Stability of sulphide-fucntionalized SBA-15 in aqueous medium

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The stability of mesoporous mesostructured MCM-41 and SBA-15 materials has been previously investigated [1]. In [2] the sulfide-functionalized sorbents (Fig.) based on these materials have been obtained and their potential availability for selective sequestration of heavy and noble metals from aqueous solutions was proved. The questions arise: How stable these sorbents are? How long can they function as a sorbent in solutions processing. The preliminary results on stability of sulfide-functionalized SBA-15 sorbents in aggressive media have been obtained. The R-S-R' type materials have been treated with water, hydrochloric, nitric and sulfuric acids, ammonia. The pickling has been carried out by processing the materials for one hour in 1 M acids and 0.1 M ammonia solutions. The solid / liquid ratio was equal to 1: 100. Similar experiments have been performed on silica gel to compare.

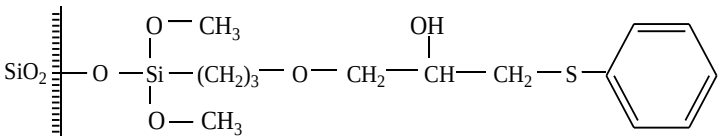

Fig. The sulfide-functionalized SBA-15 sorbent [2].

The control of pored silicate structure, organic part content and sorption ability has been realized during the pickling process. For that process the mass loss of samples has been observed. The mass loss for the functionalized silica-gel samples was greater than that for functionalized SBA-15 samples, especially in case of acidic media. We also observed an increase in the specific surface areas and pore volume during the pickling process. However, the materials have a high degree of structural order before and after the pickling process that was confirmed by accurate X-ray diffraction. The silicate framework does not degrade according to IR-spectroscopy data as well. We can observe three bands in the region 400-1200 cm^{-1} that respond to Si-O-Si vibrations in tetrahedron SiO_4. These bands stay invariable after treatment in all aggressive media.

Nevertheless the part of organic component insignificantly decreases. This is due to the decomposition process of the surface graft layer. The graft layer decomposition leads to decreasing sulfur content and as a consequence to decreasing the sorption ability of materials. However, in these experiments we have used a very harsh environments than it is needed for practical sorption processes. Thus, these materials can be employed in different technological solutions for a long time.

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References

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