ADSORPTION CHARACTERISTIC OF Mg^{2+} FORM OF THE ZEOLITE 4A

Prof. Blagica Cekova PhD

MIT University, Faculty of ecological resources management, Skopje, Macedonia

cekovab@yahoo.com

Viktorija Bezhovska

Faculty of technology and metallurgy, University St. Cyril and Methodius, Skopje, Macedonia

bezhovska@gmail.com

Filip Jovanovski

Faculty of technology and metallurgy, University St. Cyril and Methodius, Skopje, Macedonia

fillip.jovanovski95@yahoo.com

Abstract: The first experimental works for adsorption of gases on zeolites and the influence of molecular - sieve properties was made on natural materials by F. Gradian who studied adsorption of gases on dehydratited zeolites. The ability of adsorption properties of the zeolites is determined by two factors, character of the porous structure and the heteropolar character of the polar centers. In our research adsorption is determined with water vapor by a static - gravimetric method. The results are presented in tables and graphic dependence is represented by adsorption isotherms in Langmuir 's coordinates.

Key words: Mg^{2+} form of the zeolite 4A, adsorption, Langmuir's equation, Langmuir's coordinates

INTRODUCTION

Adsorption of water vapor of zeolite type Mg^{++} NaA with a static method, is performed in a desiccator with sulfuric acid in different concentrations or relative pressures P / P_o .

EXPERIMENTAL PART

Dry sample in the amount of 1 g is placed in vegglas while vegglas is placed in the desiccator set in a thermostat, where it is held constant temperature of 298K. For each relative pressure, the amount of adsorbed water vapor is followed after adsorption of 10 days.

RESULTS AND DISCUSSION

The results of the measurements are given in table 1 and graphical dependence is shown with adsorption isotherms in Langmuir's coordinates (Figure 1 and figure 2). From the linear form of adsorption isotherms is defined adsorption capacity a_m , which is used in the calculation of the specific surface area S .

The ability of Mg^{++} NaA zeolite for adsorption is followed by specific area for which determination is used adsorption isotherm of water vapor. From the adsorption isotherm is specifies mono - layered capacity used in the equation of Langmuir.

Dependence between specific surface and monolayer capacity gives the equation:

$$S = a_m \times N \times A_m \times 10^{-18} \text{ [m}^2\text{/kg]}$$

Where:

S– specific surface area

a_m – mono – layered capacity

N – Avogadro constant

A_m - Area of cross-section of one molecule of the adsorbent (H_2O) in a densely packed layer, expressed in nm^2

In calculating of the specific surface area is taken $A_m=0,125nm^2$. Area of the cross section of a molecule from the

adsorbent is variable and it depends on nature of the adsorbent and adsorbate.

Samples 1 – 3 were obtained under the following conditions:

- concentration of $\text{MgCl}_2 \cdot 6 \text{H}_2\text{O}$ of 2,5 mol/dm³
- temperature of 293 K
- time of change of 40.30 and 20 minutes

The results for adsorption characteristics of the obtained zeolite Mg

⁺⁺ -NaA are given graphically. It can be seen that most adsorption capacity has sample 3 with monolayer capacity of $a_m = 3,70 \text{ mol/kg}$, with a largest surface area $S = 27,85 \text{ m}^2/\text{kg} \times 10^3$.

Sample 3 has the largest specific surface area as a result of the large crystallinity. The other specific surfaces of samples 1 and 2 are smaller, which is probably due to the chosen minor relations on ionic change of the granulation of outgoing 4A zeolite material from which it is derived zeolite $\text{Mg}^{2+} \text{NaA}$.

Figure1.- Adsorption isotherm of water vapor of Mg^{++} - NaA zeolite for sample 3

Figure 2.-Linear shape of adsorption isotherm in
Langmuir's coordinates

Table 1. Amount of water vapor adsorbed on zeolite Mg ++ - NaA obtained with ion exchange of zeolite 4A as a function of pressure

Sample	P [kPa]	a [mol/kg]	P/a[kPa/(mol/kg)]	am [mol/kg]	S [(m ² /kg)10 ³]
1	0,1370	2,56	0,053	3,30	24,84
	0,2999	3,01	0,099		
	0,5218	3,12	0,170		
	0,7908	3,20	0,250		
	1,1154	3,32	0,330		
2	0,1370	2,58	0,053	3,45	25,97
	0,2999	2,59	0,102		
	0,5218	3,11	0,168		
	0,7908	3,19	0,248		
	1,1154	3,29	0,339		
3	0,1370	2,76	0,049	3,70	27,85
	0,2999	3,28	0,091		
	0,5218	3,41	0,153		
	0,7908	3,49	0,226		
	1,1154	3,61	0,309		

CONCLUSSION

As we already mentioned third sample (sample 3) has the largest surface area that is a result of kristalitet and the remaining samples are smaller. This is due to the chosen Minor relations on ion exchange or granulation of the outgoing material zeolite 4A.

LITERATURE

- [1] М.М.Дубинин, В.А.Астахов, Изв.АН.СССР. сер.хим . 1971, 5
- [2] R.M.Barrer, Brit.Chem.Emg.May 1, 1959
- [3] М.М.Дубинин, В.А.Астахов, Изв.АН.СССР. сер.хим . 1971, 11
- [4] М.М.Дубинин, В.А.Астахов, Изв.АН.СССР. сер.хим . 1971, 17
- [5] М.М.Dubin, J. Of Colloid and Interface Sci. 23, 487, 499 <1967>
- [6] В.Секова“Synthesis of zeolite type 4A starting from the remains after the pickling of alunite from alunites tuff“ - master work