{meso} (volume of mesopores), d_{mean} (pore size range 1–100nm) and the V_{meso} content are also summarized. The values of these attributes of ASA-0.4 are higher than that of ASA-

2, especially surface area, V_{meso} and V_{meso} content. It means the existence of abundant mesopores on the ASA-0.4, which is consistent with the results obtained from Support Fig. 2-a. The highest V_{micro} (0.31g/mL) and the lowest V_{meso} content (38%) reflect the microporous characteristics of USY, which is not conducive to effective internal diffusion and chemical adsorption of diesel macromolecules[7, 8].

As to the supports, prominent V_{meso} content (84%) of USY-ASA-0.4/2 support indicates that additional mesoporous structures constructed by the combination of ASA-0.4 and ASA-2. The lowest specific surface area is caused by less micropores[9], manifested by the lowest V_{micro} among the supports.

Referees

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