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Influence of Technological Parameters on the Process of AZOTNOIC Acid Leaching of Kaolinic Clays.

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ABSTRACT: The results of a study on the extraction of aluminum from calcined Angren kaolin clays are presented. Optimum technological indicators were determined, allowing to extract Aluminum from clays up to 93.73%. The acid concentration, acid norm, rheological properties of the solutions, that is, density and viscosity depending on time and temperature, were studied.

I. INTRODUCTION

Don't producing oxide aluminum even there is a lot of raw materials containing aluminum in our Republic. Oxide aluminum bringing from outside or obtaining by processing secondary aluminum metals. There is actual problem develop technology of obtaining oxide aluminum from local raw materials.

Purpose and task of the work. The purpose and task of the work is investigation of ptocess obtaining oxide aluminum with decomposition Angren kaolins with nitric acid and working out useful technology.

II. LITERATURE SURVEY

In recent years, the Republic has paid great attention to the development of new industries for the production of finished products based on the deep processing of local raw materials [1]. One of these types of mineral raw materials is kaolin clay from the Angren deposit, the reserves of which exceed 1 billion tons [2, 3]. Kaolin clays of the Angren deposit contain 23-27% aluminum oxide and are raw materials for the production of alumina, refractories, and ceramics. However, there is no alumina production in the Republic due to the lack of an acceptable technology for separating aluminum from kaolin clays.

Of the developed methods for processing kaolins into alumina, the nitric acid method is the most suitable for the conditions of Uzbekistan [4, 6]. Therefore, our research was aimed at obtaining alumina from kaolin clays of the Angren deposit by nitric acid leaching [5].

III. RESEARCH METHODS

For the research, we used kaolin clays calcined at a temperature of 650°C, containing (wt. %): SiO_2 - 52.57%, Al_2O_3 - 25.00%, Fe_2O_3 - 0.50%, CaO - 0.32%, MgO - 0 ,18%. The studies were carried out using a 100 ml autoclave. The temperature of the leaching process was maintained by placing the autoclave in an oven. Mixing was carried out periodically, every 15 minutes, by shaking the autoclave.

IV. EXEPERIMENTAL RESULTS

Previously, the processes of calcination of kaolin clays, the influence of leaching temperature and process duration on the chemical composition of the liquid phase and the degree of aluminum recovery were studied. It has been established that the optimal temperature for aluminum extraction by the autoclave method is 150°C, the norm is 30% nitric acid and 130%. Next, the influence of the duration of the leaching process on the degree of aluminum extraction

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from calcined kaolin was studied at optimal leaching parameters - temperature 150°C, norm 30% nitric acid 130%. The results obtained are shown in figure 1.

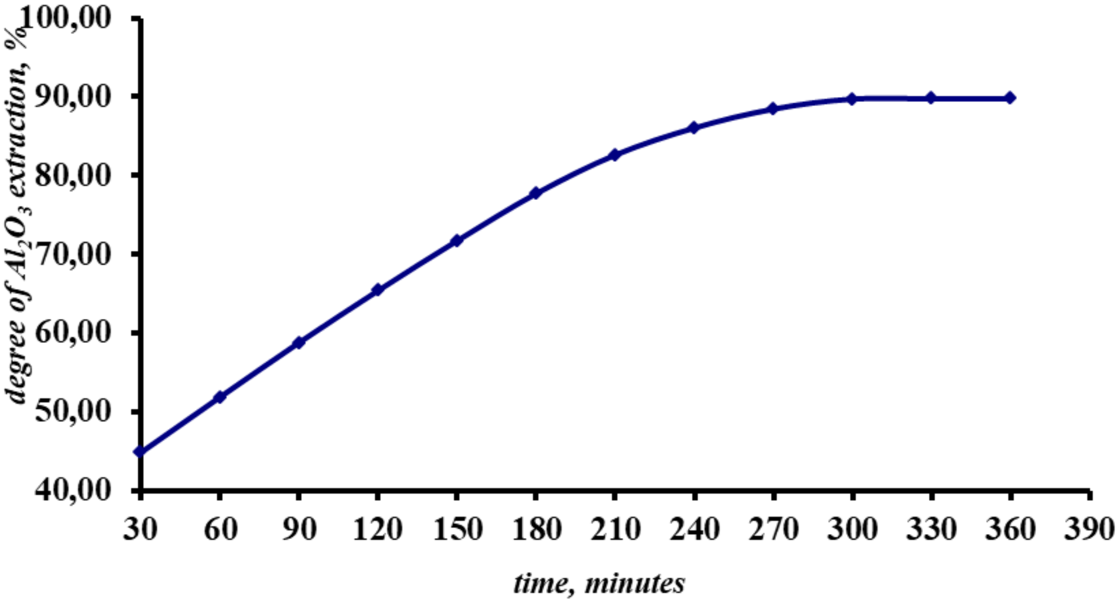

Figure. 1. The influence of the duration of the leaching process on the degree of aluminum extraction at a temperature of 150°C, a nitric acid concentration of 30% and a norm of 130%.

The figure shows that increasing the duration of the extraction process from 30 minutes to 5 hours helps to increase the degree of aluminum extraction from 46.79% to 93.73%. Further increasing the duration of the leaching process to 6 hours increases the degree of aluminum extraction to 93.75%, that is, by 0.02%. Therefore, for further research we limited the duration of the leaching process to 5 hours.

Studies of the effect of nitric acid concentration on the degree of aluminum recovery, carried out at a nitric acid rate of 130%, a leaching temperature of 150°C and a process duration of 5 hours, showed that the degree of aluminum recovery reaches a maximum at a nitric acid concentration of 30-35% (Fig. 2).

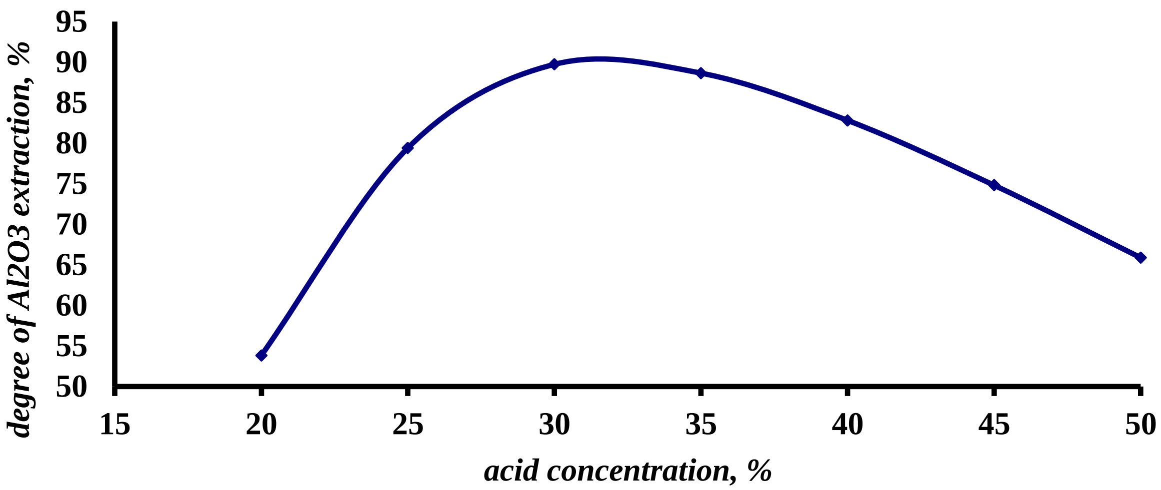

Figure. 2. The influence of nitric acid concentration on the degree of aluminum extraction at an acid rate of 130%, a temperature of 150°C and a process duration of 5 hours.

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For further research we settled on a nitric acid concentration of 30%.

The rheological properties of leaching solutions were studied. Table 3 shows the effect of temperature and process duration on the density and viscosity of the liquid phase at a rate of 30% nitric acid and 110%.

Table 3
The influence of temperature and process duration on the density and viscosity of the liquid phase

№	Time, min.	Temperature, °C	Density, g/cm^3				Viscosity, cPa			
			20°C	40°C	60°C	80°C	20°C	40°C	60°C	80°C
1	60	90	1,215	1,209	1,204	1,201	2,218	1,525	1,090	0,863
2		120	1,223	1,217	1,212	1,209	2,233	1,535	1,097	0,868
3		150	1,245	1,239	1,234	1,231	2,273	1,562	1,117	0,884
4		180	1,232	1,226	1,221	1,218	2,249	1,546	1,105	0,875
5	120	90	1,218	1,212	1,207	1,204	2,223	1,528	1,092	0,865
6		120	1,225	1,219	1,214	1,211	2,237	1,537	1,099	0,870
7		150	1,247	1,241	1,236	1,233	2,277	1,565	1,119	0,885
8		180	1,234	1,228	1,223	1,220	2,253	1,548	1,107	0,876
9	180	90	1,226	1,220	1,215	1,212	2,239	1,538	1,100	0,871
10		120	1,233	1,227	1,222	1,219	2,251	1,547	1,106	0,876
11		150	1,255	1,249	1,244	1,241	2,291	1,575	1,126	0,891
12		180	1,242	1,236	1,231	1,228	2,268	1,558	1,114	0,882
13	300	90	1,245	1,239	1,234	1,231	2,274	1,563	1,117	0,884
14		120	1,252	1,246	1,241	1,238	2,286	1,571	1,123	0,889
15		150	1,274	1,268	1,263	1,260	2,326	1,599	1,143	0,905
16		180	1,261	1,255	1,250	1,247	2,303	1,583	1,131	0,896

With an increase in the leaching temperature from 20°C to 180°C, the density and viscosity of the liquid phase increases to a temperature of 150°C and then decreases. Densities increase from 1.215 g/cm^3 to 1.245 g/cm^3 at a leaching temperature of 90-150°C and a measuring temperature of 20°C. Under these conditions, the viscosities increase from 2.218 cPa to 2.273 cPa. A further increase in the leaching temperature to 180°C leads to a decrease in density to 1.232 g/cm^3 and viscosity to 2.249 cPa.

Increasing the temperature for measuring density and viscosity from 20°C to 80°C helps to reduce these indicators. The densities of the liquid phase vary from 1.215-1.245 g/cm^3 at 20°C to 1.201-1.231 g/cm^3 at a temperature of 150°C. Viscosities vary from 2.218-2.273 cPa to 0.863-0.884 cPa.

Figures 3 and 4 show data on changes in density and viscosity depending on the rate of 30% nitric acid at a leaching temperature of 150°C and a process duration of 5 hours.

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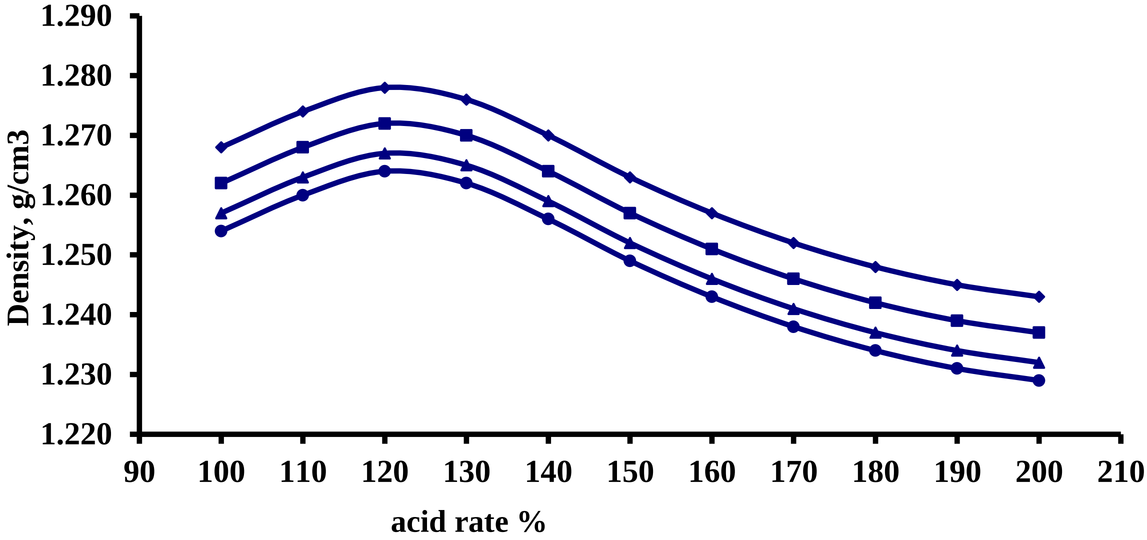

Figure. 3. Change in the density of the liquid phase depending on the rate of nitric acid at measurement temperatures of 1-20°C, 2-40°C, 3-60°C and 4-80°C.

From figure 3 it can be seen that the density graphs of the liquid phase, regardless of the measurement temperature, have the same appearance with a maximum at a nitric acid rate of 110-130%.

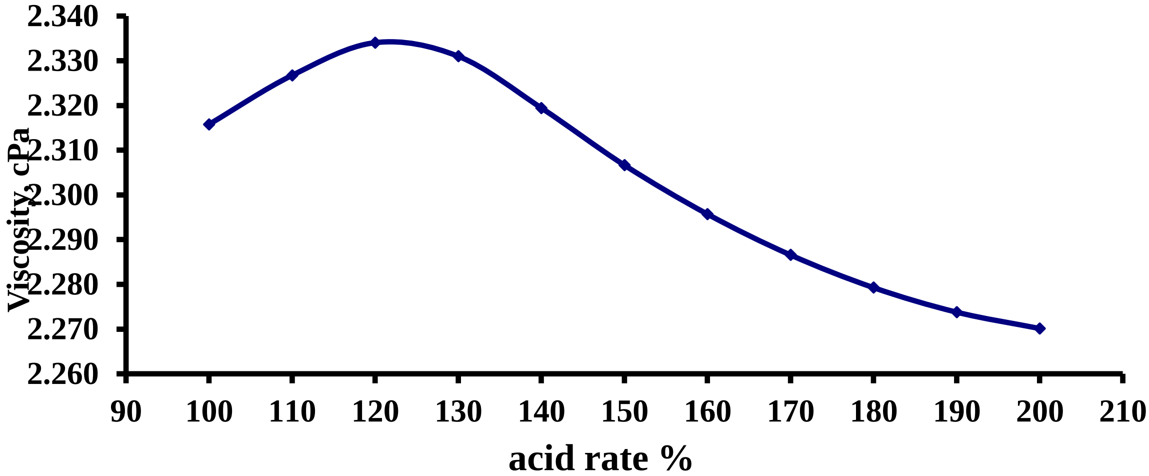

Figure. 4. Change in viscosity of the liquid phase depending on the rate of nitric acid at a measurement temperature of 20°C.

The viscosity of the liquid phase, measured at 20°C, also has a maximum value at a nitric acid rate of 110-130%.

V. CONCLUSION

Thus, the conducted studies showed the possibility of extracting aluminum from calcined kaolin clays of the Angren deposit. The liquid phase during nitric acid leaching of calcined kaolins from the Angren deposit has acceptable rheological properties and can be pumped without difficulty. The optimal parameters of the autoclave leaching process are nitric acid concentration 30-40%, norm 110-130%, temperature 145-160°C, process duration 4-5 hours. At the same time, the degree of aluminum extraction is 89.75-93.73%.

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