Granulation of natural zeolite

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Granulation of natural zeolite: *This research aims to investigate and demonstrate the feasibility and effectiveness of an opportunity for granulation of natural zeolite. This proved date and quite an easy task technology. Preliminary studies for the preparation of granules by the method of "fluid bed" showed that obtaining granules of pure natural zeolite is impossible.*

In our country, natural zeolite is used a lot (desiccant) in the form of pre-shredded material by mechanical method and sieve fraction (particle with 2-4 mm). This practice leads to large losses of natural material.

The present study deals with issues granulation of natural zeolite with a grain size of 2-4 mm. As the main feedstock used natural clinoptilolite (milled and dried) in a career "White layer" of Eastern Rhodopes.

For this study developed a series of mixtures containing clinoptilolite, kaolin (type "BoExtra", from "Kaolin AD") and the binding component (aqueous solution of gum arabic). The conducted studies have proved that a mixture containing an amount up to 80% of natural zeolite (clinoptilolite) and 10 % kaolin, is possible to form a granule with adhesives containing 10% - aqueous solution of gum arabic. Granulation is done by a "fluid bed" method, a specially designed and constructed for this purpose pelletizing plant. The granules so produced is also possible to use as a drying agent, or are subjected to further processing for crystallization of the kaolin portion of the granule. It was found that the natural zeolite has a beneficial effect on zeolitizirane grain as it fulfills the role of crystallization. It was found that the addition of natural zeolite also lowers the purity of the phases of the resultant synthetic zeolite.

It has been shown that it is possible to use natural zeolite (clinoptilolite) in an amount up to 45%, for preparing a mixture with kaolin to form suitable granules. It has been found that this is one possible way of using the natural zeolite in the preparation of synthetic zeolite

Key words: : *Natural zeolite, zeolite A, kaoline, granulation, fluidized bed, clinoptilolite.*

INTRODUCTION

This research aims to investigate the possibility for the granulation of natural zeolite. This proved to be up to date technology and highly responsible task. Preliminary studies on the subject showed that pure natural zeolite is difficult obtaining suitable granules by the method of "fluidized bed".

The goal here is to create the conditions for obtaining the appropriate spherical granules having sizes (grain diameter 2 to 4 mm), while the granules are suitable as sorbents. In practice, this leads to greater difficulties in the preparation of the granulate, as in many cases the "glue" material (water, aqueous solution of water glass, an aqueous suspension of the clay, an aqueous solution of gelatin and gum arabic, etc.). Forming granulate, it is possible to "plug" the channels and cavities of the zeolite structure, and thus its sorption properties are lost.

In practice this would not be possible if the natural zeolite is mixed with kaolin and granulated, and the granules thus obtained are subjected to further processing for crystallization (zeolitization) of the kaolin of the granule.

EXPERIMENTAL PART AND RESULTS

The technology for preparing granules of a natural zeolite having the following steps: preparation of the starting ceramic matrix; molding the granules of a size (diameter 2-4 mm); thermal activation of the beads; packaging of the final product.

For this study feedstock use of natural Bulgarian zeolite (clinoptilolite) by deposit of career „Beli Plast" in Northeastern Rhodopes. Chemical composition of the same in weight % is: SiO_2-66.60, Al_2O_3-11.41, Fe_2O_3-0.80, TiO_2-0.15, MgO-0.06, CaO-2.80, Na_2O-0.22, K_2O-2.90. The content of clinoptilolite in natural product reaches 90%.

The zeolite is subjected to the following pretreatment: milling, sieving (used was a fraction with a grain size up to 50 μm) and dried at 120°C for 1 h.

Experimental studies prepared following mixtures containing natural zeolite, kaolin and the binding component listed in Table 1.

Table 1 Experimental mixtures granulation

Hatural zeolite , %	Kaolin, %	Binding component (10% - aqueous solution of gum arabic), %
30	60	10
40	50	10
50	40	10
60	30	10
70	20	10
80	10	10
85	5	10

The conducted studies have proved that a mixture containing an amount up to 80% of natural zeolite and 10% kaolin, is possible to form a granule with adhesives containing 10% - gum arabic. It has been found that the addition of zeolite has a beneficial effect on zeolitizirane granule as natural zeolite acts as a crystallization germ. It was found that the addition of natural zeolite lowers the purity of the phases of the resultant synthetic zeolite.

Experimental mixtures using a suitable kaolin (type "BoExtra", from "Kaolin AD"). The same is particularly suitable, because it, by hydrothermal treatment, may be readily synthesized zeolites [1-3].

On the basis of technology for synthesizing zeolites, and from this text to the granulation process and the type granulating systems has made a laboratory unit granulation method "fluidized bed" type "ProCell System" [4-7].

In fig. 1 is a general scheme of the developed system for granulation type "ProCell System".

The choice in favor of this granulation system is supported by the fact that the system allows: the preparation of granules (of ceramic materials in the "fluidized bed") type "Blackberry", with a diameter of 0.5 to 5.0 mm; separating the resulting granules in the range of 2 to 4 mm; drying the resulting granules to 100 ° C; the potential for rapid and fine-tuning, and change the action of the fluid in the working chamber; the system is sufficiently secured (outflow of fine powders) having two cyclonic devices; additionally can be fitted with devices for computer setting the working fluid.

The installation is equipped with a centrifugal fan high pressure power 7.5 kW and a capacity of 2800 m^3/h. Body and plant working chamber made of stainless steel. Management of the working fluid are mounted 9 pcs. regulating valves (type "Butterfly").

To prepare the granules having a high strength, the granulation process comprises treating a ceramic powder suitable for the purpose liquids (solutions of sodium silicate, carboxymethyl cellulose, etc.) In which easily forms a nearly perfect spherical shape granule, but this case is the so obtained. encapsulation - the resulting granules have an active surface.

That is why we chose a new approach for the preparation of pellets by the method of "fluidized bed". Development and installation of a special device (network grid) for injecting the fluid. This grating (type "SpinFlow") it is possible to generate a stable complex and "fluid vortex" in the working chamber. Thus, compaction and finishing of the beads, as they become more solid, without losing the porous structure [5,7].

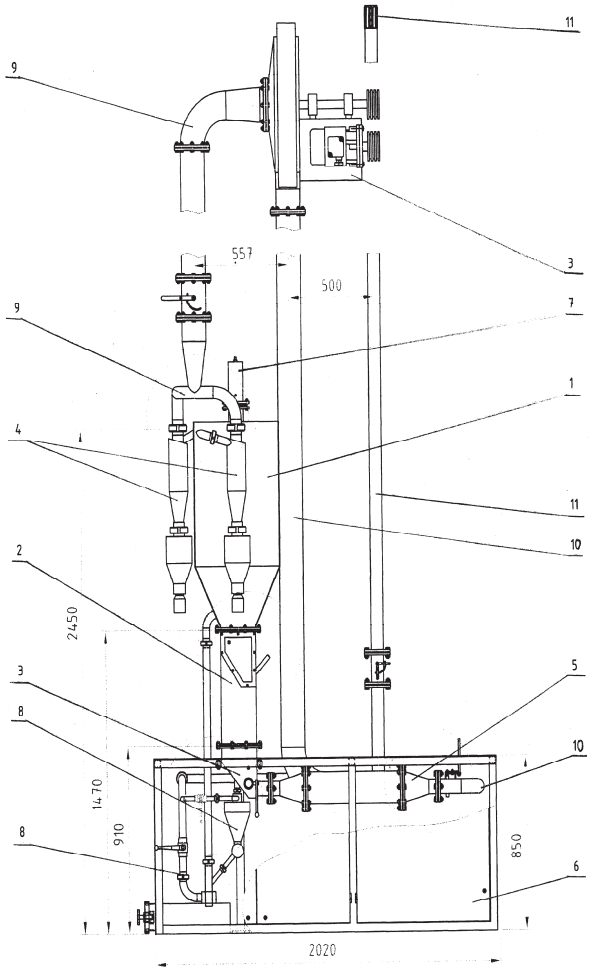

Fig. 1. General scheme of a plant for producing granules by a process of "fluid bed" type "ProCell System": 1 - separation chamber; 2 - working with camera array; 3- bottom of the grid; 4 - cyclones; 5- heaters; 6 - table; 7 - lighting; 8 - separation system; 9-11 – pipelines.

To the installation is constructed in a system for regulating and separating the resulting granules in terms of the diameter of the granule. The construction of the system for separating the granules is presented in Figure 2. It is composed of a nozzle (1) by means of which the granulating solution is sprayed into the bed of powder particles. The nozzle is arranged in the zone of intense fluidizing flow upward movement of the particles in this zone is vortical in the profile of the grating. Studies have shown that the continuous washing of the nozzle of the granulated powder prevents its "fouling bed".

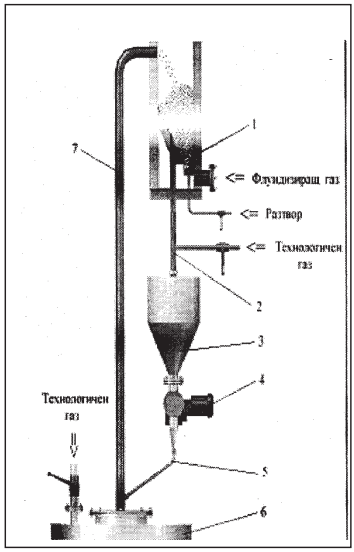

Fig. 2. A system of selection and separation of the beads

Team of the granules of the layer takes place in two stages: a system consisting of a central tube rough separation (2), hopper (3) sectoral dispenser (4) accurate separation tube (7) and bunker choicest granules [7,8].

Granulation was carried out on the installation method of "fluid bed", and for this purpose are shaped pellets, type "Blackberry" with dimensions of 2 to 4 mm. The system automatically separates the granules with preset dimensions. They are dried at a temperature of - 100 °C, under conditions of a fluidized bed. This is done to obtain the initial strength of the granules (called green strength). The granules thus obtained are subjected to thermal activation in a muffle furnace at a temperature 420°C for 3 h. It suction and packaging of the final product.

CONCLUSIONS

The analysis of the results of this study allows us to draw the following conclusions:

• It has been shown that it is possible to use natural Bulgarian zeolite (clinoptilolite) by deposit of career "Beli Plast" in Northeastern Rhodopes in an amount up to 80%, for the preparation of a mixture of kaolin (type "BoExtra", from "Kaolin AD") and tackifiers (aqueous gum arabic) to form suitable granules (type "Blackberry" with dimensions of 2 to 4 mm);

• It has been found that this is one possible way of using the natural zeolite in the preparation of synthetic zeolite. Detailed further analysis and further research in this direction will be answered about the effectiveness of this approach in the synthesis of zeolites.

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This paper has been reviewed