to calculate sorption parameters with lower reliability (R^2> 0.90). The BET model, which describes the multilayer binding of sorbates by homogeneous active centres of the sorbent, is not applicable to the description of this process.

Adsorption kinetics. To study the adsorption kinetics of Cd (II) and Pb (II) ions, the pseudo-first order (proposed by Lagergren) [26] and pseudo-second order (proposed by Ho and McKay [27]) models were applied.

Table 3 – Comparative characteristics of adsorption isotherms models fitting to Pb^{2+} and Cd^{2+} ions adsorption

Parameters of model	clay + Cd^{2+}	clay + 0.1% PVP + Pb^{2+}
Experimental isotherm		
q_{max}, mg/g	11.195	7.558
Langmuir model		
K_L	0.009	0.016
q_{max}, mg/g	10.989	4.934
R^2	0.998	1.000
Freundlich model		
K_F	0.288	0.095
n	1.371	1.395
R^2	0.906	0.944
BET model		
K_{BET}	4.307	6.086
q_{max}, mg/g	5.528	5.476
R^2	0.484	0.684

The most commonly used forms of equations for these models are linear (equations (7) and (8) for pseudo-first and pseudo-second orders, respectively):

$$\ln(q_e - q_t) = \ln q_e - k_1 t \quad (7)$$

$$\frac{t}{q_t} = \frac{t}{q_e} + \frac{1}{k_2 q_e^2} \quad (8)$$

where k_1 and k_2 are pseudo-first and pseudo-second order rate constants; q_t is the equilibrium amount of adsorbed cations.

Table 4 – Kinetic parameters of the sorption process of Pb^{2+} and Cd^{2+} ions

System	Pseudo-first order		Pseudo-second order	
	k_1, min^{-1}	**R^2**	**k_2, L*min/mg**	**R^2**
clay + Cd^{2+}	0.0247	0.3110	0.0002	0.9440
clay + 0,1% PVP + Pb^{2+}	0.0159	0.4760	0.0161	0.9760

Comparison of the results in Table 4 shows that the pseudo-second order equation most closely matches the obtained experimental data with high correlation coefficients ($R^2 \approx 1$). This indicates that the sorption process is described by the pseudo-second order reaction model.

Conclusions

- It was found that the natural clay can be used to extract Cd^{2+} ions without modification, the extraction degree reaches (97.40 ± 1.99)% from 10 mg/L solution;