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Hydroxylation of 1,4-dichlorobenzene to produce 2,5-dichlorophenol over Fe/activated carbon catalyst

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PURPOSE OF THE ABSTRACT

Hydroxylation of 1,4-dichlorobenzene to produce 2,5-dichlorophenol over Fe/activated carbon catalyst

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Activated carbon (AC), with large surface area, high porosity and diverse oxygen groups, is a kind of classic support for its excellent catalytic activity in C-H activation reaction with aqueous H₂O₂ as oxidant [1]. AC could be produced by cheap and widely available resources, such as renewable biomass. Thanks to the surface oxygen groups, they can interact with metallic species to form active phase for different catalytic reactions.

2,5-dichlorophenol is an important intermediate for fine chemicals, especially for the production of low-toxic pesticide dicamba. Generally, worldwide industrial production of 2,5-dichlorophenol are done from 1,2,4-trichlorobenzene or 2,5-dichloroaniline via a multistep reaction processes. The multistep processes have many disadvantages, such as, acid and alkali corrosion, high equipment requirements, energy consuming, low atom efficiency and serious environmental pollution.

In the present work, a series of iron-loaded AC was prepared and used for one-step hydroxylation of dichlorobenzene with H₂O₂ as oxidant. The effect of the amount of Fe/AC, Fe content, the reaction temperature, the amount of H₂O₂ and the reaction time on the yield of the products over Fe/AC is investigated. The results are shown in the Figures 1-2. As can be seen, the highest yield of 39.5% to 2,5-dichlorophenol is obtained with the selectivity of 55.8%, under the reaction condition of 6.6 mmol 1,4-dichlorobenzene, 10 mL acetonitrile, 10 mL H₂O₂ (30 wt%), 0.3 g Fe/AC (0.20 mmol/g, jujube carbon) in 60°C water-bath for 120 min.

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FIGURES

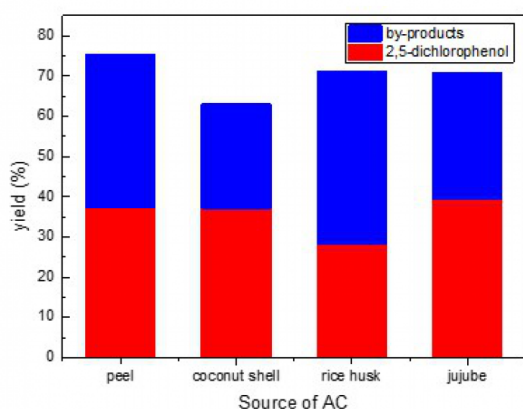


FIGURE 1

Fig.1.

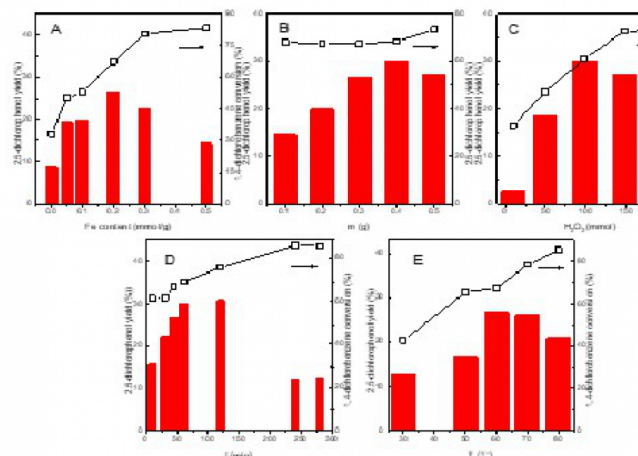


FIGURE 2

Fig.2.

Optimization of reaction parameters: (A)The influence of Fe content; (B)The influence of the amount of Fe/AC(peel); (C)The influence of the H₂O₂ dosage; (D)The influence of reaction time; (E)The influence of temperature.

KEYWORDS

Fe/AC | 1,4-dichlorobenzene | 2,5-dichlorophenol | green synthesis

BIBLIOGRAPHY