

## SYNTHESIS OF ALKOXYSILYLATED HUMIC DERIVATIVES AND THEIR IMMOBILIZATION ONTO MINERAL SURFACES

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Humic substances (HS) are biogenic, high-molecular, heterogeneous, polyfunctional organic materials, that can interact with both metal ions and organic chemicals. HS are ubiquitous in the environment and comprise the most abundant pool of non-living organic matter. Humic materials are typically derived on an industrial scale from peat, sapropel, coal and river water<sup>1</sup>. Heavy metal and organic contamination of soils, buildings and equipment systems is a major environmental concern at both industrial and government sites. It is known in the art to use unmodified HS to treat environmental contaminants.

Permeable reactive barriers are receive a great deal of attention as an innovative cost-effective technology for clean up of groundwater contamination. A PRB is a subsurface wall of reactive permeable media emplaced across the flow path of a contaminant plume. The plume is allowed to migrate passively through the PRB and in the process contaminants are precipitated, sorbed, or degraded. Humic acids possible to irreversibly sorb on the surface of silica containing minerals can be used for *in situ* creating of permeable reactive barriers (PRB). In this case, the installation of PRB will be brought up by the injection of solutions of such derivatives under the ground.

That's why, the goal of the work was the development of the method of synthesis of alkoxy-silylated humic derivatives and studying of the process of their immobilization on the silica gel surface.

Two types of organosilanes were used for modification – 3-amino-propyltrimethoxysilane (APTS) and 3-glycidoxy-propyltrialkoxysilane (GPTS). The method of modification is described elsewhere<sup>2</sup>. The modification with 3-aminopropyltrimethoxysilane led to higher level of modification than the use of 3-glycidoxypropyltrimethoxysilane.

Humic acids of different origin were modified with APTS. The amount of grafted APTS grew in the row: coal HS < river HS < peat HS. The modification depended on the amount of free functional COOH groups in parental humic substances.

The structure of obtained substances was studied by NMR and FTIR analysis. It was proved, that formation of amid bonds between HS and APTS takes place.

All obtained substances can irreversibly sorb on the surface of silica-containing materials from water solution. More of that, the amount of immobilized HS was nearly 100 mg per 1 g of silicagel.

The suggested method of immobilization of humic acids on silica gel from the water solution gives result comparable with the generally accepted method of immobilization of humic acids on the surface of aminated silicagel in the organical solvent<sup>3</sup>.

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### References

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