

Figure S1. XRD profiles of the (a) raw Huolinhe lignite and (b) demineralized sample.

There are clear minerals peaks (such as silicon dioxide, kaolin clay and so on) for raw coal, as shown in Figure S1a. After the acid treatment, the diffraction peaks of minerals are absent, as shown in Figure S1b indicating the removal of minerals in the demineralized sample.

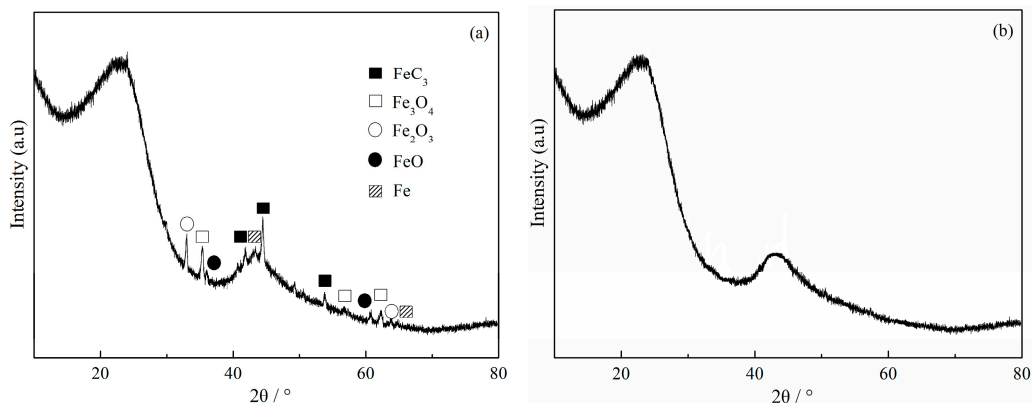


Figure S2. XRD phase analysis of C-1FeHLH-5 and C-1FeHLH-5(H).

There are Fe-based components (such as Fe_3O_4 , Fe_2O_3 , FeO , Fe and Fe_3C) for C-1FeHLH-5, as shown in Figure S2a, indicating that the FeCl_3 catalyst reacted with some substances in coal during pyrolysis. To eliminate the interference of Fe-based compounds in chars for the results of XRD and Raman analysis, some char samples, including Fe-based compounds, were treated by $0.2 \text{ mol L}^{-1} \text{ HCl}$ and washed with distilled water to remove chloride ions. After acid treatment, the diffraction peak of Fe-based components of C-1FeHLH-5(H) had disappeared, as shown in Figure S2b.

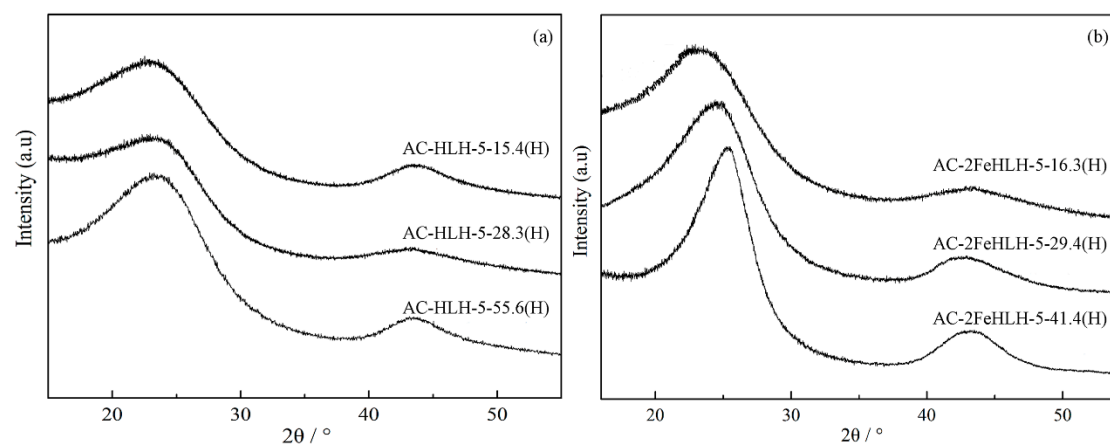


Figure S3 XRD profiles from different AC during activation