Nanomaterials on the base of acid-activated bentonite clays and its applications for environmental protection

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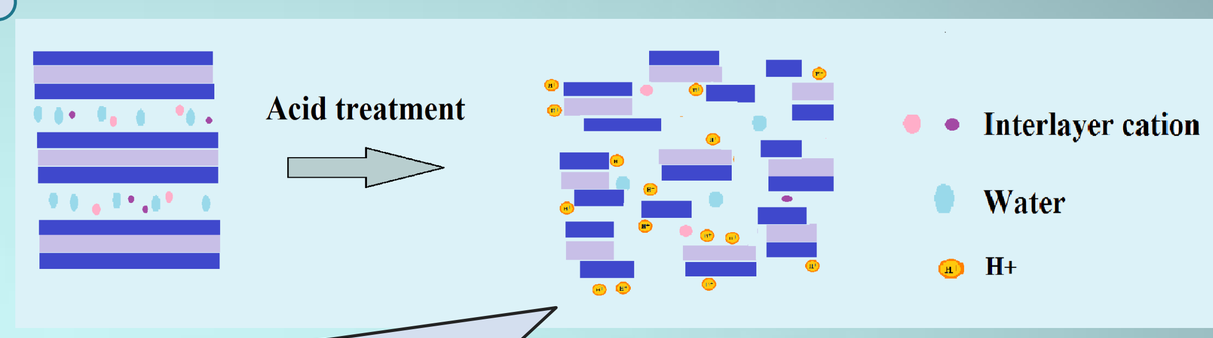
The aim of the present study is the removal of radionuclides U(VI) and Sr(II) from contaminated water by the sorption method on acid-treated bentonite

✓ Taking into account large areas with contaminated water, and the huge volumes of waste generated during the mining and processing of radioactive ores, it becomes especially important to search for the cheapest reagents and materials used in appropriate environmental protection technologies

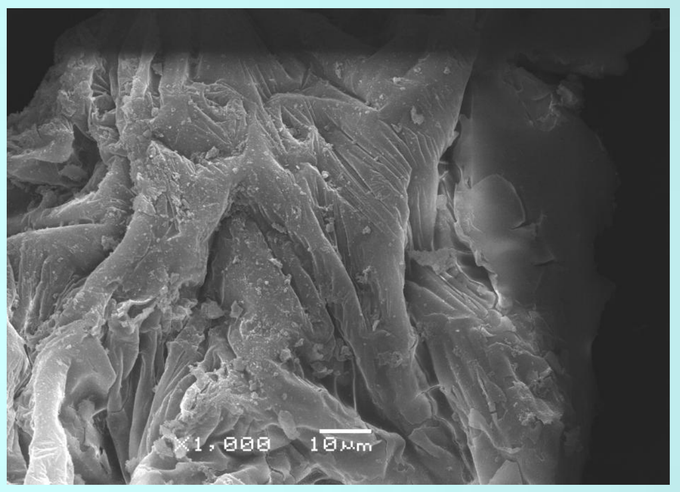
✓The feasibility of using natural clay minerals is due to their availability and low cost

✓In industrial applications using clays as sorbent materials, one of the simplest tech-nological operations to increase their surface activity is acid activation

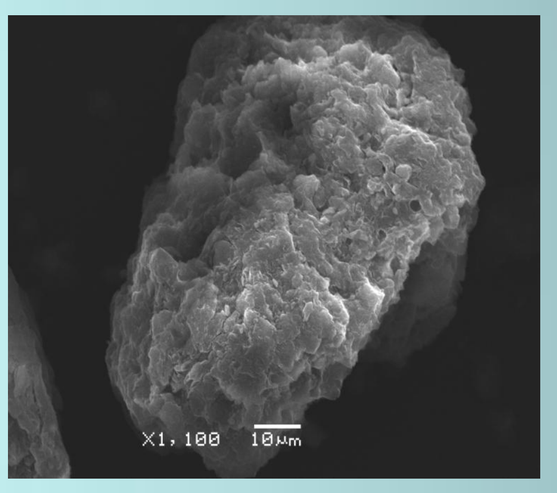
✓An important result of acid treatment of clay minerals (from the point of view of their further use in catalysis and sorption technologies) is the development of their meso- and microporous structure



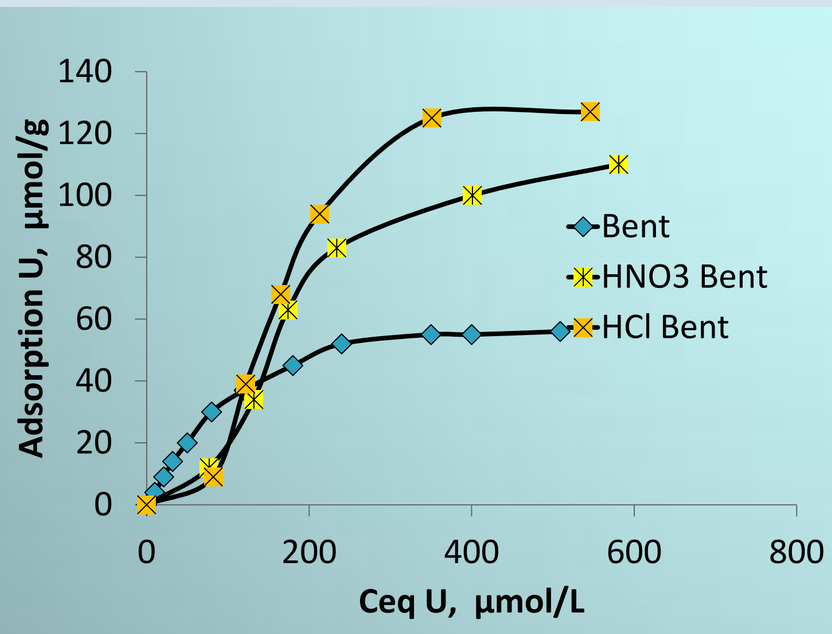
Schematic illustration of acid activation of bentonite

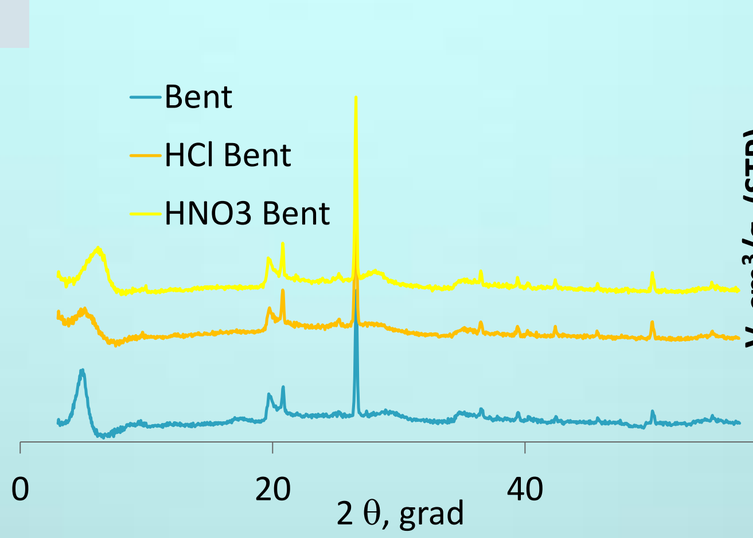


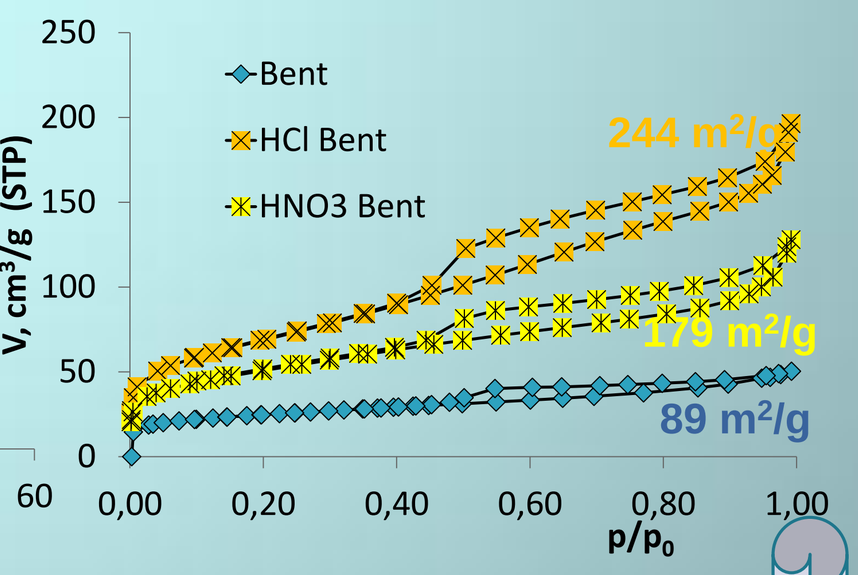
Raw bentonite



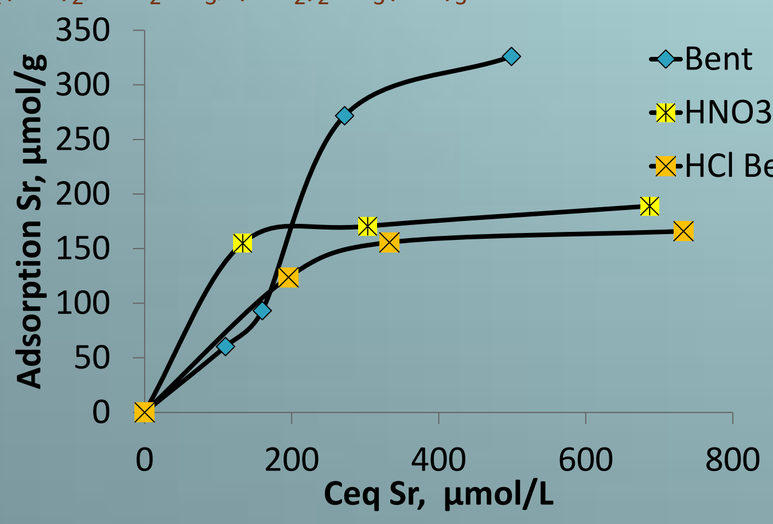
Acid activated bentonite







- The main form of U(VI) in water: UO_2^{2+} , UO_2OH^+, $(UO_2)_2(OH)_2^{2+}$, $(UO_2)_3(OH)_4^{2+}$, $(UO_2)_3(OH)_5^+$, $(UO_2)_4(OH)_7^+$ and others.
- In the groundwater (with higher concentrations of dissolved CO_2,): $UO_2(OH)_2$, UO_2CO_3, $(UO_2)_2CO_3(OH)_3^-$



The main amounts of strontium in waters are transported in the ionic form

➢Acid-activated bentonite demonstrated gradually destroyed and replaced crystalline structure by amorphous phase.

➢ The porosity of acid-activated bentonite changes significantly due to the partial dissolution of its oxide structure. There is an increase in the specific surface and the volume of pores.

➢ The increase in uranium sorption on acid-activated bentonite is due to the appearance of new sorption centers formed by proton attack.

➢ Some negative effects for strontium were observed. The acid treatment neutralizes part of the negative charge of the bentonite surface and might even generate positively charged sites (protonation of Si-OH groups or acceptance of protons by octahedrally coordinated $A1^{3+}$ or Fe^{3+}).

➢The obtained sorbents can be widely used in water purification technologies and modern environmental protection technologies as effective cheap sorbents