COMPOSITION AND PROPERTIES OF MAGNESIUM-CONTAINING CARBONATE-AMMONIUM NITRATE

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Abstract: *the process of obtaining granular magnesium-containing carbonate-ammonium nitrate on the basis of mixing of ammonium nitrate (AN) with dolomite (D) "Navbahor" of the Uzbekistan deposit at mass ratios AN: D = 100: (3-35) was studied. The prilling method is used for granulating the nitrate-carbonate melt. The composition and properties of the products were studied. It is shown that the nitrate melt activates the carbonate material, that is, it transfers the carbonate mineral from the unassembled form into a form that is assimilated to plants. At the same time, the dolomite additive used significantly reduces the caking rate, porosity and absorbability with respect to liquid fuel, increases the strength and stability of fertilizer granules.*
Keywords: *ammonium nitrate, dolomite, magnesium-containing carbonate-ammonium nitrate, composition and properties.*

СОСТАВ И СВОЙСТВА МАГНИЙСОДЕРЖАЩЕЙ ИЗВЕСТКОВО-АММИАЧНОЙ СЕЛИТРЫ

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Аннотация: *изучен процесс получения гранулированной магнийсодержащей известковой аммиачной селитры на основе смешения плава аммиачной селитры (АС) с доломитом (Д) «Навбахор» месторождения Узбекистана при массовых соотношениях АС : Д = 100 : (3-35). Для гранулирования нитратно-карбонатного расплава применён метод приллирования. Изучены состав и свойства продуктов. Показано, что расплав селитры активизирует карбонатное сырьё, то есть переводит в нём карбонатный минерал из неусвояемой формы в усвояемую для растений форму. При этом используемая добавка доломита значительно снижает слёживаемость, пористость и впитываемость по отношению к жидкому топливу, повышает прочность.*
Ключевые слова: *аммиачная селитра, доломит, магнийсодержащая известково-аммиачная селитра, состав и свойства.*

The process of obtaining magnesium-containing calc-ammonium nitrate on the basis of NA (34.9% N) and dolomite "Navbahor" deposit of Uzbekistan was studied in [1, 2], composition (wt.%): CaO_{total} - 28; MgO - 20; CO_2 - 43.3; Fe_2O_3 - 0.58; Al_2O_3 - 0.62. The amount of dolomite varied from 3 to 35 g with respect to 100 g of nitrate melt. The rheological properties of the melt of magnesium-containing calc-ammonium nitrate in the range of the ratios NA: D = 100: (3-35) and temperatures (160-185°C) indicate their sufficient mobility. For the granulation of the melt of magnesium-containing calc-ammonium nitrate, the prilling method is applied. It is shown that the nitrate melt activates the carbonate raw material, that is, it transfers the form of CaO and MgO, which is not digested in it, into the form which is assimilated for the plants. An increase in the mass proportion of dolomite in relation to the floating of NA leads to a decrease in the proportion of assimilable forms of CaO and MgO. Adding dolomite to the saltpeter significantly increases the strength of the granules of the latter. And the composition of magnesium-containing lime-ammonium nitrate varies depending on the mass ratios NA: D as follows: N - from 25.54 to 32.52%; CaO - from 0.82 to 7.29%; MgO - from 0.60 to 5.16%; $CaO_{ass.}$: CaO_{total} 2% citric acid - from 44.28 to 17.83% and $MgO_{ass.}$: MgO_{total} 2% citric acid - from 37.51 to 15.04%.

This report presents the results of the study of certain physicochemical properties of magnesium-containing lime-ammonium nitrate data (Table).

The strength of granules of fertilizer samples with pellet sizes of 2-3 mm was determined on a MIP-10-1 instrument. It can be seen from the table that with an increase in the amount of dolomite additive, the strength of the product granules increases. With the change in the mass ratio of the fusion of NA to D, the strength of the granules changes as follows: for the ratio NA: D = 100: 3.0 - 3.44 MPa; 100: 15 - 5.28 MPa; 100: 25 to 7.98 MPa and 100: 35 to 10.44 MPa; against the strength of granules of NA with magnesia additive (0.28% MgO) produced by JSC "Maxam-Chirchik" - 1.58 MPa and pure NA without additive - only 1.36 MPa. The higher the strength of the granules, the less their porosity and internal specific surface, so less diesel falls into the granules, and as a consequence, the detonation capacity of ammonium nitrate is determined to a lesser extent.

Table 1. Properties of magnesium-containing lime-ammonium nitrate

Mass ratio of NA: D	**Strength of granules, MPa**	**Caking rate, kg / cm^2**	**Porosity, %**	**Absorption, g**
Granular NH_4NO_3 grade "c"	1.36	5.62	22.0	4.82
AC with magnesia additive (0.28% MgO)	1.58	4.67	9.10	4.33
100 : 3.0	3.44	3.29	8.43	3.17
100 : 5.0	4.13	3.10	8.09	2.96
100 : 10	4.86	2.93	7.78	2.81
100 : 15	5.28	2.75	7.50	2.60
100 : 20	6.60	2.58	7.16	2.44
100 : 25	7.98	2.37	6.87	2.25
100 : 30	8.89	2.16	6.61	2.08
100 : 35	10.44	2.0	6.25	1.89

Caking is one of the most important indicators of the commercial properties of NS fertilizers. Briquetting conditions: compression pressure of the sample at a

weight of 2.8 kg, temperature - 50°C; the length of stay of the cylindrical cassette in the mold is 8 hours. The briquettes were tested for destruction using a МИП-10-1 instrument. The compressibility of X samples (in MPa) was calculated by the formula:

$X = P / S$

where, P - destructive force, H (kgf); S is the cross-sectional area of the sample (cm^2).

The dolomite additive of any kind significantly reduces the caking capacity of the NA. To obtain granules of calc-ammonium nitrate containing at least 28% N, which have sufficient strength (3.44-6.60 MPa), the weight ratio of NA: D should be 100: (3-20). In this case, the caking capacity of the NA with dolomite additive is 3.29-2.58 kg / cm^2, which is 1.42-1.81 times less than that of standard saltpeter with addition of 0.28% MgO (4.67 kg / cm^2). And for the samples obtained at NA: D = 100: (25-35), this value is in the range 2.37-2.0 kg / cm^2. The proposed mechanism for the action of dolomite additives, which increase the strength of the NA granules and at the same time reduce its caking capacity, is based on the creation of a number of crystallization centers, which accelerates the crystallization process and causes the formation of small crystals that make the granules more dense and durable.

The indicator of the quality of thermostable NA is also the value expressing the porosity of the granules. From the table, it can be seen that the porosity of granules of pure ammonium nitrate and NA with a magnesium additive is 22.0 and 9.10%, respectively. And the addition of ammonium nitrate dolomite in the amount of 5 to 35 g in relation to 100 g of ammonium nitrate contributes to a decrease in the porosity of the granules of niter from 8.43 to 6.25%. This fact confirms the reason for the increase in the strength of the granules and, thus, the increase in the thermal stability of the products.

As the data in the table show, the porosity and absorbency of the granules do indeed correlate. Depending on the change in the weight ratio NA: D from 100: 3 to 100: 35, the absorbency of the granules of the magnesium-containing CAN varies between 3.17 and 1.89 g. It is 4.82 g in granular NA, and in the case of NA with a magnesium additive of 4.33 g.

Thus, the introduction of dolomite into the melt of ammonium nitrate allows not only to increase its agrochemical efficiency, but also to improve its physico-chemical and commodity properties: reduces caking, porosity and absorbency with respect to liquid fuels, increases strength.

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