



## Free-template synthesis of porous carbon nanofiber assembled by hollow carbon nanospheres and their adsorption kinetics and isotherms for methylene blue

Tao Ni, Zhigang Jia\*, Ziyu Li, Shengbiao Li

*School of Chemistry and Chemical Engineering, Anhui University of Technology, No. 59 Hudong Road, Ma'anshan 243002, Anhui Province, China, Tel. + 86-555-2311551; Fax: + 86-555-2311882; emails: zjchemyue@126.com (Z. Jia), 3013261430@qq.com (T. Ni), 496761147@qq.com (Z. Li), 283317835@qq.com (S. Li)*

Received 6 April 2017; Accepted 12 September 2017

---

### ABSTRACT

In this work, porous carbon nanofibers assembled by hollow carbon spheres were first obtained via calcination and subsequent acid leaching process for nitrilotriacetic acid nickel salt nanofibers. The as-obtained samples were characterized by various techniques such as scanning electron microscopy, transmission electron microscopy, X-ray diffraction, Fourier transform infrared spectroscopy and N<sub>2</sub> adsorption/desorption measurement. The results showed that the as-prepared carbon nanofibers with higher surface area were built by plenty of Ni(NiO)/carbon composite nanoparticles or hollow carbon nanospheres containing rich active groups. The formation mechanism of porous carbon nanofibers was also discussed. The adsorption performance of the as-prepared carbon fibers for methylene blue (MB), such as the kinetics, isotherms and thermodynamic property, was investigated in detail. The adsorption of samples NC-1 and NC-2 for MB could be fitted to pseudo-second-order model. The Langmuir adsorption model agreed well with the experimental data. Thermodynamic parameters revealed the spontaneity and the endothermic nature of the adsorption process. These results demonstrated that the as-prepared carbon nanofibers can be used for the treatment of dye-containing wastewater.

*Keywords:* Carbon nanofiber; Composite; Hollow nanosphere; Adsorption

---

\* Corresponding author.