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PROCEDURES FOR OBTAINING THE PRODUCTS BASED ON ZEOLITE MINERALS

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Abstract

There are several zeolite surface modifiers. For example, modification of the zeolite surface with primary amines and quaternary ammonium ions [1]. The organomineral complex is created by the activation of minerals with the surface-active substances [2,3]. The Institute for Technology of Nuclear and Other Mineral Raw Materials (ITNMS) in Belgrade started several years ago development of the new modern technologies and new materials for agriculture as well as materials for fertilization and melioration of degraded and contaminated soils. This paper gives a brief description of preparation the surface-modified zeolite minerals. Also a schematic representation of the technological process for obtaining the assortment of zeolites (Minazel and Minazel Plus) [4].

***Keywords** : zeolite minerals, surface modification, Minazel*

1. INTRODUCTION

Modification of zeolite surface with the primary amines and quaternary ammonium ions [1] is done when a product is obtained for the adsorption of weakly polar organic molecules, inorganic anions (sulfate, phosphate, chromate), as well as radionuclides. The organomineral complex is created by activation the minerals with the surface-active substances [2,3]. The quaternary ammonium ions are the most commonly used surfactants with the ionic polar groups.

For many years, the Institute (ITNMS) has been working on development the new materials - adsorbents based on the modification of hydroaluminosilicate minerals (especially zeolite). They are defined in the world in a major development trend as the SUPERSORB MINERALS. Research in development the materials - zeolite-based adsorbents, in the domain of their application in the animal husbandry, is always carried out in cooperation with the faculties of veterinary science and agriculture. The results of the research made it possible to conquer the processing technologies of natural zeolites. Too and commercial products - materials (adsorbents) that are offered and placed on the market.

2. OBTAINING THE SURFACE MODIFIED ZEOLITES

The mechanism of adsorption the quaternary ammonium ions on the surface of clinoptilolite (zeolite mineral) depends on concentration the organic cation in solution [2,5]. At lower concentrations, the organic cation in solution exists in the form of monomers. At higher concentrations, micelles are formed. Below the critical micellar concentration, the organic cation is mainly adsorbed on mineral surface in the form of monomers (Figure 1).

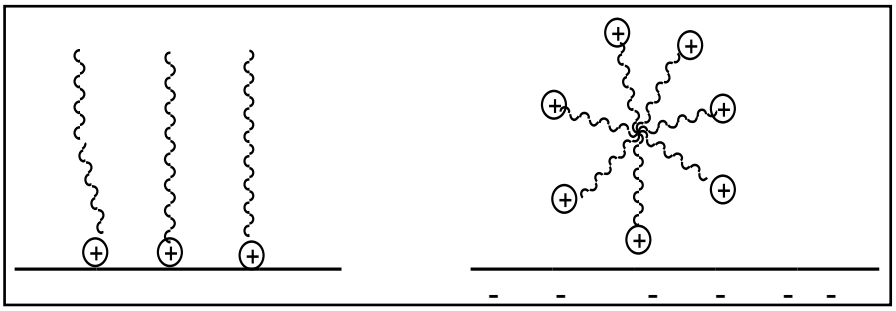

Figure 1. *Adsorption of an organic cation on mineral surface; a) in the form of monomers, b) in the form of micelles (according to Daković, 2001)*

Quaternary ammonium ions have long chains (for example the dimensions of the HDTMA - hexadecyl trimethyl ammonium ion are 0.694 x 4.194 nm). Dimensions of clinoptilolite channels are much smaller (0.31 x 0.75 nm). Their adsorption on clinoptilolite can only occur on the outer surface of mineral [5].

3 OBTAINING THE PRODUCTS BASED ON ZEOLITE MINERAL

The Institute for technology nuclear and others mineral raw material (ITNMS) in Belgrade started before more year development the new ones modern technology and new ones material for agriculture (acceptor , corrector , donor and modulator - for the plant and livestock production). Also, the materials for fertilization and melioration degraded and contaminated land . For many years, the Institute has been working on development the new materials - adsorbents. They are based on modification the hydroaluminosilicate minerals (especially zeolite), defined in the world in a major development trend as the SUPERSORB MINERALS. Development materials - adsorbents are based on the proven traits hydroaluminosilicate minerals , especially zeolite , on the active own centers, the surface and in the structure grains. Especially from organisms of people and animals, livestock food, degraded land, waste water etc. The biggest developmental domains these material reached are technologies of organic and inorganic modifications . They are achieved in the processes of changing the individual active centers (exchangeable cations), on the surface or in the structure of minerals (zeolite).This change is being made with the others organic or inorganic cations.

Research in development materials - adsorbents on the base zeolite, in the domain of their applications in animal husbandry, all time is performed in cooperation with the faculties for veterinary medicine and agriculture. A success of these researches is confirmed by many patents. Also, the interest of domestic consumers and users of foreign countries (Federation, Republic of Croatia, Italy, Greece). The research in scope of semi-industrial and industrial verification is intensified. Especially in the experimental production as the final stage of application the scientific results.

Within the framework of ITNMS, a semi-industrial-experimental plant for the processing of trench zeolite and production of a wider range of products for animal husbandry was designed and assembled [4] . Figure 2 gives a schematic representation of the technological process of obtaining an assortment of zeolites for animal feed in the experimental plant at ITNMS. Obtaining the organo zeolite by the "dry" process is shown in Figure 2, and a schematic view of obtaining the organo zeolite is given in Figure 3.

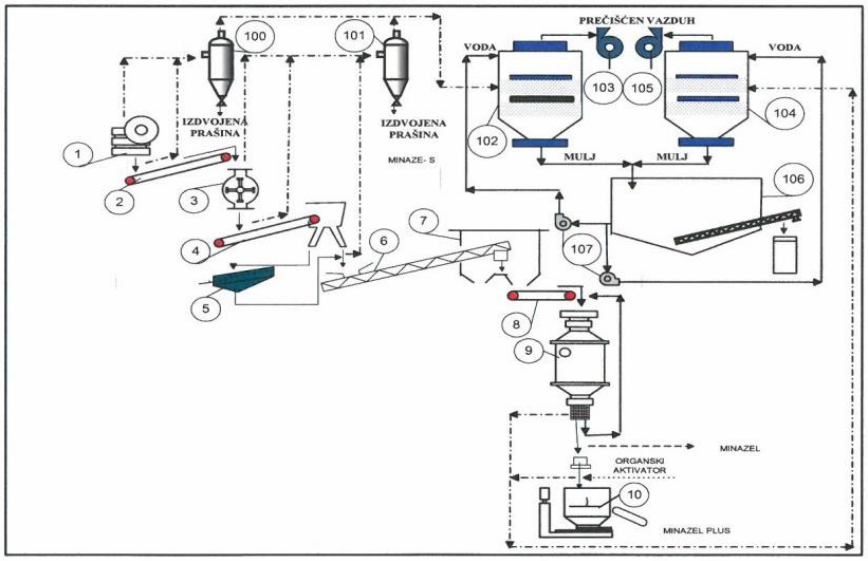

Figure 2. *Schematic representation of the technological process of obtaining an assortment of zeolites (Minazel and Minazel Plus) for animal feed in a semi-industrial plant in the ITNMS (obtaining the organo zeolites by the "dry" process*

Mumpton wrote as early as 1973 [6] about the application and obtaining the products based on natural zeolite. The technological procedures for obtaining the zeolite-based products mainly include shredding (multi-stage crushing, grinding) and classification (Pavlović et al., 1998). Technological processing processes can have a flexible character. It is in terms of grading and packaging depending on the purpose of the product. If a wider range of products is obtained from the raw materials, it is necessary to perform the organic activation . This modifies the surfaces of those minerals. The final product of larger size (eg for adsorption of ammonia and unpleasant odors) is obtained after crushing . Sifting is carried out on appropriate sieves.

Based on schemes 2 and 3, applied in the ITNMS, it can be observed that two products are obtained. One is obtained from natural zeolite (Minazel) . The second one is surface modified, i.e., organo zeolite called Minazel Plus.

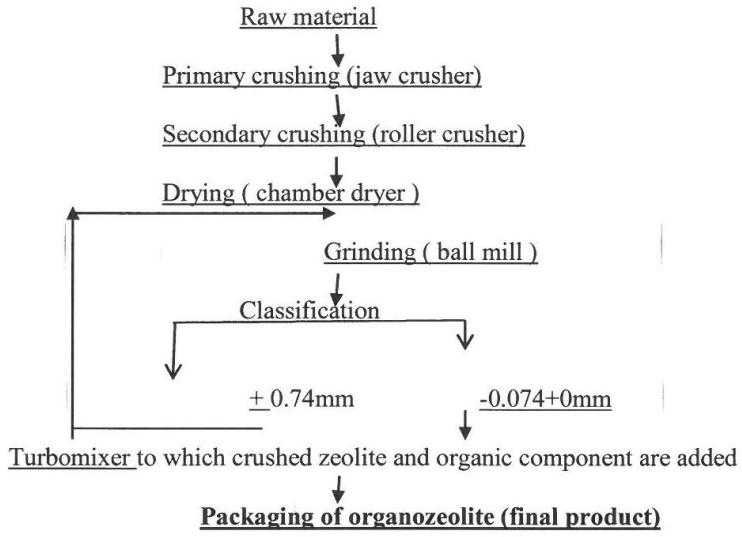

Figure 3. *Schematic representation of the technological process for obtaining organo zeolites in the ITNMS*

There are differences in the quality of individual zeolite size classes. Therefore, it is important to define which size class is necessary for a specific purpose . Then the procedure for obtaining that class is defined, taking into account the quality of trench zeolite.

The finished products produced in the ITNMS, based on the processing of natural zeolitic tuffs, are mineral adsorbents of mycotoxins present in the animal feed, "Minazel" and "Minazel Plus" [4] . Their main characteristics are:

- They are obtained by the technological processing (modification) of natural zeolite with a high content of the zeolite mineral clinoptilolite (over 85%). According to their chemical composition, they are hydrated aluminosilicate of alkaline and alkaline earth cations.
- They are bacteriologically correct for use in the animal nutrition and do not contain harmful elements.
- They selectively bind and inactivate mycotoxins present in the contaminated animal feed. This activity is particularly pronounced against alphatoxins, zeralenone, ochratoxin and T2 toxin, which reduces their harmful effects in the gastrointestinal tract of animals.
- They do not adsorb amino acids, vitamins and trace elements.
- Their positive effect has been confirmed by many years of research . These are in vitro (laboratory conditions) and in vivo (by performing tests on a large number of animals under conditions of intensive application in the industrial animal fattening).
- They are used in the amount of 0.2% (Minazel Plus) to 0.5% (Minazel) in complete preventive feed mixtures for all types of animals. Their mixing in premixes is recommended.

- Significantly improve the health condition of animals. They reduce the occurrence of diarrhea and vulvovaginitis. With the content of mycotoxins in the blood, liver and other organs, they reduce the appearance of aflatoxin M1 in milk, and increase immunity.
- They have a positive effect on increasing production results during intensive animal breeding. They increase the body weight of animals and reduce their mortality.
- They are harmless, non-resorbable and do not leave residues in meat, milk and eggs.
- They are stored in a dry place with an unlimited shelf life.

4. CONCLUSION

For many years, the Institute, ITNMS, worked on development the new materials - adsorbents. They are on the base modifications hydroaluminosilicate minerals, especially zeolite. Development of materials - adsorbents is based on the proven property of hydroaluminosilicate minerals, especially zeolites, that they can adsorb various toxic substances from the human and animal organisms on the active centers they possess, on the surface and in the grain structure; a;sp, from the livestock food, degraded land, waste water, etc. The biggest developmental domains these material reached are technologies organic and inorganic modifications . They are achieved in the processes of changes the individual active centers (changeable cation) on the surface or in the structure minerals (zeolite), with others organic or inorganic cations . The results of researc have enabled a conquest technology for processing the natural zeolite . Especially the commercial products - materials (adsorbents) which are now offered on the the market. The applied research in scope of the semi-industrial and industrial verification, especially in the experimental production came as the final phase of application the scientific results.

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