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Debromination of polybrominated diphenyl ethers by attapulgite-supported Fe/Ni bimetallic nanoparticles: Influencing factors, kinetics and mechanism

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Graphical abstract

Highlights

- Attapulgite-supported Fe/Ni nanoparticles (A-Fe/Ni) were synthesized for use in 2,2',4,4'-tetrabromodiphenylether (BDE47) degradation.
- Attapulgite could reduce Fe/Ni nanoparticle aggregation and enhance their reactivity.
- BDE47 could be degraded completely by A-Fe/Ni.
- Influencing factors on the debromination of BDE47 were studied.
- Stepwise debromination pathway for BDE47 by A-Fe/Ni was elucidated.

Abstract

To enhance the removal efficiency of 2,2',4,4'-tetrabromodiphenylether (BDE47) in aqueous solutions, novel attapulgite-supported Fe/Ni bimetallic nanoparticles (A-Fe/Ni), which were characterized by a core-shell nanoparticle structure and with an average diameter of 20–40 nm, were synthesized for use in BDE47 degradation. The presence of attapulgite in bimetallic systems could reduce Fe/Ni nanoparticle aggregation and enhance their reactivity. BDE47 was degraded with a significant improvement in removal efficiency of at least 96% by A-Fe/Ni that played a reductive role in the reaction. The degradation kinetics of BDE47 by A-Fe/Ni complied with pseudo-first-order characteristics. To better understand the removal mechanism, detailed analyses were performed for several influential parameters. The improved dosage of A-Fe/Ni was found to be beneficial, and higher

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