

CHEMICAL SCIENCES

ACQUISITION OF NATURAL CLAY-BASED CATALYSTS, PROCESS OF ALKYLATION OF BENZENE WITH HIGHER OLEFINS

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Abstract

The article provides a method for preparing the active form of bentonite clay for the normal implementation of the processes of alkylation of benzene with linear olefins based on natural clays. When natural clay is treated with ammonium salt, it is heated at high temperature and transferred to H-form.

Keywords: bentonite, catalyst, natural clay, benzene, alkylation process

INTRODUCTION: As can be seen from the literature, unactivated clays do not exhibit catalytic activity.

In order to obtain catalysts based on natural clays, we analyzed different methods of clay activation and selected different activation methods. Activation of clay by thermochemical method, which consists of thermal processing of clays with passivation of iron impurities (catalysts based on troshkov clay formed from minerals of kaolinite-halloysite and allophane groups) is known. Calcination of clay is carried out at 700 - 750 °C in a reducing environment with the presence of hydrogen and carbon monoxide [1].

Another activation method - acid activation - is associated with the dissolution of impurities and part of clay aluminum with further drying and burning in acid. With acid activation, the mechanical strength of the catalyst is partially lost. The use of this method is associated with equipment corrosion and significant depletion of the aluminum catalyst [2].

There is also a milder way to convert the clay into the H-active form by treating it with ammonium salts and then heating it to stabilize it at 300-600°C. At this time, ion exchange of alkali metals for ammonium cations occurs, and then the transition of clays to H form occurs. In activated clays, the content of SiO₂ increases, while the number of Na₂O, CaO, MgO, Al₂O₃ inclusions decreases. During chemical processing, the acidity of clays increases, additional pores are formed, total porosity and specific surface area increase. Catalytic activity is limited by geometrical factors and the resulting diffusion limitations. The concentration of acidic OH groups, which are proton donors in alkylation and cracking reactions, is determined by the number of Al-O-Si bonds, that is, by the number of tetrahedral aluminum atoms, and the possible localization of protons depends on the following. SiO₂/Al₂O₃ is relatively complex. The stability of the acid sites involved in the reactions decreases sharply during high temperature treatment [3].

Since the dissolution of the crystal structures of aluminosilicates occurs at high firing temperatures, the specific surface area decreases, and ammonium forms decompose at lower temperatures, we chose the third method of bentonite clay activation to obtain a catalyst. This method, in our opinion, will not only preserve the

structure of the mineral - montmorillonite, but also allow us to continue the preparation of catalysts modified with various metal ions, thereby allowing the extensive study of various minerals.

EXPERIMENTAL PART: Since the natural clays of different deposits do not have the same composition and structure, there is a modification technique specific to the creation of catalysts for different hydrocarbon transformations. We believe that the study of Azerbaijani bentonite clays containing up to 40% montmorillonite will allow to create an economically viable catalyst for the alkylation of aromatic hydrocarbons with higher α -olefins by applying various modification methods and to study the parameters of alkylation. The process carried out will allow us to determine the optimal reaction conditions.

CONDUCT OF THE EXPERIMENT: The procedure for preparing the H/NH₃ form of natural bentonite is as follows: the clay is divided into pieces of 0.5-2 mm diameter and washed several times with distilled water. Then the top layer with clay suspension is separated.

The remaining free montmorillonite is dried with constant stirring to a free-flowing state, then poured into a hot (80-90°C) 5% NbCo solution and stirred for 12 hours. After that, the precipitate is separated and washed with distilled water. The ion exchange is repeated again. The precipitate was separated and washed twice with distilled water, then dried in a conventional oven at 150°C and calcined in a muffle furnace (thermal activation or regeneration) at 250°C for 4 hours [4].

Modified bentonite was prepared by treating with metal nitrate or chloride solution of NLCNH₃ form (calculated as 0.07 mol Meⁿ⁺ per 1 kg ml) at room temperature for 12 hours. Then the solution is evaporated at room temperature, the obtained precipitate is dried and subjected to thermal activation at 375°C for 4 hours. Bentonite Bme was purchased. The prepared catalysts were stored in a desiccator.

The granular form of the catalyst was obtained by treating the clay with ammonium chloride as described above. The raw clay dried at 150°C was ¼ part, the remaining ¾ part was modified with salts of some metals and mixed with 1/4 part of bentonite dried in raw form, the granules were formed and dried at 375°C for 30 hours [3].

It is known that in order to achieve high specific activity of the catalyst, a wide contact surface of the reagents with the active centers is required. This can be achieved either by maximum dispersion or by creating a highly developed internal surface of the catalyst granules. In the first case, it is often difficult to separate fine catalyst particles suspended in the reaction medium from the final products and reuse them. Therefore, highly dispersed heterogeneous catalysts are effective only at high specific process rates. In the second case, the increase of the internal surface by creating high porosity is limited by the decrease in the strength of the granules, which are destroyed and crushed during their operation.

In this study, the active surface of the catalyst and its granulation methods were not studied, and these problems are the subject of our further research.

RESULT: In the process of alkylation of benzene with higher olefins, an active catalytic complex was prepared based on ecologically clean and economically favorable (i.e. cheap) natural clays for obtaining monoalkylbenzenes with a high yield.

Literature

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