Application of Heavy Metal Ions Separation from Contaminated Water in Industry

Shixaliyev Kerem

Abstract: to achieve - study the sorption of silver, copper, nickel ions, the method of changing the volume of solutions of a constant concentration of metal ions is used. The amount of zeolite and constant concentrated solution is taken in such an amount that the molar (molecular) parts of the exchanged ions are in a wider range. Some concentrated solutions are taken in flasks in an amount of 20 40 60 80 120 ml and 0.5 g of zeolite are added to them, mixed and a sample is taken periodically for analysis. After 2-2.5 hours, equilibrium occurs. By measuring the density of equilibrium, the amount of sorption of ions is determined.

Key Words: Heavy Metal Ions, Natural Zeolite, Ionites, Adsorber, Sorption, Diffusion, Na-Clinoptilolite, Kinetic Curve, Cu^{2+}, Ni^{2+}

I.   INTRODUCTION

At present, pollution of industrial waters with toxic metal ions is the most important problem for the environment. The aim of this article is separating heavy metal ions from industrially polluted water. Thus, the effects of factors on intemal kinetic processes play an important role, and the leaming of these processes is of practical importance [1-3]. Consequently, it may be concluded that when modifiedNa-clinoptilolide conditions are favorable, the modified natural zeolite can be successfully used in heavy metal ions to purify industrial waste.

Experimental part

It is known that access to pure water is a key factor for the health of society. At present, pollution of industrial waters with toxic metal ions Cu (II), Ni (II), Ag (II), Co (II) is the most important problem for the environment. Wastes that incorporate non-ferrous metals, such as mercury, silver, cadmium and nickel, occur during metallurgy industry development, are processing, electrolysis and galvanic production. This wastewater treatment requires a lot of efficient processing methods, from which adsorption, sedimentation, ion exchange, and flotation are in the focus of attention. Given the above, the following objective is to be addressed: The most pressing problem is the purification of industrial wastewater from heavy metal ions by the adsorption method, as wastes of petrochemical and oil refineries cause environmental pollution. Let's look at some experimental and theoretical foundations of that process[4-8].

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To achieve this goal, the method of changing the volume of the solution by constant concentration of the metal ions was used to study the sorption of silver, copper, nickel ions [1] .The amount of zeolite and constant concentrated solution is that the large range of molten portions of exchanged ions . Certain concentrated Solutions are taken in tubes of 20,40,60,80,120 ml and added to them by adding 0.5g zeolite and mixed for periodic analysis. After 2-2.5 hours, the equilibrium occurs. Determine the amount of ions sorption by measuring the thickness of the precipitate[9-11].

II.   RESULTS AND DISCUSSIONS

All experiments were conducted for all types of heavy metals at temperatures of 25°C, 50°C, 75° C. The result is shown in Fig 1. Here, the equilibrium curves of the ion exchange at temperatures of 25°C,50°C, 75 ° C are shown in the Na-shaped clinoptilolide of Ni^{2+} ions at the starting density of the solution at Co= 7,14 • 10^{-3} mq-ekv /ml When the temperature is increased from 25° C to 75° C, the Ni^{2+} ion exchange activity is   increasing. As is evident, these are Langmuir type curves.
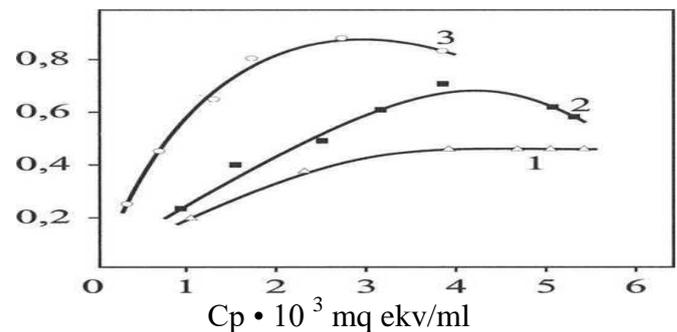
Sp,mq • ekv/ml

Fig 1. Equilibrium curves of Ni^{2+} ion exchange in Na-formed clinoptilolide: 1-25°C; 2-50° C; 3-75° C; C_0 - 7,14 • 10^{-3} mg•ekv / ml

Fig 2 shows the equilibrium curves of Cu $^{2+}$ ion exchange in Na-clinoptilolide in the case of 25,50,75° C. and ionic initiation Co = 6.24 • 10^{-3} mg•ekv / ml.
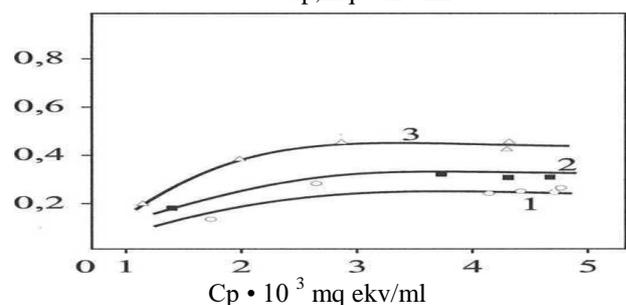
Sp,mq - ekv/ml

Fig 2. Equilibrium curves of the Cu $^{2+}$ ion exchange in Na-clinoptilolide:

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132

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1-25° C; 2- 50° C; 3-75°C; $C_0 = 6.24 \cdot 10^{-3}$ mg • ekv / ml
Fig 3 shows the kinetic curves of the Ni^{2+} ion exchange in Na- clinoptilolide a temperature of 25 ° C and a solution velocity of 2.76 to 30.12 cm / min. The solubility of the Ni^{2+} ions was initially coincident with the thickness of $Co = 1.10 \cdot 10^{-4}$ mg • ekv / ml, zeolithic layer x = 9.3cm, diameter 1.2cm. The fractional dimensions of the grass are in the range of 0.63-1.00 mm, the average radius of the grain is R = 0.041 cm. The amount of sorbent is g = 10q, the porosity of the nucleation m' = 0.40 [2].
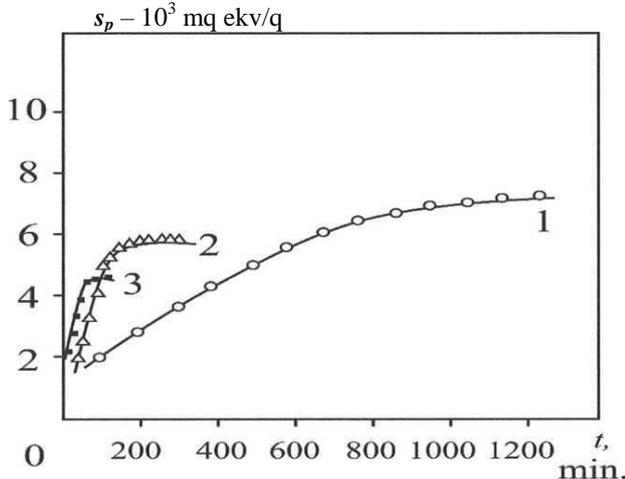
$s_p - 10^3$ mq ekv/q

Fig 3: Kinetic curves of Ni^{2+} ion exchange at different speeds of solution flow in Na- clinoptilolite:
1-V = 2,82 cm / min; 2-V = 14.52sm / min; 3-V = 28.44sm / min; T = 25° C

As shown in the figure, the rate of transfer of Ni^{2+} ions is increased several times in the sorbent layer, but the capacity of Na-clinoptilolit decreases, reducing its speed from 14.52sm / min to 28.44sm / min shows more clearly.

More information is obtained by modeling the output indicators. They are widely used in the calculation of the parameters of the exchange process and in the preparation of industrial sorption technology. Experimental output and kinetic indicators were obtained in the same dynamic conditions. As seen from Fig 4, the images of the ionite layer at the output of Ni^{2+} ions are 9.3cm in different speeds. Output images V = 2,82sm / min, 1 min 40 min after $C_{np} = 0,063 \cdot 10^{-4}$ mq • ekv/ ml, V = 14,52sm/ min, after 2 minutes $C_{np} = 0,102 \cdot 10^{-4}$ mg• ekv / **ml at a rate of V = 28.44sm / min, in $C_{np} = 0.153 \cdot 10^{-4}$ mg • ekv / ml after 10 minutes.**
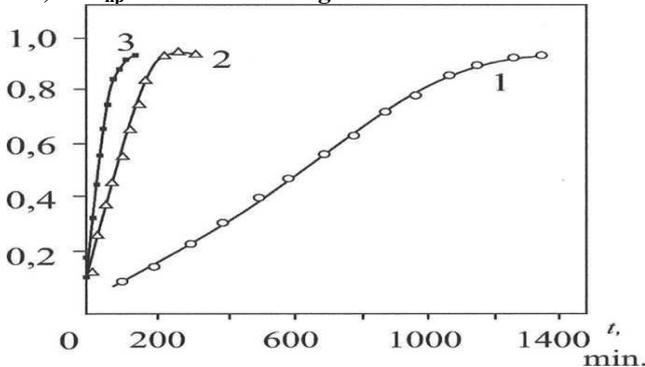

Fig 4. Exit curves of Ni^{2+} ions exchange at different velocities of Na-clinoptilolite:
1-V = 2.82 cm / min; 2-V=14,52 cm / min; 3-V=28.44 cm / min; T = 25 ° C As it tums out, the increase in the flow rate of the solution flow increases by 2.5 times the Ni^{2+} output at the output of Na-clinoptilolite, but the duration of the leak is

reduced to ten times.The mathematical model of adsorption dynamics, taking into account the diffusion of external and intemal diffusions, as well as the balloon grains, is based on the following equations and boundary conditions:

$$\frac{\partial a}{\partial t} + \frac{\partial C}{\partial t} + \vartheta \frac{\partial C}{\partial x} = De \frac{\partial 2C}{\partial x2} ;$$
$$\frac{\partial ag}{\partial t} + \frac{\partial Cg}{\partial t} + \vartheta \frac{\partial C}{\partial x} = Dc \frac{1}{r2} \frac{\partial}{\partial r} (r^2 \frac{\partial Cg}{\partial r}) ;$$
$$a_g = \Gamma_1 C_g + A \, \Gamma_2 \square^{-1} \int_0^r \quad (x, r, \delta) \omega(\frac{1-\delta}{\tau}) d\delta ;$$
$$D_C \frac{\square Cg}{\partial r} r = R = \beta[C(x,t) - Cg(x, R, t)] ;$$
$$a(x,t) = 4\pi N \int_0^R \quad (ag - Cg)) dr ;$$
$$C(0,t) = C_0; C(x,0) = a(x,0) = C(\infty, t) = 0 ; a_g(x,r,0) = 0 ;$$
$$C,(x,r,0) = 0; (r \frac{2\partial Cg}{\partial r})_{r=0} = 0$$

Where: Cg (x, r, t), ag (x, r, t) - a small amount of average value local concentration in the nucleus in the non-invasive phases of adsorbtion;; $x = r_0^2/D_a$, $A = 4\square \, r_0^2 \, N$, D_a, D_c- diffusion coefficients; G-Henri coefficient; N-unit number of grains Lef s look at the calculation of model parameters. Definition of Dc - diffusion coefficient

$$F = / C^p - C^e / \leq \epsilon$$

Based on the criterion, a random search method is used. C^p, C^e - report and experimental prices according to the concentrations of metal ions in the wax; c-any accuracy given. Selecting a few starting points $((D_e o))$ of the effective coefficient of diffusion will be performed in C report. Then add the step h to the D_e, and Repeat the C^p again. D_e value, which provides the condition F = / $C^p - C^e$ /≤ ϵ , is considered optimal. Where: Cg (x, r, t), ag (x, r, t) - a small amount of average value local concentration in the nucleus in the non-invasive phases of adsorbtion;; $x = r_0^2/D_a$, $A = 4\square$ r_0^2 N, D_a, D_c- diffusion coefficients; G-Henri coefficient; N-unit number of grains Lef s look at the calculation of model parameters. Definition of Dc - diffusion coefficient

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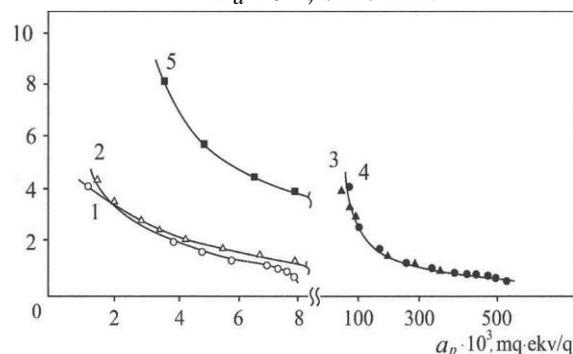
$D_a \, 10^{17}$, sm^2/min.

Fig 5. Diffusion coefficient: 1- Ni^{2+}; 2-[Ni $(NH_3)_6$]$^{2+}$; 3-Cu^{2+}; 4-[Cu $(NH_3)_4$]$^{2+}$; In the crystal interior space of the 5-Ag^+ Na-clinoptilolite (T = 20 ° C, in smaller prices of V)

133

III. CONCLUSIONS

If we compare the data for nickel and copper, we will see that the price of diffusion in them is the same. However, for the copper, the equivalent price reaches a value of 2 times the price of the micronutrient ion exchange rate relative to nickel. The initial density of the exchanged ions affects the density in micrometers, but they do not affect the diffusion process.

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134

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