SYNTHESIS OF HIGH-SILICONE ZEOLITES

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Abstract. During the study, the synthesis, texture and physicochemical characteristics of high-silica zeolites from bentonite and kaolin were studied. Adsorption isotherms are characteristic of type IV according to the de Boer classification and characterize the adsorption of monomolecular substances. On the isotherm in the range \( P/P_0 = 0-0.05 \), monomolecular adsorption in mesopores and adsorption in micropores are observed. At \( P/P_0 = 0.05 \), mono- and polymolecular adsorption is observed in mesocytes. \( P/P_0 = 0.05-0.4 \) is a polymolecular adsorption field. Based on the obtained results, adsorption of gases \( \text{CO}_2, \text{H}_2\text{S} \) and \( \text{NO}_2 \) by absorption of a mixture of salts \( \text{CaCl}_2 \cdot \text{ZnCl}_2 \cdot \text{MnCl}_2/\text{HSZ} \) into a synthesized sorbent was investigated. According to the results of the experiments, the dynamic capacity \( \text{CaCl}_2 \cdot \text{ZnCl}_2 \cdot \text{MnCl}_2/\text{HSZ} \) for hydrogen sulfide was 2.76% by weight. The total dynamic capacity of the adsorbent by \( \text{H}_2\text{S} \) was higher than 20-25%.

Introduction. In recent years, natural and artificial zeolites have been widely used in hydrocarbon processing. Adsorption methods are one of the most common hydrocarbon purification methods in the industry. Their use allows returning to production several valuable compounds [1-2]. The study of zeolites is devoted to many works. Zeolites are a microporous substance with the correct crystal structure and a controlled size not exceeding 2 nm [3-6]. Zeolitic scaffolds are lattices consisting of tetrahedral T-atoms (T = Si, Al, etc.), Connected by atoms in oxygen. More than 200 types of synthetic zeolites of various structural types are currently known [7-9]. However, no more than 10% of all known structures are produced in industry, and only 5 structural types are actually used as catalysts [10-13]. The most important requirements for adsorbent materials are high specific surface area, selectivity and ease of regeneration [14-15]. The adsorbent must also be inexpensive and harmless, non-corrosive, capable of maintaining its adsorption properties for a long time and having high mechanical strength. One of the most common adsorbents is activated carbon, which is available in various brands. One of the most important directions today is the development of environmentally friendly sorbents, preservatives and catalysts based on local raw materials [16-17].

Experiment. To determine the chemical and physicochemical characteristics of the synthesized high-silicon zeolites, samples of pellets weighing 100 g were placed in a glass flask with a volume of 250 cm³ and poured with 150 cm³ of distilled water. The flask was stirred on an ABY-6 device at 120 rpm for 24 hours. After drying, the adsorbent was passed through a 0.5 and 0.25 mm sieve and the remaining samples through a 0.25 mm sieve were passed through a 0.5 mm sieve. chemical characteristics were studied. Before acid treatment, the soil was ground to 0.08 mm. To 10 g of ground, the soil was added 40 g of heated \( \text{H}_2\text{SO}_4 \) and heated by stirring in a water bath. After treatment, the soil was filtered through a paper filter in a Buchner funnel and washed with distilled water at pH = 5.4-5.7. The soil was then dried in an oven at 120 °C with filter paper for 5 hours. The distribution of pores by specific surface area and size was detected on the automatic absorptiometer “ASAB 2010” by low-temperature nitrogen desorption. Sedimentation analysis was carried out by
the “Oden method” in water and an aqueous glycerol mixture in various dispersion media. X-ray phase analysis (Co-Kα irradiation) was performed on a DRON-4 diffractometer with a cobalt X-ray tube. The PDF-2 database of the International Diffraction Data Centre (JCPDS, 1999) was used for the analysis of diffractograms. The parameters of the porous structure of the samples were determined by low-temperature nitrogen desorption in a Quanchrome NOVA analyzer (USA). Before measurement, each sample was degassed under vacuum at 250 °C for 2 hours. The subjects of the study were bentonite Navbahor and kaolin Pakhtachi [19-20].

The synthesis of high-silicon zeolite (HSZ) was carried out as follows: by mixing 30 g of bentonite in 300 ml of bi-distilled water, a suspension was prepared and slowly mixed, during which the bentonite-containing minerals were separated into fractions. The resulting suspension was left for a day. The sample was then centrifuged at 7,000 rpm for 5 minutes. The resulting fraction was dried in the open air at room temperature for 6 hours and then at 65 °C for 12 hours. The sample was then activated in 1.5 M nitric acid at 80-90 °C for 2 hours. After activation, 200 ml of distilled water was added to the bentonite suspension and cooled rapidly.

The resulting sample was then washed several times with distilled water, centrifuged and dried at room temperature for 12 hours and then at 65 °C for 12 hours. Chemically treated with sodium carbonate and 25% nitric acid in the same order.

**Results and discussion.** In order to purify the oil products of the various gases, 20% of the solutions CaCl₂, ZnCl₂, MnCl₂ were swallowed for 2 hours on the high-silica zeolite obtained by the above method under strong shaking. The result was a sample containing CaCl₂•ZnCl₂•MnCl₂/HSZ. The chemical composition of the sample was analyzed by an energy dispersion spectrometer and a radiographic method using a scanning electron microscope.

![HSZ microscopy obtained by scanning electron microscopy: an increase of 2,000 times (A), 8,000 times (B), 25,000 times (A) and 40,000 times (B).](image-url)
Figure 2 shows the differential curves of adsorption-desorption isotherms and pore distribution radius of the synthesized HSZ. Adsorption isotherms are characteristic of type IV according to the de Boer classification and characterize the adsorption of meso-cellular substances. On the isotherm in the range \( P/P_0 = 0 - 0.05 \), monomolecular adsorption in mesopores and adsorption in micropores are observed. At \( P/P_0 = 0.05 \), mono- and polymolecular adsorption is observed in mesocytes. The \( P/P_0 = 0.05 - 0.4 \) field is polymolecular adsorption which is used in the BET equation to determine the specific surface area (\( S_{sol} \)). On the isotherm of adsorption, \( P/ P_0 = 0.4 - 1.0 \) characterizes the occurrence of capillary condensation in mesocytes.

Thus, some textural and physicochemical characteristics of a high-silica zeolite obtained from bentonite and kaolin have been studied.

References:

[1] Chester, A. W., & Derouane, E. G. (2009). Zeolite characterization and catalysis (Vol. 360). New York: Springer,p. 358p.
[2] Zhicheng, L. I. U., Yangdong, W. A. N. G., & Zaiku, X. I. E. (2012). Thoughts on the future development of zeolitic catalysts from an industrial point of view. Chinese Journal of Catalysis, 33(1), 22-38.
[3] Везенцев, А. И., Королькова, С. В., & Буханов, В. Д. (2010). Текстурные характеристики и сорбционные свойства природной и магний-замещенной монтмориллонит содержащей глины. Научные ведомости Белгородского государственного университета. Серия: Естественные науки, 11(9 (80)).
[4] Файзуллаев, Н. И., Жуманазаров, Р. Б., Норкулов, У. М., & Оманов, Б. Ш. (2018). Винилацетат ишлаб чиқаришнинг ихчамлаштирилган технологияси. СамДУ ўилмий ахборотномаси.
[5] Мусурмонов, Н. И. Ф. Н., & Оманов, Б. Ш. (2019). Бифункционал катализаторларда ацетиленнинг каталитик ўзгаришлари. Монография. СамДУ нашриёти.
[6] Mamadoliev. I.I. & Fayzullaev. N.I. (2020). Optimization of the Activation Conditions of High Silicon Zeolite. International Journal of Advanced Science and Technology. Vol. 29, No. 03, pp. 6807 – 6813.
[7] Mamadoliev. I.I., Fayzullaev. N.I., & Khalikov. K.M. (2020). Synthesis of High Silicon of Zeolites and Their Sorption Properties. International Journal of Control and Automation. Vol. 13, No. 2, pp. 703 – 709.
[8] Fayzullaev N.I., Bobomurodova S.Y., & Xolmuminova D.A. (2020). Physico-chemical and texture characteristics of Zn-Zr/VKTS catalyst. Journal of Critical Reviews. Vol. 7, Issue 7 , p. 917-920
[9] Оманов, Б. Ш. У., & Файзуллаев, Н. И. (2020). Параметры технологического режима синтеза винилацетата. Universum: химия и биология, (4 (70)).
[10] Фоизов, С. Ф., Файзуллаев, Н. И., & Содикова, М. М. (2019). Каталитическая парофазная гидратация ацетилена. Научный аспект, 8(1), 976-979.
[11] Sh, S. B. (2018). Rakhmatov Sh. B., Fayzullayev NI High silicon zeolite preparation from kaolin. Scientific journal of SamSU, 5(109), 106-111.
[12] Файзуллаев, Н. И., Туробжонов, С. М., & Оманов, Б. Ш. (2018). Винилацетат ишлаб чиқаришнинг
такимиллашылуу технологиясы. И. Каримов номидагы Тошкент даямат техника университети. ТошДТУ хабарлары.

[13] Fayzullaev, N. I., & Sh, S. B. (2018). Catalytic aromatization of methane with non-mo-contained catalysts. Austrian Journal of Technical and Natural Sciences, (7-8).

[14] Fayzullaev, N. I., & Shukurov, B. S. (2017). Kinetics and Mechanism of the Reaction of Catalytic Dehydroaromatization of Methane. International Journal of Oil, Gas and Coal Engineering, 5(6), 124.

[15] Файзуллаев, Н. И., Курбанов, А. М., Шугаев, Н. А., & Турдиев, М. Ф. (2016). Катализитическое ацетилирование ацетилена в паровой фазе и присутствии нанокатализатора. Вестник АИНГ.

[16] Fayzullaev, N. I., Jumanazarov, R. B., & Turabjanov, S. M. (2015). Heterogeneous Catalytic Synthesis of Vinylchloride by Hydrochlorination of Acetylene. IJISET-International Journal of Innovative Science, Engineering & Technology, 2(9).

[17] Файзуллаев, Н. И., & Турсянова, Н. С. (2018). Получение этилена из метана с использованием маргансодержащего катализатора. Химия и химическая технология, (1), 24-28.

[18] Мухамадиеv, А. Н., & Файзуллаев, Н. И. (2018). Газохроматографическое изучение реакции каталитического превращения метана в метанол. In XXXV Всероссийский симпозиум молодых ученых по химической кинетике, pp. 110-110.

[19] Файзуллаев, Н. И., Курбанов, А. М., & Доскалиева, Г. Ш. (2016). Гетерогенный каталитический синтез метилена из ацетилена. In Достижения, проблемы и перспективы развития нефтегазовой отрасли (pp. 408-474).

[20] Файзуллаев, Н., Акмалайулы, К., & Хакимов, Ф. (2020). Совместное получение винилхлорида и хлоропрена из актинила. Збірник наукових праць, ЛОГОС, 129-133. https://doi.org/10.36074/21.08.2020.v1.47.

[21] Файзуллаев, Н., Сагинаев, А., Шкуров, Б., & Холлиев, Ш. (2020). Катализитическая дегидрозвароматизация нефтязиного попутного газа. Збірник наукових праць ЛОГОС, 122-126. https://doi.org/10.36074/21.08.2020.v1.45.

[22] Файзуллаев, Н., Акмалайулы, К., & Хакимов, Ф. (2020). Новый нанокатализатор для синтеза актинила. Збірник наукових праць, ЛОГОС, 126-129. https://doi.org/10.36074/21.08.2020.v1.46.

[23] Акмалайулы, К., Файзуллаев, Н., & Хакимов, Ф. (2020). Гетерогенный каталитический синтез винилхлорида из актинила. Збірник наукових праць, ЛОГОС, 113-115. https://doi.org/10.36074/21.08.2020.v1.42.

[24] Файзуллаев, Н., Акмалайулы, К, & Хакимов, Ф (2020). Катализитический синтез винилаллата в ацетилированием актинила в паровой фазе. Збірник наукових праць ЛОГОС, 118-122. https://doi.org/10.36074/21.08.2020.v1.44.

[25] Файзуллаев, Н., Акмалайулы, К, & Хакимов, Ф (2020). Гетерогенно-катализитический синтез винилаллата и хлоропрена гидрохлорированием актинила. Збірник наукових праць, ЛОГОС, 115-118. https://doi.org/10.36074/21.08.2020.v1.43.

[26] Omanov, B. S., Fayzullaev, N. I., & Xatamova, M. S. (2020). Vinyl Acetate Production Technology. International Journal of Advanced Science and Technology, 29(3), 4923-4930.

[27] Fayzullaev, N., Akmalialu, K., & Jianov, A. (2020). Catalytic synthesis of a line by acetylene hydration. News of the National Academy of Sciences of the Republic of Kazakhstan, Series chemistry and technology, 2(440), 23-30.

[28] Файзуллаев, Н. И., & Муратов, К. М. (2004). Исследование реакции каталитического парофазного синтеза винилхлорида на нанесенном катализаторе. Химическая промышленность, 81(3), 136-138.

[29] Omanov BS, Fayzullaev NI, Musulmonov NK, Xatamova MS, Asrorov DA. Optimization of Vinyl Acetate Synthesis Process. International Journal of Control and Automation. 2020 Feb 27;13(1):231-8.

[30] Файзуллаев НИ, Фозилов СФ, Ибодуллаев МН, Хотамов КШ. Гетерогенно-катализитический синтез винилаллата из актинила. Научный аспект. 2019(1).

[31] Fayzullaev, N. I., Karjava, A. R., & Yusupova, S. S. (2020). Catalytic Synthesis of Acetone Direct Acetylene Hydration. International Journal of Advanced Science and Technology, 29(05), 4507-4514.

[32] Omanov, B. S., Fayzullaev, N. I., & Xatamova, M. S. (2019). VINYLCETATE Production Out of ACETYLENE. International Journal of Advanced Research in Science, Engineering and Technology, 6(12).

[33] Файзуллаев, Н. И., Сарисакова, Н. С., & Бакиева, Х. А. (2018). Метод получения винилаллата и хлоропрена из актинила. Молодой ученый, (24), 273-275.

[34] Файзуллаев, Н. И., Турожков, С. М., & Оманов, Б. Ш. (2018). Винилаллат синтеза реакторной моделпаштириш ва жараёнə макбулпаштириш. И. Каримов номидаги Тошкент даямат техника университети. ТошДТУ хабарлары.

[35] Файзуллаев, Н. И., Курбанов, А. М., Шугаев, Н. А., & Турдыев, М. Ф. (2016). Катализитическое ацетилирование актинила в паровой фазе. In Достижения, проблемы и перспективы развития нефтегазовой отрасли. pp. 474-479.
THE CHARACTERISTICS OF CATALYSTS IN THE CATALYTIC AROMATIZATION REACTION OF PROPANE- BUTANE FRACTIONS

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Abstract. To examine the catalytic aromatization reaction of propane-butane fraction \(\text{(MoO}_3\text{)}\cdot(\text{ZnO})_y\cdot(\text{ZrO}_2)_z\) in the mesoporous catalyst, this experiment was conducted under the following optimal conditions: when 1.0 mass% Zr nanopowders were added to the mesoporous catalyst \(\text{(MoO}_3\text{)}\cdot(\text{ZnO})_y\cdot(\text{ZrO}_2)_z\), containing the flow differential reactor, \(V_{\text{cat}} = 1.0 \text{ cm}^3\), the size of catalyst granules 0.5-1.0 mm, the temperature 450-650ºC, \(P = 0.1 \text{ MPa}\), volumetric rate of propane 600 h\(^{-1}\). It was determined that both types of acid centers' concentrations and strengths were increased.

Introduction. The most efficient way of recycling propane-butane fractions is recycled them chemically and obtain aromatic hydrocarbons. It is known that aromatic hydrocarbons are primary products in the main organic synthesis industry. At present, the aromatic hydrocarbons are processed from recycling liquid products of oil, catalytic reforming and pyrolysis processes. Changing in the petrochemical complex raw material base are leading to a shortage of these hydrocarbons Therefore, searching for alternative energy sources to replace petroleum products for obtaining aromatic hydrocarbons remains an important task. Nowadays the main alternative sources are natural gas and petroleum gases are aromatic compounds.

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