

## Supporting Information

### **Magnetic solid sulfonic acid-enabled direct catalytic production of biomass-derived *N*-substituted pyrroles**

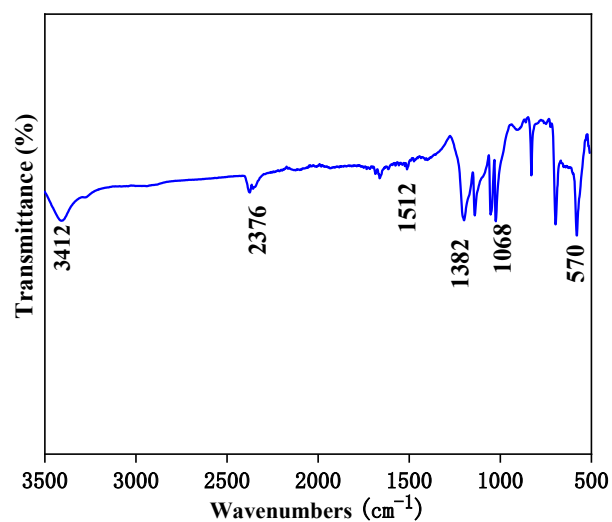
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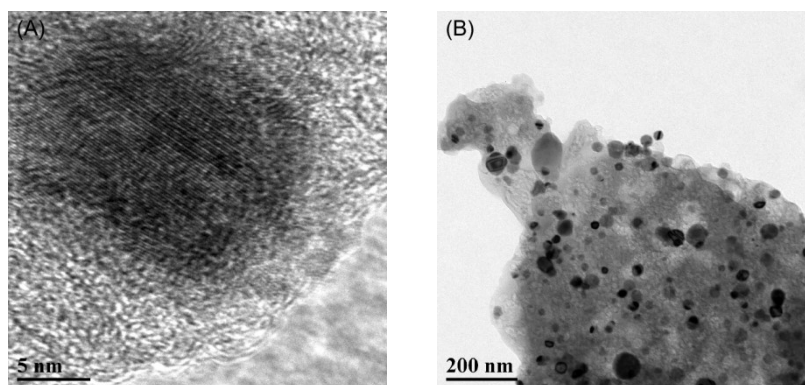
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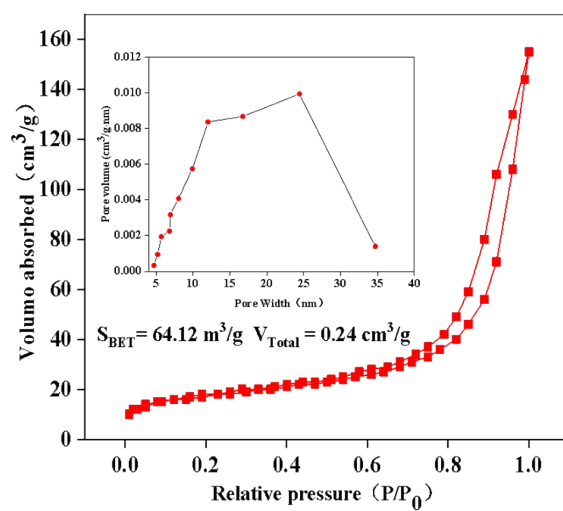
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**Fig. S1** FT-IR spectrum of the reused WK-SO<sub>3</sub>H.

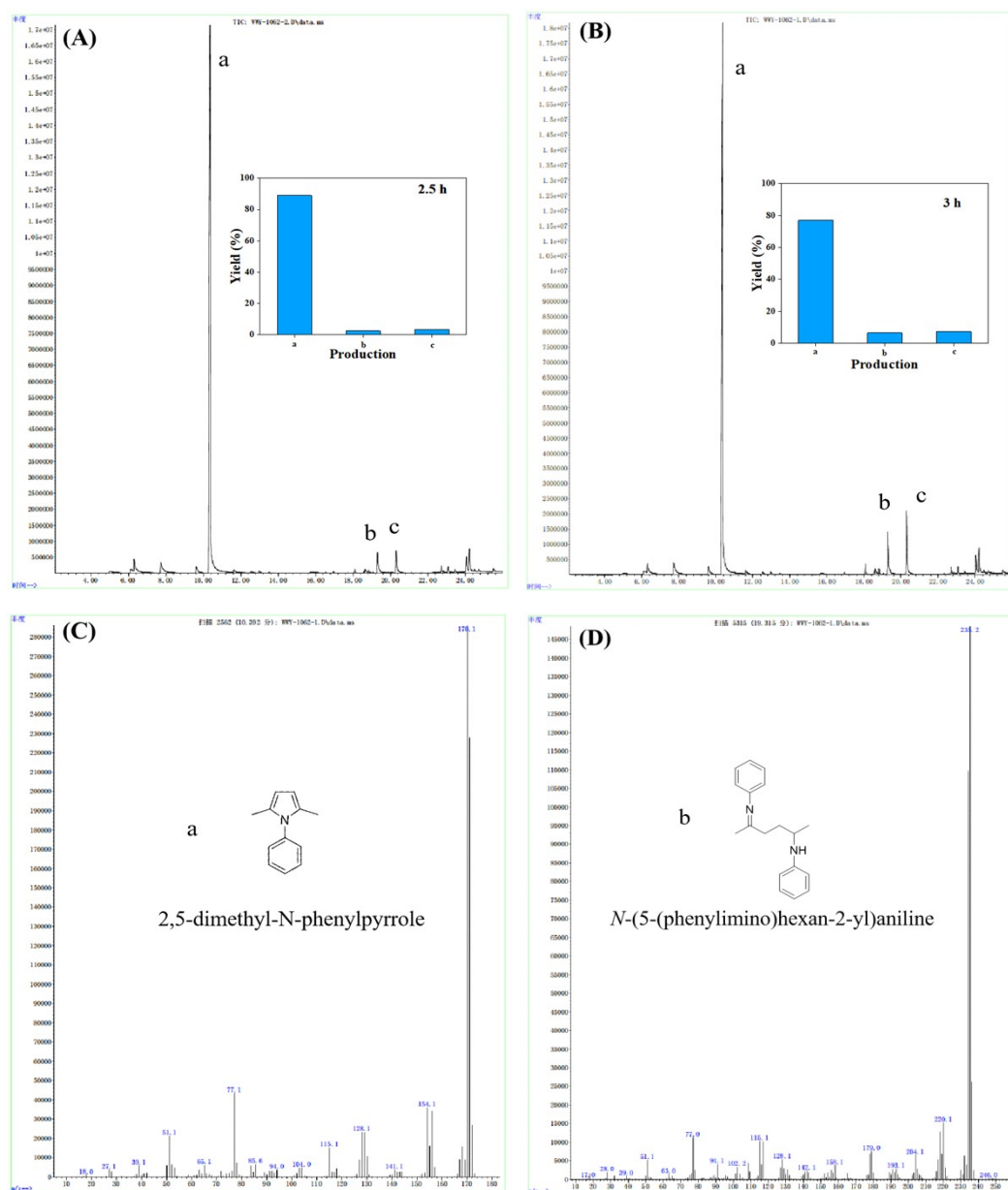


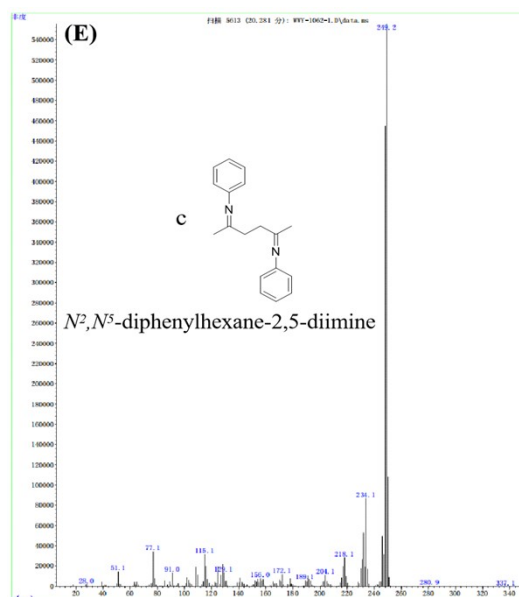
**Fig. S2** (A) HR-TEM and (B) TEM images of WK-SO<sub>3</sub>H.



**Fig. S3** N<sub>2</sub> adsorption-desorption isotherm of Fe<sub>3</sub>O<sub>4</sub>@SiO<sub>2</sub> (the insert is pore size distribution).

In addition to the formation of the dominant product **a** (2,5-dimethyl-N-phenylpyrrole), 6.5% of **b** (*N*-(5-(phenylimino)hexan-2-yl)aniline), 7.2% of **c** (*N*<sup>2</sup>,*N*<sup>5</sup>-diphenylhexane-2,5-diimine) and a trace amount of unknown products were mainly produced for 2.5 h. The GC-MS spectra of the target products and side-products have been illustrated in Fig. S2. After extending the reaction time to 3 h, the yields of products **b** and **c** increase (**b**-6.5%, **c**-7.2%) appropriately. By comparing the reaction results obtained after 2.5 h and 3.0 h, it can be found that the difference between conversion and yield is indeed due to the conversion or degradation of the target product.





**Fig. S4** (A) Product distribution diagram after 2.5 h; (B) Product distribution diagram after 3 h; MS diagrams of (C) Product **a**, (D) Product **b**, and (E) Product **c**.

Control experiments show that the yield of **a** (2,5-dimethyl-N-phenylpyrrole) is 3.1% when pure Fe<sub>3</sub>O<sub>4</sub> is used, and 5.4% is obtained as SiO<sub>2</sub> is used as carrier (Table S1, entries 1 & 2). The catalytic activity of the carbonaceous material without — SO<sub>3</sub>H is extremely low (entries 2 & 4). Directly encapsulating CS on Fe<sub>3</sub>O<sub>4</sub> and loading sulfonic acid on CS provided 27% yield (entry 3). Only WK-SO<sub>3</sub>H can provide high yield (89%). This can be attributed to the SiO<sub>2</sub> can protect Fe<sub>3</sub>O<sub>4</sub> from reacting with the introduced acid species. In addition, the acid loading reduces the specific surface area, pore volume and pore volume of SiO<sub>2</sub> (Figs. 3 & S3).

**Table S1** Reactivity of different catalysts in reaction of aniline and 2,5-dimethylfuran to 2,5-dimethyl-N-phenylpyrrole (**a**).

Entry	Catalysts	Yield (%)
1	Fe <sub>3</sub> O <sub>4</sub>	3.1%
2	Fe <sub>3</sub> O <sub>4</sub> @SiO <sub>2</sub>	5.4%
3	Fe <sub>3</sub> O <sub>4</sub> @CS-SO <sub>3</sub> H	27%
4	Fe <sub>3</sub> O <sub>4</sub> @SiO <sub>2</sub> @CS	7.1%
5	Fe <sub>3</sub> O <sub>4</sub> @SiO <sub>2</sub> @CS-SO <sub>3</sub> H (WK-SO <sub>3</sub> H)	89%