Sobolev Institute of Geology and Mineralogy SB RAS (IGM SB RAS)
Trofimuk Institute of Petroleum Geology and Geophysics SB RAS (IPGG SB RAS)
Novosibirsk State University (NSU)

8th INTERNATIONAL SIBERIAN EARLY CAREER GEOSCIENTISTS CONFERENCE

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THE EXPERIMENTAL STUDYING OF BEHAVIOR ELEMENTS AT INTERACTION OF DRAINAGE WATERS WITH NATURAL AND MODIFIED SORBENTS UNDER MAGNETIC FIELD

Rybkina E., Edelev A.

Trofimuk Institute of Petroleum Geology and Geophysics, SB RAS, Novosibirsk, Russia

Magnetic field, wastewater treatment, geochemical sorbents, experiment

One of the actual problem facing humanity is a violation of chemical elements circulation and their natural balance due to the growth of industrial and other anthropogenic emissions into environment. In some cases this balance is already broken owing to increasing the concentration of different substances and elements in soil, in the hydrosphere and the atmosphere on a global scale. Natural biogeochemical cycles of many fundamental (in aspects of environment protection) substances and elements were studied insufficiently in detail. Steadily amplifying anthropogenic influence stimulates the intensive researches in the field of technogenic geochemistry, ecological geochemistry and biogeochemistry. In this connection, the requirements for purification of drainage waters increases, and economic and readily available materials are looked for every year. The adsorptive processes using natural mineral sorbents appear to be more applicable currently with a possibility of their use in the processes of water purification because of their low cost and high sorption volume. In real life, the interaction of natural waters with the host rocks and deposits of the water objects (which have been accumulated for long time) differs in their variability depending on the influence of various physical and chemical conditions. So, it is hard to model these processes. For high-quality experiments and correct interpretation of the obtained results it is necessary to use various methods of research and, whenever possible, to apply them in a complex.

Moreover, excessive dispersion of toxic elements, heavy metals and other components takes place in a real condition for the further profitable industrial extraction of the useful components though the specific experimentally fulfilled and economically justified technology. In addition, it is a serious problem for the located nearby objects of environment.

Several features of magnetic processing of water

Ions presence, atoms or molecules without coupled electrons cause magnetic properties of substance, as known. At the same time, each electron is a magnet itself. The electron can be considered as the particle with a negative charge rotating round its nucleus. According to the classical theory of electromagnetism the rotation of any charge causes emergence of the magnetic moment. Moreover, the electron moves in the closed way around a nucleus and (in classical representations) has to be the same magnetic moment, as well as at course of electric current on the closed conductor. Magnetic properties of atom or ion are defined by set of both moments, i.e. own spin moment of an electron and orbital, arising due to the movement of an electron around a nucleus. Magnetic fields can be used for separation of the charged particles in the disperse systems. The basic of this separation are the Lorentz forces. This force effects on the charged particles moving through a magnetic field. The force increases linearly with the particle charge, the particle velocity, and the orthogonal vector component of the magnetic field strength. Positively and negatively charged particles and ions under the effect of Lorentz forces deviate to the opposite sides, during their moving besides particles at different rates are also sorted in the magnetic field according to their speed.

The following features are:

1. Magnetic processing demands obligatory water course at some speed through one or several magnetic fields.

2. The effect of magnetization disappears after the end of the action of the magnetic field, after for hours or some days.

3. The effect of processing depends on the induction of the magnetic field and the gradient, the speed of a stream, the structure of water system and time in the field.

It is noted that there is no direct proportionality between the effect of processing and the size of the magnetic field intensity. The gradient of the magnetic field is of the important role. As a rule, values of the magnetic field induction lies within 0,2 — 1,0 T, and the gradient — 50,00 — 200,00 T/m [2]. The research conducted and the results obtained show that with growth the magnetic field intensity it impacts

on the condition of salt solution, hydration of ions and structuration of hydroxide. Processing of these structural changes is inherent part in all hydroxides with diamagnetic ions: their sorption capacity increases and the specific surface decreases. Differences are connected with specific features of hydroxides, with their crystal structure, geometrical form of particles, their volume packing, temperature of sedimentation of hydroxides, etc. [3].

Statement of experiment and result

For sorption system treatment, several types of substances have been chosen i.e.: the metal shaving, zeolites, mosses and lichens processed by humates. Besides, theoretically known, that the water structure changes under the influence of the magnetic field. Parallel experiments with similar sorbents, but under the effect of magnets were performed. At the initial stage the experiment using several types of sorbents was made:

- magnetized metal shaving of 0,1-0,5 cm the dimension,
- zeolite of 0,1-0,25 cm,
- complex sorbent included metal shaving and zeolite.

The experiment deal with waste solution of the Ursky tailings dam proceeded through sorbents at natural speed in the column from top to the bottom. Height of the column is of 10 cm, the diameter is 0,6 cm where the sorbent weighted 25gr. The ratio of the passed solution and the sorbent was 2:1. The obtained solutions passed through filter paper, and then they were sent to the ICP AES analysis.

As a result, of the data obtained, the complex sorbent was the most effective. Concentration of some metals and nonmetals, such as: an arsenic, a titanium decreased at 10 and 8 times respectively; AL, Fe, Bi, Cu, Nd, P, S, Ti, Zn and Zr decreased in 2 and more times. Concentration of Ca, B, Li, Mn, Sr increased twice, Ba, Na, Ni and K in 10 times, So, Cr, Mg, Si, Sb - did not changes.

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