

## **(54) Method for preparation of complex N:K fertilizer**

### **(57) Abstract**

The present invention refers to the preparation of a nitrogenous potash mineral fertilizer. The essence of the method is that for the process of the ammonium nitrate preparation from ammonia and nitric acid, 2-20 mass% of potassium nitrate (based on ammonium nitrate) is added at the neutralization stage in the form of a 30-70% solution, and then the mixed solution is processed into a finished product by evaporation and granulation through the use of a known method.

The complex fertilizer contains (mass%) N 34.2-30.4 and K<sub>2</sub>O 0.9-9.3. The fertilizer prepared does not contain chlorine, owing to which it has improved quality and higher agrochemical value, and the addition of potassium nitrate facilitates the removal of residual moisture from fusion cake at evaporation, which improves the parameters of the technological process.

1 claim, 2 dependent claims; 1 figure.

### **Description of Invention**

The present invention relates to the chemical industry and can be used in manufacturing, in the production of mineral fertilizers.

Methods are known for preparation of complex N:K fertilizers by mechanical mixing of powdered or granulated nitrogen- and potassium-containing products or by mixing accompanied by the introduction of liquid reagents (ammonium nitrate fusion cake, nitric acid and ammonia) into the process, which is followed by granulation of the mixture (M. Ye. Pozin, "Technology of mineral salts", v. II, p. 1364, "Khimiya", 1974).

A disadvantage of these methods is the separation of the fertilizer mechanical mixtures, and in the case of the granulation of mixtures after or during the process of mixing, so that the implementation of this process is complicated technically and from the point of view of equipment.

As for the technical essence, the most similar method is the preparation of nitrogenous potash fertilizer (Dukhanin B.F., Serebryakov A.I., RU patent 2154620, Jan. 14, 2000).

In addition to the aforesaid, a disadvantage of this method is the use of the potassium-containing component potassium chloride, which causes equipment corrosion and reduces the agrochemical value of the fertilizer due to the introduction of chloride ion.

The objective of the present invention is an improvement in the quality and an increase in agrochemical value through the improvement of the technological process parameters and the introduction of a second nutrient into the product composition.

The above objective is realized by the introduction of potassium nitrate in the ammonium nitrate in the amount of 2-20 mass% based on ammonium nitrate. To simplify the process, potassium nitrate is introduced in the form of a 30-70% solution at the stage of nitric acid neutralization with gaseous

ammonia. The improvement of the technological parameters is manifested at the stage of the evaporation of the mixed ammonium and potassium nitrate solution.

It is established that potassium nitrate addition significantly facilitates the removal of residual moisture from a fusion cake. Thus, upon evaporation of a 90% solution of ammonium nitrate without any additions, the moisture content in the product is 0.4-0.6%, and at the addition of  $\text{KNO}_3$ , for example, of 2-10 wt%, the moisture content does not exceed 0.2-0.3% despite the dilution of the parent mixed solution to a concentration of 82% with addition of potassium nitrate. The upper limit of the added potassium nitrate content (20%) is determined from the fusion diagram for the  $\text{NH}_4/\text{NO}_3/\text{KNO}_3$  system (Reference book "Fusion Diagrams of Salt Systems", part II, M. 1977, p. 87). Mixtures that contain more than 20 wt% of  $\text{KNO}_3$  have a crystallization temperature above 170 °C, which can lead to decomposition of the ammonium nitrate.

The drawing shows a scheme for the preparation of nitrogenous potash fertilizer. Non-concentrated nitric acid containing 56-58 wt% of  $\text{HNO}_3$  and gaseous ammonia are fed into the neutralization, which results in the formation of an 85-90% solution of ammonium nitrate. Simultaneously, the vessel is continuously charged with a 30-70% solution of potassium nitrate. After the neutralization, the mixed product that contains 2-20 mass% of  $\text{KNO}_3$  is led into an evaporator, and then in the form of fusion cake, it is routed to granulation. After air-cooling in a fluidized bed apparatus, the granulated product is packaged.

#### Example 1.

To 1 kg of an 85% ammonium nitrate solution was added 0.3 kg of a 65% potassium nitrate solution. The mixture of the solutions was stirred and evaporated until the residual moisture content was 0.3%. The highly concentrated melt of the salts was crystallized by the "granulation into liquid" method, which resulted in obtaining the finished product.

The complex fertilizer obtained contains, %

N – 31

$\text{K}_2\text{O}$  – 8.7

#### Example 2.

To 1 kg of an 87%  $\text{NH}_4\text{NO}_3$  solution was added 0.25 kg of a 50%  $\text{KNO}_3$  solution. After this point, the process was conducted in the same way as described in Example 1.

The complex fertilizer obtained contains, %

N – 32.2

$\text{K}_2\text{O}$  – 5.8

#### Example 3.



To 1 kg of a 90%  $\text{NH}_4\text{NO}_3$  solution was added 0.1 kg of a 30%  $\text{KNO}_3$  solution. After this point, the process was conducted in the same way as described in Example 1.

The complex fertilizer obtained contains, %

N – 34.2

$\text{K}_2\text{O}$  – 1.5

### Claim

1. A method for the preparation of a complex N:K fertilizer, comprising the neutralization of ammonia with nitric acid, mixing with a potassium-containing additive, evaporation of the mixed solution and granulation of the fusion cake, wherein potassium is added at the neutralization stage in the amount of 2-20 mass% based on the ammonium nitrate in the form of a 30-70% solution of potassium nitrate.
2. The complex N:K fertilizer prepared according to Claim 1.
3. The complex N:K fertilizer according to Claim 2, which contains 34.2-30.4 of N; 0.9-9.3 of  $\text{K}_2\text{O}$  (mass%).

### Notifications regarding the patent for an invention

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Drawing	
30-70% solution of $\text{KNO}_3$	ammonia
$\text{NH}_4\text{NO}_3$ solution + 2-20 mass% of $\text{KNO}_3$	
Pre-neutralizer	
Nitric acid	evaporation fusion cake granulation
Neutralization	vapor
Gaseous ammonia	air cooling of product packaging

