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The Effect of Silane Modification on the Adsorptive Properties of Natural Pyrophyllite and Synthetic Titanium-Based Powders Prepared by the Sol-Gel Process

Şadiye ŞENER[1], Murat ERDEMOĞLU[2], Meltem ASİLTÜRK[1],
Hikmet SAYILKAN[3]
[1]Department of Chemistry, İnönü University 44069 Malatya-TURKEY
e-mail: snsener@inonu.edu.tr
[2]Department of Mining Engineering, İnönü University 44280 Malatya-TURKEY
[3]Department of Science Education, İnönü University 44069 Malatya-TURKEY

Abstract: Our aim was to improve the relatively poor adsorption characteristics of natural pyrophyllite and those of TiO_m and $Ti(OR)_x(OH)_y(O)_z$ obtained from titanium tetraisopropoxide (TTIP) by the sol-gel process. For this purpose, the surfaces of the above-mentioned adsorbents were coated with a surface modifier by dipping them in 1% and 50% (w/w) solutions of N-(2-aminoethyl)-3-aminopropyltrimethoxysilane (DIAMO) in methanol. Realization of the coating processes was checked by FT-IR and SEM analyses. FT-IR analyses of the coated powders heat treated at 110 °C showed that condensation took place between OH groups of prehydrolyzed silane molecules and hydroxyl groups and/or oxygen atoms on the surface of the powders, ensuring the attachment of the silane molecules to the surface. Adsorption properties of coated and uncoated adsorbents were compared. Adsorption percentage of natural pyrophyllite was 46.35% for 4-nitrophenol (4-NP) in aqueous solution, whereas 1% and 50% amino-coated pyrophyllite displayed 52.14% and 73.84% adsorption, respectively. The highest adsorption of 4-NP was realized when the calcinated powder obtained from the hydrolysis-condensation product of TTIP was coated with DIAMO from 50% solution.

Key Words: Aminosilane coupling agents, surface modification, 4-nitrophenol, adsorption

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