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## Suspended Npk Fertilizer

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**ABSTRACT.** The possibility of obtaining new effective forms of suspended compound fertilizers (NPK) based on the products of nitric acid decomposition of calcium-containing sludge, feed ammonium phosphate (CFA), carbamide and potassium chloride of the UP of the Dekhkanabad potash fertilizer plant is shown. On the basis of the conducted research, the optimal technological parameters and conditions for obtaining new forms of suspended complex NPK fertilizers were established.

**KEYWORDS.** Calcium sludge, potassium chloride, ammonium nitrate, ammophos, basic solution

### I. INTRODUCTION

After gaining independence in our country, on the basis of large-scale events, a high-level organization of a number of scientific research and development of economically efficient methods of their use in agriculture has achieved theoretical and practical results in developing technologies for producing nitrogen, phosphorus, potassium-containing fertilizers, and other nutritional components. based on local raw materials. In this regard, it should be noted that fertilizers (ammophos, nitrophos, superphosphate, ammonium nitrate, etc.), which serve to increase crop yields. However, these fertilizers in composition do not contribute to obtaining a high yield from crops, and the increased energy consumption during their production is not taken into account.

When developing technology for suspended fertilizers, it is necessary to substantiate a number of relevant scientific decisions, including in the following areas: development of an intensive method for sludge decomposition with an incomplete rate of nitric acid; determination of optimal conditions for obtaining suspended fertilizers from calcium nitrate sludge, ammophos, potassium chloride and ammonium nitrate.

### II. SIGNIFICANCE OF THE SYSTEM

The possibility of obtaining new effective forms of suspended compound fertilizers (NPK) based on the products of nitric acid decomposition of calcium-containing sludge, feed ammonium phosphate (CFA), carbamide and potassium chloride of the UP of the Dekhkanabad potash fertilizer plant is shown. The study of literature survey is presented in section III, methodology is explained in section IV, section V covers the experimental results of the study, and section VI discusses the future study and conclusion.

### III. METHODOLOGY

For laboratory experiments, calcium-containing sludge shop of water treatment of JSC "Farg'onaazot" composition (wt.%): CaO -44.95; MgO - 2.00; CO<sub>2</sub>-37.51; H<sub>2</sub>O -15.01; but. - 0.85, potassium chloride of the Dekhkanabad potash fertilizer plant (K<sub>2</sub>O-60%), urea (N-46%), ammophos (N-10%; P<sub>2</sub>O<sub>5</sub>- 45%), 57% nitric acid. For the synthesis of suspended complex NPK-fertilizers, it is necessary to prepare a basic suspension. At the same time, the estimated amount of calcium sludge was decomposed at a temperature of 35-45 °C with nitric acid, taken in the amount of 100% of stoichiometry within 20-25 minutes. The resulting solution of calcium nitrate sludge (NKSH) was mixed at a temperature of 70-80 °C with constant stirring of ammophos granules. The ratio of NHS solution and ammophos is 1:1, 1:0.75, 2:1 and 4:1. For the synthesis of more concentrated suspended NPK fertilizers in the basic suspension of ammophos with constant stirring, the calculated amount of ammonium nitrate, potassium chloride was dissolved and water. The content of all forms of P<sub>2</sub>O<sub>5</sub> (total, digestible, water-soluble) in the feedstock and the resulting products was determined by a photo-colorimetric method in the form of a yellow phosphorus and molybdenum complex on a KFK-3 photo colorimeter (440 nm) [1; C.16-22, 2; 22c.]. Nitrogen content - by the Kjeldahl method of ammonia distillation

and the chloramines method [3; 7s.]. The potassium content in the obtained samples was determined by the method [4; P.11-18].

The viscosity of samples of liquid and suspended fertilizers was determined using a VPZH-2 glass capillary viscometer with a diameter of 0.77 mm in the temperature range of 10–50 °C. The density was determined by the pycnometric method.

The crystallization temperature of liquid suspended fertilizers was determined by a visual-polythermal method [5; 94c]. In this case, the clarified part of liquid fertilizers was used, since when using suspended liquid fertilizers it is impossible to determine the freezing temperature due to the turbidity of the solutions.

#### IV. EXPERIMENTAL RESULTS

To obtain a triple suspended fertilizer in suspended suspended NP-fertilizer at a temperature of 70-80 °C and constant stirring, the calculated amount of potassium chloride was dissolved. After obtaining a homogeneous suspension of the finished product with constant stirring, cooled to a temperature of 20-25 °C. Tables 2.10-2.12 show the results of chemical analysis, as well as the properties of the suspended complex NPK-fertilizer depending on the ratio of nutritional components, the norms of the basic suspension and potassium chloride.

It was established that only in the SSU obtained from the basic suspension of ammophos with the ratio N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O = 1: 1: 1, 7.85% of the nitrogen is in the nitrate form, i.e. in the form of calcium and magnesium nitrates. It mainly consists of 34.33% Ca(NO<sub>3</sub>)<sub>2</sub>, 1.91% Mg(NO<sub>3</sub>)<sub>2</sub>, 16.37% ammophos and 12.00% KCl.

And the SSU with the ratio N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O = 2: 1: 1 and 3: 1: 1 contains 10.90 and 12.90% nitrogen in ammonium and nitrate forms, 5.45 and 4.30% phosphorus, 5.45 and 4.30% potassium (K<sub>2</sub>O) and 8.87 and 7.00% calcium, respectively.

SSUs obtained from a basic suspension of ammophos 2: 1, depending on the ratio of nutritional components, contain 8.82-14.19% of nitrogen in the form of 21.01-11.27% Ca(NO<sub>3</sub>)<sub>2</sub>, 1.17-0.63 % Mg(NO<sub>3</sub>)<sub>2</sub>, 20.04-32.55% NH<sub>4</sub>NO<sub>3</sub>, 8.82-10.75% ammophos, and 14.70-7.87% KCl.

**Table 2.10**  
**The chemical composition of complex suspended NKP-fertilizers based on the basic suspension of ammophos, ammonium nitrate and potassium chloride, %**

N: P <sub>2</sub> O <sub>5</sub> :K <sub>2</sub> O	N	P <sub>2</sub> O <sub>5</sub>	CaO	K <sub>2</sub> O	MgO	H <sub>2</sub> O
When the ratio of NKS: Ammophos = 4: 1						
1:1:1	7,85	7,2	11,71	7,20	0,51	35,20
2:1:1	10,90	5,45	8,87	5,45	0,39	36,37
3:1:1	12,90	4,3	7,00	4,30	0,31	37,13
When the ratio of NKS: Ammophos = 2:1						
1:1:1	8,82	8,82	7,17	8,82	0,32	34,12
2:1:1	12,31	6,16	5,01	6,16	0,22	35,9
3:1:1	14,19	4,73	3,84	4,73	0,17	36,85
When the ratio of NKS: Ammophos = 1:0,75						
1:1:1	9,39	9,4	5,09	9,40	0,23	33,74
2:1:1	12,87	6,44	3,49	6,44	0,15	35,71
3:1:1	14,69	4,9	2,65	4,90	0,12	36,74
When the ratio of NKS: Ammophos = 1:1						
1:1:1	9,71	9,71	3,95	9,71	0,17	33,52
2:1:1	13,16	6,58	2,67	6,58	0,12	35,61
3:1:1	14,92	4,97	2,02	4,97	0,08	36,69
1:2:1	6,37	12,80	5,20	6,37	0,23	31,5

**Table 2.11**

**Salt composition of complex suspended NKP-fertilizers based on the basic suspension of ammophos, ammonium nitrate and potassium chloride, %**

N: P <sub>2</sub> O <sub>5</sub> :K <sub>2</sub> O	H <sub>2</sub> O	Ca(NO <sub>3</sub> ) <sub>2</sub>	Mg(NO <sub>3</sub> ) <sub>2</sub>	NH <sub>4</sub> NO <sub>3</sub>	АММОФОС	KCl
When the ratio of NKS: Ammophos = 4: 1						
1:1:1	35,20	34,33	1,91	-	16,37	12,00
2:1:1	36,37	25,99	1,45	14,56	12,40	9,07
3:1:1	37,13	20,51	1,14	24,14	9,78	7,16
When the ratio of NKS: Ammophos = 2:1						
1:1:1	34,12	21,01	1,17	13,99	8,82	14,70
2:1:1	35,9	14,67	0,82	20,04	24,27	10,26
3:1:1	36,85	11,27	0,63	32,55	10,75	7,87
When the ratio of NKS: Ammophos = 4:3						
1:1:1	33,74	14,93	0,83	13,39	21,36	15,66
2:1:1	35,71	10,22	0,57	28,09	14,62	10,73
3:1:1	36,74	7,77	0,43	35,80	11,13	8,15
When the ratio of NKS: Ammophos = 1:1						
1:1:1	33,52	11,57	0,59	15,90	22,08	16,19
2:1:1	35,61	7,84	0,44	30,12	14,96	10,97
3:1:1	36,69	5,92	0,33	37,42	11,31	8,28
1:2:1	31,5	15,20	0,84	2,11	29,01	21,26

**Table 2.12**

**Rheological properties of complex suspended NKP-fertilizers based on the basic suspension of ammophos, ammonium nitrate and potassium chloride**

N:P <sub>2</sub> O <sub>5</sub> :K <sub>2</sub> O	Temperature, ° C										T.к., °C	pH
	Viscosity, Pz					Density, g/cm <sup>3</sup>						
	10	20	30	40	50	10	20	30	40	50		
When the ratio of NKS: Ammophos = 4: 1												
1:1:1	17,40	16,45	13,9	10,34	8,81	1,263	1,253	1,236	1,206	1,177	0,1	6,2
2:1:1	17,18	16,22	13,34	10,10	8,47	1,255	1,245	1,225	1,193	1,165	-0,4	6,1
3:1:1	17,06	16,09	13,51	10,00	8,47	1,250	1,240	1,219	1,187	1,157	-0,7	6,0
When the ratio of NKS: Ammophos = 2:1												
1:1:1	18,12	17,06	14,81	11,04	9,55	1,287	1,276	1,251	1,215	1,181	1,9	6,3
2:1:1	18,01	17,01	15,37	11,03	9,80	1,281	1,269	1,245	1,209	1,175	1,4	6,2
3:1:1	17,87	16,86	15,22	10,88	9,66	1,278	1,266	1,242	1,206	1,171	0,9	6,1
When the ratio of NKS: Ammophos = 4:3												
1:1:1	20,59	19,28	15,94	11,61	10,38	1,303	1,291	1,267	1,231	1,196	2,2	6,5
2:1:1	20,35	18,96	16,67	14,09	12,79	1,305	1,291	1,263	1,221	1,180	2,0	6,4
3:1:1	20,16	18,74	16,79	14,52	13,18	1,294	1,28	1,253	1,213	1,173	1,8	6,3
When the ratio of NKS: Ammophos = 1:1												
1:1:1	21,49	20,04	18,42	16,48	15,09	1,333	1,314	1,279	1,226	1,173	2,6	6,6
2:1:1	21,37	19,86	18,9	17,61	16,13	1,329	1,315	1,287	1,245	1,203	2,3	6,5
3:1:1	21,2	19,78	18,86	17,59	16,14	1,318	1,302	1,27	1,223	1,175	2,1	6,4
1:2:1	25,41	24,07	23,21	21,96	20,54	1,373	1,354	1,319	1,267	1,213	2,8	6,6

Suspended complex NKP-fertilizers from the base slurry 4: 3 and 1: 1, depending on the ratio of nutritional components, mainly consists of 14.93-7.77% and 11.57-5.92% calcium nitrate, 0.83-0.43% and 0.59-0.33%



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magnesium nitrate, 13.39-35.80% and 15.90-37.42% ammonium nitrate, 21.36-11.13% and 22.08-11, 31% of ammophos and 15.66-8.15% and 16.19-8.28% of potassium chloride, respectively. The amount of nutrients is 27.26-33.57% and 26.66-33.25%, respectively.

## V. CONCLUSION AND FUTURE WORK

On the basis of the obtained results of technological tests, the material balance of production of 1 ton of suspended complex NPK-fertilizer to the ratios N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O 1: 1: 1 was calculated on an integrated plant. The finished product contains 8.89% nitrogen in nitrate and ammonium forms in the form of calcium nitrates (20.75%), magnesium (1.17%) and ammonium (9.30%), 8.89% phosphorus and 8.89% potassium.

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