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MAIN PROPERTIES OF ZEOLITES AND THEIR MULTIPURPOSE APPLICATION

Abstract. The study of the geological system of zeolite deposits in recent years in developed countries is becoming more profound, since zeolites are significant in a broad sense mineral objects. The scientific research in this field is carried out in many countries of the world, especially in European countries. Over the past century, the use of zeolites has been expanding more and more. This is explained by the valuable mineral composition and various chemical properties of zeolites. When carrying out geological studies on this project, zeolite deposits Birlik, Kainarbulak, Kainar will be thoroughly studied and the original origin in all areas of geology is revealed. In addition, laboratory work will be carried out with the appropriate kinds of analyzes required for studying the composition and properties of zeolites.

Key words: zeolite, minerals, geological system, chemical properties, purification, fertility.

After the discovery of catalytic properties of zeolites in the late 50's, intensive studies of their structure, properties and methods of production began. In nature, zeolites are formed as a result of hydrothermal synthesis. Effective ways of enriching the rocks do not exist, therefore in practice only rich deposits of zeolites are used.

Natural zeolites refer to the first group of natural materials on thermo-and acid-fastness (i.e. highly resistant). Zeolites have good regenerative abilities, withstand high temperatures (up to 600 ° C), are resistant to aggressive environment without visible traces of destruction. Zeolites are not toxic, no mutagenic actions have been detected, and the use of zeolites has no limitations in all areas of the economy.

Chemical composition of zeolite: (Na, K2) $O{\cdot}Al_2O_3{\cdot}10SiO_2{\cdot}8H_2O$. The total cationic capacity is 87 mg-equ/100 g of rock, the ion exchange capacity is 2.5 mg-equ/g. There is an adsorption capacity for H_2O (water), methanol, CO_2 (carbon dioxide), O_2 (oxygen), SO_2 (sulphurous gas), H_2S (hydrogen sulfide), NH_3 (ammonia), N2 (nitrogen), large organic molecules (table 1).

Table 1 – Chemical composition of zeolite

SiO	69,0-74,0 %	CaO	1,7-3,3 %
TiO	0,08-0,16 %	MgO	0,4-1,7 %
Al2O3	11,4-14,0 %	K_2O	4,0-5,5 %
Fe2O3	0,60-1,8 %	Na_2O	0,4-0,9 %
MnO	0,02-0,05	H2O	до 10 %

On an industrial scale, synthetic zeolites are mainly used. Although more than 30 natural zeolites are known, only 8 of them (analcime, chabasite, clinoptilolite, erionite, ferrierite, lomontite, mordenite and phillipsite), found mainly in sedimentary rocks, can be of industrial importance. Difficulties are associated with exploration, study and development of deposits [1]. In general, the world wide potential supply of zeolites suitable for use is sufficiently large (Figure 1).

Figure 1 – Application of zeolites in various industries

The level of modern industrial production of synthetic zeolites reaches several hundred thousand tons per year and is mainly determined by the needs of the petrochemical industry, where synthetic zeolites of some structural types find wide application as catalysts or their carriers. Also zeolites are widely used for drying, cleaning and separation of substances, as well as ion exchangers. The effectiveness of using Zeolite perfectly aerates the soil, promotes the development of the root system, the growth of the entire plant; keeps in the root zone a sufficient amount of water – 40-70% of its weight, works as a storage tank for fertilizers - nitrate, phosphates, potassium, nutrients, the most important components for plant health and its growth. Zeolite captures fertilizers in its branched structure, until the roots of the plants find them. Nitrogen, detained in Zeolite, is insoluble in water and is not washed out by rain for a long period of time. Zeolite saves fertilizer. Less fertilizers, especially nitrogen, fertilizers are washed into groundwater. It increases fertilization by 20-40%. Without the use of Zeolite, about 35% of the nitrogen is washed out of the root zone and enters groundwater and pollutes it with nitrates and nitrites.

The use of Zeolite can give positive results in almost all types of soil and according to some data it can increase the yield of many crops - potatoes, barley, winter wheat, clover, maize, etc. by 10-30%. After the application of Zeolite, increased yields can be observed for 3- 4 years and more. According to some researchers, even after 7 years from the introduction of zeolite into the soil, its adsorption and cation-exchange functions did not change. In plant cultivation, Zeolite is extremely useful because of the stimulation of crop yields. When zeolite is introduced into substrates in organic mineral mixtures of the earth, the quality of the soil will improve by the majority of its parameters.

The results of numerous studies conducted in more than 20 scientific and research institutions in Ukraine show that the introduction of 4-10 tons / ha of zeolite fraction of 0-1 mm against a background of full mineral and organic fertilizer provides an increase in the yield of the main agricultural crops, reduces the consumption of nitrogen fertilizers (Table 2). Due to adsorption of gaseous and water-soluble nitrogen compounds, the coefficient of their use increases by 20-25%. Simultaneously, when zeolite is introduced in the calcareous soils, the content of exchangeable potassium increases by 20-45%.