

Characterization and surface modification of silica gel by 3-mercaptopropyltrimethoxysilane + acrylamide

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Introdução

The covalent modification of organic molecules with desired functions on to a variety of inorganic surfaces can be designed in order to get significant practical advantages, such as improved structural and thermal stability, swelling behavior and accessibility to the reactive centers. Among many inorganic materials able to bind covalently organic compounds, silica gel is highly explored due to the high thermal and chemical stabilities but also in considering its large surface area. The anchoring of organic compounds with basic functionalities on to the silica surface is useful to coordinate metal ions. These properties provide a special approach in green chemistry field as catalysis and for removal of contaminants.

The present work is related with the surface modification of silica gel with organic compounds having nitrogen and sulfur atoms to act as chelating agents for complexing cations.

Resultados e Discussão

New silylating agent was prepared by the reaction of (3-mercaptopropyl)-trimethoxysilane and acrylamide in the presence of triethylamine, as deprotonant agent, in methanol. This silylating agent was then reacted with silica gel in xylene for 72 hours in N₂ atmosphere.

The quantification of acrylamide was evaluated through elemental analysis, based on carbon and nitrogen percentages.

The IR spectra of the modified silica present bands such as siloxane stretching at 1100 cm⁻¹, C-H stretching at 2950 cm⁻¹ and C=O of amide at 1667 cm⁻¹ confirming the successful immobilization.

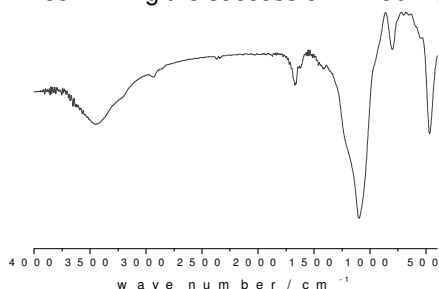


Figure 1. IR spectra of the functionalized silica.

The ²⁹Si NMR shows SiO₄ (Q₄) at -111, (SiO)₃Si-OH (Q₃) at -100 ppm. The -65 and -57 are due to the

(SiO)₃Si-OR (T⁴) and (SiO)₂SiOR (T²) species respectively¹. R stands for organic moiety.

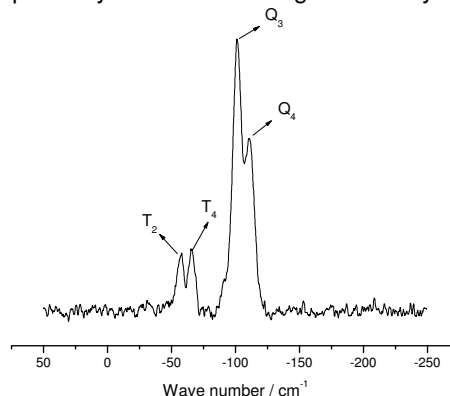


Figure 2. ²⁹Si NMR spectra of modified silica.

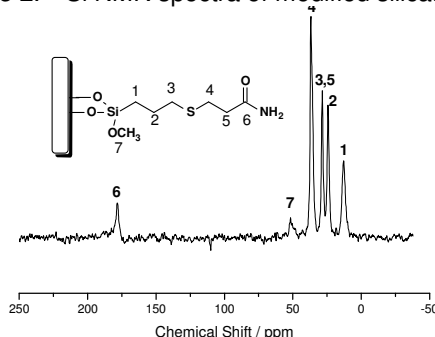


Figure 3. ¹³C NMR spectra of modified silica.

The ¹³C NMR spectrum of the modified silica are numbered according to the proposed structure.

Conclusões

This investigation demonstrated the successful immobilization of acrylamide and 3-mercaptopropyltrimethoxysilane on the silica gel surface. The modified silica contains three basic atom centers on the surface, which have the ability to remove heavy metal ions from aqueous solution.

Agradecimentos

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¹ Prado, A. G. S.; Airoidi, C. Green Chemistry. **2002**, 4, 288.