

Technical leaflet

How to apply mineral conditioning additive in the production of ammonium nitrate (AN) and complex fertilizers (NPK,NK,NP,PK)

Mineral fertilizers are prone to caking, dusting and moisture absorption. To avoid these negative factors as well as for increase the particle size Russian Mining Chemical Company offers special conditioning additive AgroMag.

Description and application: AgroMag is homogenous white powder without impurities and smells, fire and explosion proof, non – toxic. It is produced from natural raw materials – brucite (magnesium hydroxide $Mg(OH)_2$) with high magnesium content by selective extracting, drying, milling and classification. AgroMag is introduced in manufacturing process of fertilizer before the stage of granulation.

characteristic	Characteristic and norm
Appearance	Powder mass
Color	white
Chemical content:	
- $Mg(OH)_2$ content, %	average 90,0% min 88,0%
- in terms of MgO, %	average 61,5% min. 60,0%
- CaO content, %	average 2,5% max. 4,0 %
- SiO_2 content, %	average 3,0% max. 4,0 %
- SO_3 content, %	average 0,01% max. 0,1%
- Fe_2O_3 content, %	average 0,15% max. 0,5 %
Fractional composition:	
Pass through sieve 0,315 mm	90,0%

Technology of application of AgroMag in manufacturing of ammonium nitrate

Nowadays Lilamin, NowoFlow and other organic conditioners are applied in fertilizer manufacturing. This is the products of Akzo Nobel, Holland Novochem and other companies; these products have high price, 8-10 times higher than price of AgroMag.

The most effective conditioning additive, which allows to increase plant capacity and has positive effect on the physics - chemical characteristics of ammonium nitrate granules (caking, solidity, particle size) is magnesium hydroxide additive $Mg(OH)_2$.

AgroMag $Mg(OH)_2$ is used in preparing of the solution of magnesium nitrate. The mass content of $Mg(NO_3)_2$ is 30-40%. Then the magnesium nitrate solution $Mg(NO_3)_2$ is added to ammonium nitrate solution.

The ammonium nitrate which was produced with use of AgroMag have absolutely white color, the use of CMP (caustic magnesium powder) gives dirty yellow cream shades to ammonium nitrate.

Consumption of AgroMag per 1 ton of ammonium nitrate will be: $(3.5kg \times 100):50\% = 7.0$ kg/ton, where 3.5 kg – average content of MgO in product. When the MgO content in the finished product is about 0.35% (3.5 kg / ton) the strength of the granules increases from 0.7 to 0.85 kg /granule. The increase of MgO content in finished product increases solidity of granules to 1.5 kg per granule.

Physics-chemical explanation of the effect: the solidity of granules of ammonium nitrate mostly depends on the size of the crystals forming granule. Addition of magnesium nitrate NH_4NO_3 in number of 0.6% (which corresponds to 0.16% MgO) decreases the size of ammonium nitrate crystals NH_4NO_3 to 54nm. When the concentration of $Mg(NO_3)_2$ become 0,8 – 3,0% the size is constant and equal to 36 nm. Increasing the content of $Mg(NO_3)_2$ to 10% leads to a slight reduction in the size of crystals NH_4NO_3 .

In this case manufacturer additional treatment of nitrate granules with organic conditioners (amines, etc.) may not be used, if it is not required under the contract with the consumer.

Technology of AgroMag application in manufacturing of combined fertilizers NPK

One of the plants producing mineral fertilizers use the following industrial way of introduction AgroMag during the process of producing the fertilizer DAFK 10:26:26:

AgroMag is introduced into extraction phosphoric acid (EPA) before it will be introduced in process of manufacturing the DAFK. This is done in DAFK production workshop, the “head” of the process. Phosphoric acid and AgroMag are introduced in mixer. It is a kind of funnel (or cyclone): phosphoric acid stream twists in it, AgroMag is poured on top and there is a mixture. The mixture of AgroMag and EPA is instantly. Thus AgroMag is dissolved in all phosphoric acid, mother waters are not prepared. AgroMag consumption is 6.5-7 kg per ton of product. Holding time of AgroMag in EPA is from 40 minutes. The temperature of EPA is the temperature of environment. The concentration of EPA is 49-52% P₂O₅. SO₄⁻² content is about 2%. Fluoride content is 0.3-0.5% based on F.

AgroMag interacts with phosphoric acid as well as with sulfuric acid (which is contained in small quantities in EPA). Magnesium sulfate and magnesium phosphate are formed. After that phosphoric acid and magnesium are introduced in production process of DAFK. AgroMag is measured by big-bags (one big-bag is 800kg).

Chemism of the process was not fully investigated. It is most likely that magnesium sulfate, which is in fertilizer granules in anhydrous (crystalline) state. It seeks to move from anhydrous state to hydrated one (MgSO₄ → MgSO₄·7H₂O), thus taking the excess moisture. Magnesium phosphate completes the picture. Also other salts as fluoride and magnesium silicon fluoride may be formed.

Despite on some uncertainty of the theory – in practice there is significant improvement in physics – chemical characteristics of granules (caking, hardness, particle size).

Complete replacement of organic conditioner by AgroMag as well as combining AgroMag with conditioner in production process are possible (the share of expensive organic conditioner is reduced).

The above method of introducing AgroMag is not final, it can be changed and modified for the specific production.

The results:

1. consumption of expensive organic conditioner decreased
2. caking tends to 0%
3. hardness of granules increased by 30%
4. particle size of mineral fertilizer improves
 - 4.1. granules became larger
 - 4.2. the number of fines was decreased significantly (0-1mm)
 - 4.3. amount of 1-2mm fraction was decreased

<i>Without AgroMag[®]</i>	<i>With AgroMag[®]</i>
Mass share of granules with size of 1- 5 mm, in the range of 85-88 %	Mass share of granules with size of 2- 5 mm, not less than 90 %

This confirms the previously known properties of magnesium hydroxide, positively influencing on the particle size, strength and caking of fertilizers.

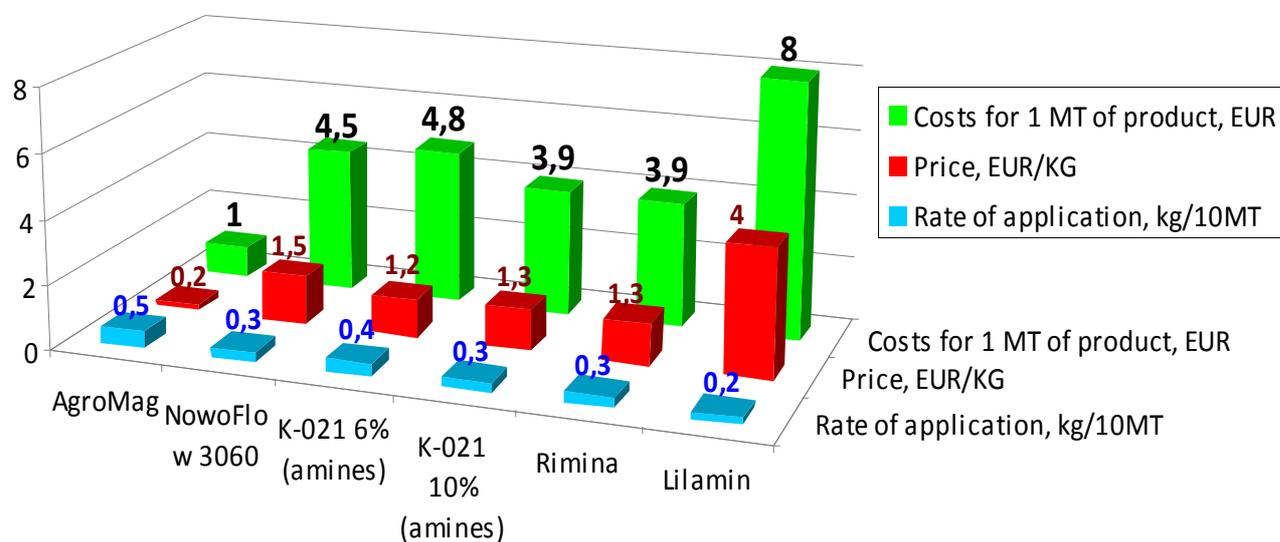
The result of using AgroMag

- reducing in caking of granules of mineral fertilizer
- increasing of solidity of mineral fertilizer granules
- coarsening of particle size, reducing of fine fraction and dust of mineral fertilizer
- simplification of technological process of conditioning (refusal from the system of heating the mineral fertilizer, atomizers for its introduction and other equipment)

Economic effect from application

1. Reducing in net cost of 1 ton of fertilizer by 3-7 euro (substitution organic conditioner for mineral one)

Comparing costs of AgroMag and organic conditioners



Manufacturers of ammonium nitrate (AN) and complex fertilizers (NPK, NK, NP, PK), who applied conditioning additive AgroMag now days.

1. Cherepovetsky Azot (PhosAgro) - Russia
2. Nevinnomyssky Azot (EuroChem) – Russia
3. Novomoskovskii Azot (EuroChem) - Russia
4. Bereznokovskii Azot (UralChem) - Russia
5. Voskresensk (UralChem) - Russia
6. Acron (Acron) - Russia
7. Dorogobuzh (Acron) - Russia
8. RovnoAzot (OstChem) - Ukraine
9. CherkassyAzot (OstChem) - Ukraine
10. KazAzot - Kazakhstan
11. NavoiAzot - Uzbekistan
12. Achema – Lithuania

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