Preparation and Characterization of Modified TNTs on Wastewater Degradation

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Abstract

In recent years, titanium nanotubes (TNTs) have been used to purify environmental pollutants and serve as excellent catalysts. Among conventional wastewater treatment technologies, physical adsorption is generally considered to be one of the treatment technologies that is simple, reliable, economical and efficient. Therefore, activated carbon and other composite materials are widely used as adsorbents. However, physical adsorption is affected by its slow kinetics, limited adsorbent capacity, and the need for adsorbent regeneration. The high energy requirements and other shortcomings limit. In contrast, photocatalytic degradation is considered to be one of the green, effective, environmentally friendly and highly promising advanced wastewater treatment processes. The photocatalyst TiO_2 is non-toxic, has a high photocatalytic active crystalline phase, low cost, high efficiency and excellent performance. However, TiO_2 is limited by the aggregation effect of nano particles and short light absorption wavelengths. Therefore, we combine the porous biochar carbon material with titanium dioxide, which not only maintains strong photodegradation ability, but also exerts the characteristics of physical adsorption and photocatalysis to achieve the ability to quickly and effectively remove pollutants. In the application of nanotechnology, nano-level zero valence (nZVI) has become the most important due to its strong reduction ability (E°= -0.44 V) and its ability to adsorb most water pollutants. However, the degradation ability will be reduced due to its easy aggregation characteristics, so we uniformly attach it to TNTs to avoid aggregation. FE-SEM and HR-TEM photographs showed that the average length of TNTs is about 100 nm and, the diameter is around 8 ~ 10 nm, TNTs have hollow tube column structure with a wall thickness of 2.4 nm, and XPS elemental analysis showed that the surface elements of TNTs and TNTs@BC are mainly oxygen and titanium. So we can be sure that theTNTs are successfully combined with BC. In the MB degradation test comparison, the adsorption capacity of TNTs@BC (14;1) is about 4.5% higher than that of TNTs; the catalyst with the highest photodegradation efficiency is pure TNTs, which can be degraded within 120 minutes after exposure to light. Charcoal does help TNTs increase the physical adsorption capacity, but at the same time it is not conducive to TNTs to accelerate the photodegradation efficiency.The comparison of degradation efficiencies of Fe-TNs by Fenton is 1% Fe-TNs > 3% Fe-TNs > 5% Fe-TNs > TNs.

Keywords – Zero-valent iron nanoparticle, titania nanotube, Biochar, Photocatalysis degradation.

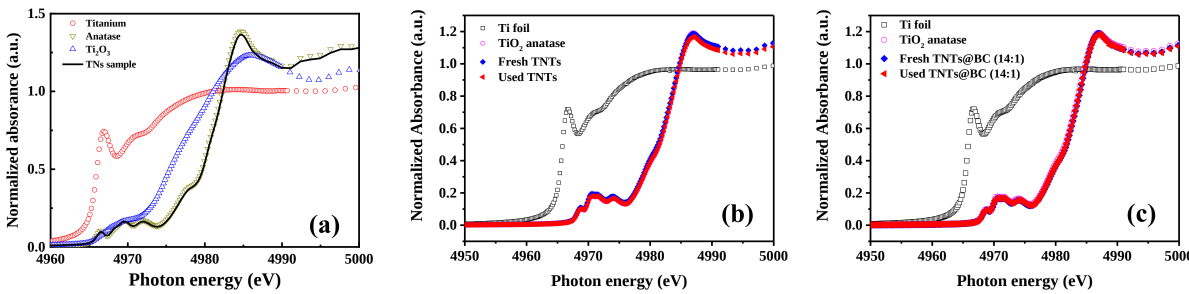

Fig. 1. Ti K-edge XANES spectra of (a) TiO_2 standards, (b) TNT, and TNTs@BC samples.