石油学报（石油加工）
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硝酸改性活性炭对模拟汽油中苯并噻吩的吸附

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Adsorption of Benzothiophene in Simulated Gasoline on Nitric Acid Modified Activated Carb

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摘要 用硝酸对活性炭进行改性，对改性前后活性炭的性质进行了表征，并考察了改性前后活性炭对模拟汽油中苯并噻吩的吸
动力学行为。采用Freundlich、Langmuir、Sips和BET吸附模型分别对改性前后活性炭吸附苯并噻吩的吸附平衡数据进行拟
一阶、准二阶、混阶和修正的准*n*阶速率方程对其动力学数据进行拟合。结果表明，BET和Sips吸附模型对改性前活性炭吸附
的吸附等温线拟合度最高，Sips和Freundlich吸附模型对改性后的拟合度最高；改性前后活性炭对苯并噻吩的吸附均以物理
改性后活性炭表面活性位的异质化程度增加，对苯并噻吩的亲和力增强。修正的准*n*阶速率方程对活性炭吸附苯并噻吩动力学
最高。活性炭表面含氧官能团的密度是决定其吸附容量的主要因素，改性后活性炭对苯并噻吩的吸附容量提高33.7%。

关键词： 活性炭 硝酸改性 苯并噻吩 吸附平衡 动力学

Abstract: Activated carbon was modified with nitric acid. The properties of activated carbon before and
modification were characterized. The adsorption equilibrium and kinetics of benzothiophene on the original
activated carbon and its modified form were studied, in which the adsorption equilibrium data were fitted v
Freundlich, Langmuir, Sips and BET adsorption models and the kinetic data were fitted with pseudo-first-o
pseudo-second-order, mixed-order and modified pseudo-*n*-order rate equations. The results showed that E
Sips models fitted best to the adsorption equilibrium of benzothiophene on the original activated carbon, S
Freundlich models fitted best to the kinetics of benzothiophene on the modified activated carbon. The ads
of benzothiophene on activated carbon before and after modification was mainly physical, and the degree
heterogeneity of the surface and the affinity with benzothiophene for the modified activated carbon were
enhanced, resulting in 33.7% increase of absorption capacity. The density of oxygen containing functional
on the surface of activated carbon was the main factor to determine the adsorption capacity.

Keywords: acitvated carbon, nitric acid modification, benzothiophene, adsorption equilibrium, kine

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