Q1: What if a sorbent material is used that can recover uranium at pH > 7?
A1: The process will be of lower radioactive risk and cost effective.

Q2: Is there any difficulty to develop such a material?
A2: Yes. When pH > 7, the electrostatic repulsion between the deprotonated functional groups and negatively charged U(VI) species will be stronger.

Q3: What shall we do?
A3: Bi-functionalized sorbents, which are covalently bound by positively charged groups and U(VI) chelating groups, are designed for uranium recovery at pH > 7.

Introduction

A large amount of basic wastewater are produced with U(VI) and high concentration of NH₃/N (pH > 10) in HTR fuel processing.

Wastewaters (NH₃, pH > 10)
Complicated & Expensive!

Uranium removal has to be pre-treated by NH₃ distilling and further neutralizing if ordinary sorbents are applied.

Bi-functionalized sorbents, which are covalently bound by positively charged groups and U(VI) chelating groups, are designed for uranium recovery at pH > 7.

Synthesis and characterization

Results and discussion

Time curves and pH effects on uranium adsorption

Conclusions

A U(VI) sorption magnetic material that work in alkaline media was developed by immobilizing ammonium phosphonate bi-functionalized groups on Fe₃O₄ nanoparticles.

The combination of the bi-functionalized groups gave rise to an excellent ability to remove U(VI) with the maximum sorption capacity of 70.7 mg/g at pH 9.8.

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