KINETICS OF DOLOMITE DECOMPOSITION OF THE SHORSU DEPOSIT BY NITRIC ACID

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ANNOTATION

The kinetics of the process of decomposition of dolomite by nitric acid was studied depending on the concentration and temperature. The main kinetic parameters of the decomposition process are established and the equations for the dependence of the foam expansion constant on the acid feed rate are derived.

Keywords: Dolomite, nitric acid, ethylene producers, foam rate. Foaming,decomposition of dolomite.

INTRODUCTION

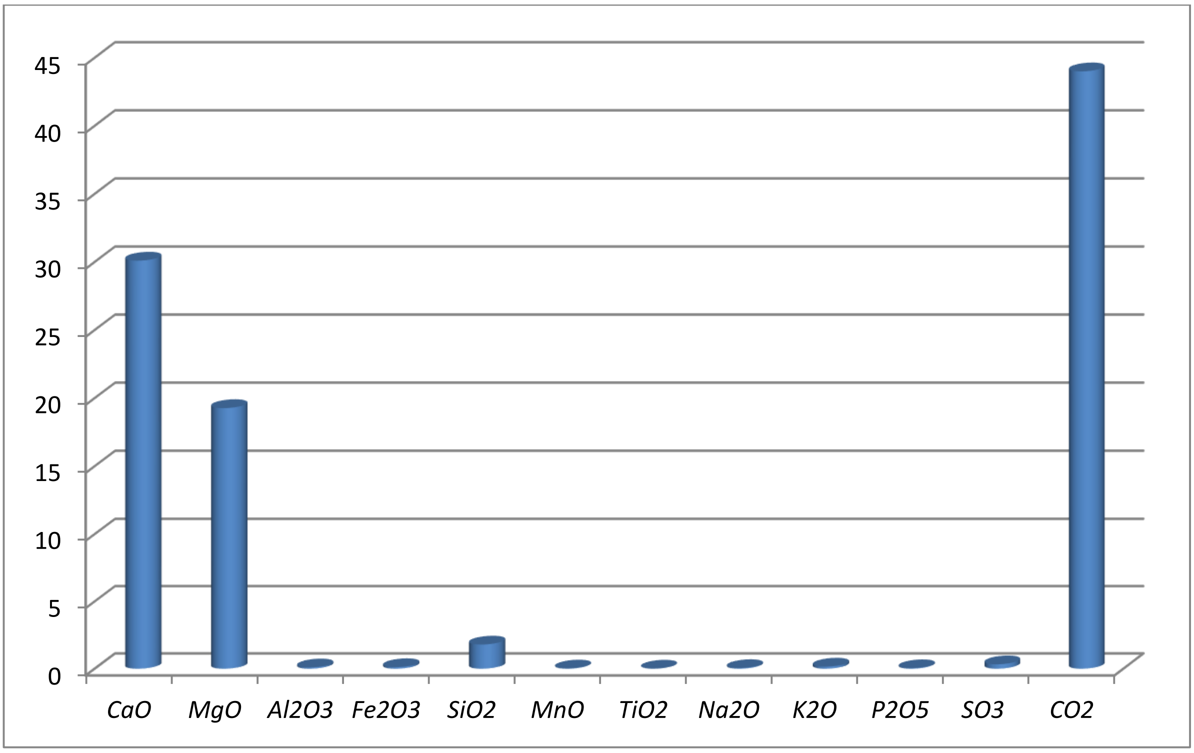
The production of mineral fertilizers requires the availability of available raw materials that meet the quality requirements of its processing.

Objects and methods of research. The object of research is dolomite. Dolomite is a mineral of the carbonate class (CaCO3 and Mg (ClO3) 2 contains admixtures of divalent metals Fe, Mn, Co, Zn and Pb. The main dolomite deposits are found in Spain, Switzerland, USA, Mexico, Canada and Russia. In Uzbekistan, dolomite is found in Fergana , Navoi, Bukhara, Samarkand, Namangan, Tashkent and Kashkadarya regions.

Results and its discussion. Since dolomite contains in its composition at the same time such nutritional components as Ca and Mg, which are necessary for the growth and development of plants, this mineral can be used to obtain liquid fertilizers. By decomposing dolomite with nitric acid, a solution of calcium and magnesium nitrates can be obtained. By further enrichment of the resulting solution with components of mineral fertilizers, physiologically active substances, as well as microelements, a liquid fertilizer of complex action can be obtained.

Dolomites of various deposits are characterized by a specific chemical and mineralogical composition. Studies on hydrochloric acid, nitric acid, sulfuric acid and sulfuric acid decomposition of dolomites of various deposits were carried out by the authors of [1-4]. On the basis of the work carried out by them, it is recommended: obtaining a solution of magnesium nitrate for use as a conditioning additive in ammonium nitrate; magnesium sulfate;
liquid nitrogen-calcium-magnesium fertilizer; bischofite; urea with the addition of magnesium sulfate and an anti-icing agent; obtaining a new chlorate calcium-magnesium defoliant; obtaining a defoliant of complex action by involving carbamide and ethylene producers in its composition.

Dolomite from the Shorsu deposit in the Fergana region was selected for our research. The chemical composition of Shorsu dolomite is shown in Figure 1.



Dolomite chemical composition (mas %)

To develop a technology for obtaining a liquid fertilizer of complex action on the basis of the products of nitric acid decomposition of dolomite m. "Shors", it is necessary to study the decomposition process depending on the acid concentration and temperature.

For this purpose, nitric acid solutions of 20, 30, 40, 57% concentration were used. The experiments were carried out in a thermostated three-mountain glass reactor at temperatures of 20, 30, 40, 50, and 60 ° C. The calculated amount of crushed dolomite was immersed in the reactor, and then the calculated amount of nitric acid was gradually poured according to 100% stoichiometry. In 30 minutes after the end of the decomposition process, the content of CaO and MgO in the solution was determined by the complexometric method of analysis [5] and the degree of extraction of CaO and MgO into the solution was calculated.

The results of the experimental data are shown in Table 2.

table 2

Dependence of the degree of extraction of CaO and MgO into solution on temperature and concentration of nitric acid

Temperature, °C	Nitric acid concentration %							
	20		30		40		57	
	Recovery rate into solution, %							
	CaO	MgO	CaO	MgO	CaO	MgO	CaO	MgO
20	68,53	70,14	81,30	82,42	89,3	90,42	89,29	91,33
30	70,74	71,23	88,32	89,61	97,3	89,42	97,41	98,50
40	71,38	72,08	89,34	90,48	98,54	99,0	98,62	99,23
50	72,04	72,56	90,28	91,39	98,82	99,35	98,90	99,47
60	72,58	73,17	91,34	91,97	99,24	99,46	99,31	99,56

Table 2 shows the results of experimental data on the effect of acid concentration and temperature on the degree of extraction of calcium and magnesium oxides into solution. It can be seen from the table that during the decomposition of dolomite with 20% nitric acid as the process temperature rises from 20 to 60 ° C, the degree of extraction of CaO is 68.53 ÷ 72.58%, MgO 70.14 ÷ 73.17%. With the decomposition of dolomite with 30% HNO3, the degree of extraction of CaO and MgO was 81.3 ÷ 91.34% and 82.44 ÷ 91.97%, respectively.

Dolomite decomposition with 40% acid promoted 89.3 ÷ 99.24% extraction of CaO into solution and 90.42 ÷ 99.46% extraction of MgO into solution.

By decomposition of dolomite with 57% nitric acid, it was found that the degree of extraction of calcium and magnesium oxides into the solution reaches 89.29 ÷ 99.31% CaO and 91.33 ÷ 99.56% MgO, respectively. That is, an increase in the acid concentration of more than 40% does not lead to a significant increase in the degree of extraction of CaO and MgO into solution. Regarding the influence of the temperature of the process of nitric acid decomposition of dolomite, it can be said that t = 30 ÷ 40 ° C is optimal. Raising the temperature to 50 and 60 ° C is not advisable, since the degree of extraction of CaO and MgO into the solution changes insignificantly. Therefore, the optimal parameters of the process of nitric acid decomposition of dolomite are: the concentration of nitric acid is 40%, the temperature is 30 ÷ 40 ° C, the time is 30 minutes.

It is known that the process of decomposition of dolomite with nitric acid, like any other acid, is accompanied by abundant release of carbon dioxide, which leads to foaming. With abundant foaming, foam can overflow through leaks and openings of the reactors, impedes the uniform distribution of raw materials, which in turn leads to a decrease in the productivity of the main equipment, as well as to a deterioration in the environmental conditions of production.

The main parameter characterizing the process of foaming during acid decomposition of dolomite is the foam ratio (Kf). The foam ratio is the ratio of the foam volume (Vn) to the liquid volume (Vж) [6].

$$K = \frac{V_n}{V_{ж}};$$

In order to reduce foaming during the decomposition of dolomite with nitric acid, the dependence of the foam rate on the acid feed rate was studied.
Foaming process during decomposition of dolomite m.r. We studied "Shores" using 40% nitric acid, since this concentration was taken as optimal for decomposition.
The results of studying the dependence of the foam rate on different acid feed rates are shown in the figure and table 3.

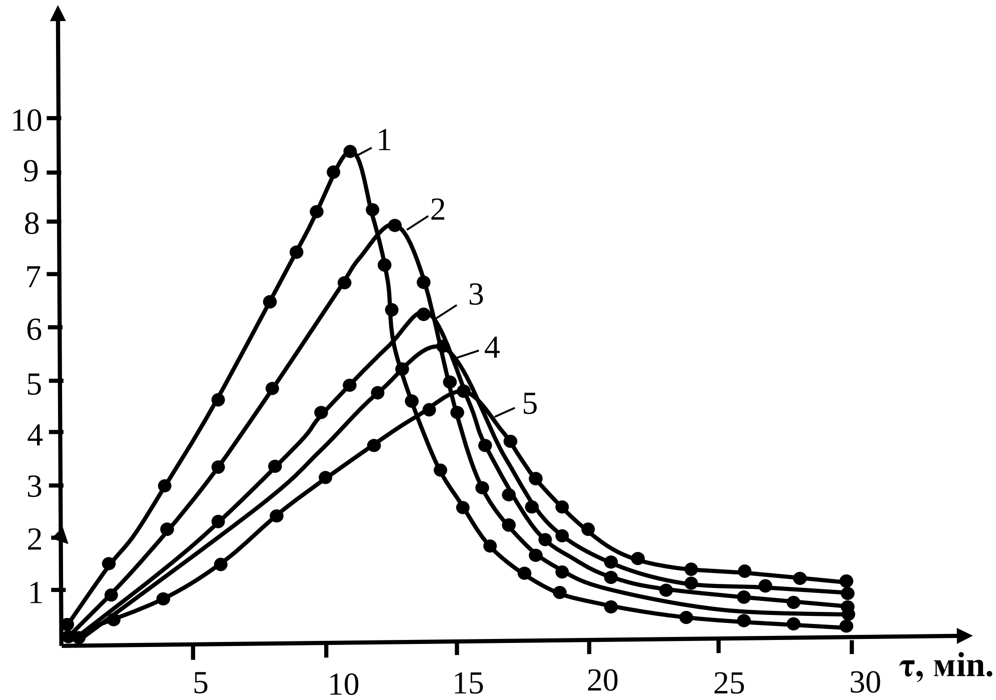


Fig. 2 Dependence of the change in the foam rate on the time and rate of nitric acid supply during the decomposition of dolomite m.r. "Shorsu"
1– at V = 20 g / min; 2 - at V = 18 g / min; 3 - at V = 16.5 g / min;
4 - at V = 10 g / min; 5– at V = 8 g / min.

Table 3

Dependence of the change in the foam rate on the acid feed rate
during decomposition of dolomite m.r. "Shorsu" with 40% nitric acid

№ п/п	Acid feed rate V, г/мin.	Volume liquid,ml	Volume foam, ml	Multiplicity of foam, Кп
1	6,5	26,5	111	4,10
2	8,0	-//-	130	4,90
3	10,0	26,5	150	5,66
4	16,5	26,5	168	6,30
5	18,0	26,5	212	8,00
6	20,0	26,5	250	9,43

From the data shown in the figure and table, it follows during the decomposition of dolomite with 40% nitric acid with an acid feed rate V = 6.5 g / min. the maximum expansion rate of the foam is Kp = 4.1. When decomposing dolomite with nitric acid supplied at a rate of V = 8.0 g / min. the maximum expansion rate of the foam was Kp = 4.90. And at a feed rate of acid V =

20.0 g / min. the maximum expansion rate of the foam was Kp = 9.43. This indicator is undesirable. As the acid feed rate increases from V = 6.5 to V = 20 g / min, Kp increases from 4.1 to 9.43. That is, the higher the acid feed rate, the more abundant foaming.

From the data in the table and Figure 2, it follows that the optimal acid feed rate during the decomposition of dolomite with 40% nitric acid is V = 10 ÷ 16.5 g / min, at which the maximum foam ratio is Kp = 5.66 ÷ 6, thirty.

Conclusion. Thus, based on the studies carried out on the decomposition of dolomite m.r. Optimal parameters of the process were set for "Shores" with nitric acid: concentration of nitric acid - 40%, process temperature 30 ÷ 40 ° C, acid feed rate V = 10 ÷ 16.5 g / min., At which the maximum foam ratio is Кп = 5, 6 ÷ 6.30.

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