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Magnesium-Phosphatic Fertilizers on the Basis of secondary Magnesite waste of processing Zinelbulak Minerals and low Posphoses of Central Kyzylkum

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ABSTRACT:In this article, the results of obtaining magnesium-phosphate fertilizers under the influence of low-grade phosphorite on the sample, appeared during the process of enriching raw materials of Zinelbulak talc magnesite deposit located Lower Amudarya region of the Republic of Uzbekistan with the content of magnesite -$MgCO_3$ 53.70%, talc - $3MgO \cdot SiO_2 \cdot H_2O$ 27.20%, kemmererit- $5MgO{\cdot}5FeO{\cdot}Al_2(SiO_3)_3{\cdot}H_2O$ 10,01 %, dolomite- $MgCO_3{\cdot}\ CaCO_3$ 7.75% and calcite - $CaCO_3$ 1.34% were mentioned

KEY WORDS: flotation, talc-magnesite, magnesite waste, low grade phosphorite, sulfur, photosynthesis, assimilation, decomposition rate, neutralization, environment.

I.INTRODUCTION

It is known that for the proper development of plants it is necessary to add to the soil not only mineral and organic fertilizers, but also a number of trace elements. Among them, the role of magnesium is invaluable. Because it is a necessary fertilizer from the correct and timely formation of the root system of plants to the period of fruiting. Magnesium plays an important role in the process of photosynthesis, participates in all stages of protein synthesis, regulates the absorption of water into the root system. In accelerates the growth of cotton, wheat, melons and fruits, increases yield and improves fruit taste.

Magnesium is naturally present in the soil, but its amount in the soil is not sufficient for the intensive growth of plants. On top of that, during rainfall and irrigation, about 4 to 8 grams of magnesium is washed away from each square meter of land per year.

In view of the above, in order to further increase soil fertility, it is important to provide it with magnesium fertilizers, along with nitrogen, phosphorus and potassium. However, the introduction of magnesium into crop fields in the form of sulfate salts has a number of advantages. The main advantage of magnesium sulfate is that it begins to be absorbed by the plant 24 hours after application and is included in the list of fast-acting fertilizers. In flowering plants, magnesium sulfate leads to a significant increase in buds and ensures subsequent flowering. Second, magnesium sulfate can improve the taste of some plants. The vegetables will have a richer taste and the potatoes will be more juicy.

II.LITERATURE SURVEY

Magnesium sulfate fertilizer is able to increase the amount of starch and other vitamins in fruits. Its sulfur content plays an important role in the proper growth and fertility of plants. Lack of sulfur leads to a decrease in the activity of biological processes that occur during the growing season of the plant. Sulfur is an integral part of the protein synthesis process. Given today's requirements for all types of crops, it is time to take care of their quality, along with high yields [1].

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In recent years, great importance has been attached to agriculture in the Republic. This in turn further increases the need for magnesium-containing fertilizers. Today, due to the lack of a large industry for the production of magnesium fertilizers in the Republic, most consumers use imported products for their needs [2, 3].

The presented scientific work is aimed at overcoming the above problems through the production of magnesium fertilizers using Zinelbulak talc-magnesite minerals located in the lower Amudarya region of the Republic. In this regard, the production processes of many types of complex fertilizers, including three or more nutrient components in different proportions, including magnesium, are being intensively studied worldwide today. The raw material base for the production of magnesium fertilizers is very diverse, with more than 200 magnesium-bearing ores in nature. These mainly include carbonate ores, magnesium silicates, as well as natural salts. While some magnesium-containing ores are used directly as ameliorants, the possibility of obtaining magnesium-containing fertilizers by processing them has been studied [4,5,6,7].

These processes are a complex technological process and require separate scientific and practical research for each case, depending on the composition, properties, location of raw materials. Therefore, scientists have used these compounds as ameliorants without processing and applied them to the cultivation of agricultural crops [8,9]. However, in these compounds, the demand of plants for magnesium is not sufficiently met due to the lack of water-soluble magnesium compounds.

In our previous studies, we studied the link between the temperature and time of the processes of obtaining water-soluble mahnesium-containing and acid-based samples, gained by recycling magnesite-containing raw material with the help of sulfuric acid of different concentrations, separated by flotation from Zinelbulak talc-magnesite raw with the content of magnesite - $MgCO_3$ 53.70%, talc - $3MgO \cdot SiO_2 \cdot H_2O$ 27.20%, kemmererit- $5MgO{\cdot}5FeO{\cdot}Al_2(SiO_3)_3{\cdot}H_2O$ 10,01 %, dolomite- $MgCO_3{\cdot}$ $CaCO_3$ 7.75% and calcite - $CaCO_3$ 1.34% as well as the optimal parameters of this process were determined [10].

III.METHODOLOGYAND EXPERIMENTAL RESULTS

During the process of taking these magnesium samples, as the concentration and the norm of acidity rose, however its pH began to fall from 3.40 to 1.01 and its acidity grow. The taken magnesium samples with high acidity were neutralized with low-grade phosphorite. Throughtout the neutralization processes, the ratio of P_2O_5 to (MgO_{gen}/P_2O_{5gen}) ranged from 0.99 to 3.90 was added to magnesium oxide. We applied low-grade and high-carbonate Central Kyzylkumphosphorites which was studied in the previous researches [11], with the content of P_2O_5 – 13,94%, CaO – 43,78%, CO2 – 19,10%, for the process.

The obtained products were dried in a drying cabinet 30-1060 of the German company MemmertGmbH+Co for two hours to a constant mass and 10% suspensions were prepared and their pH was determined and the results were analyzed on the basis of established normative documents [12, 13, 14, 15, 16]. The results are given in Table 1 below.

What can be seen from the results that when the magnesium sample containing magnesium sulfate is neutralized with phosphorite in the ratio MgO_{gen}/P_2O_{5gen}=3.24, the pH is 1.63 to 3.6, MgO_{gen}/P_2O_{5gen}=1.62, pH_{end} 5.8 and MgO_{gen}/P_2O_{5gen} the product with a pH of 7.7 at a ratio of=1.11 is released. This relationship remained virtually unchanged even during the neutralization processes of the decomposed samples with 50-60% acid concentrations. The sample (MgO_{gen}/P_2O_{5gen}) decomposed with acid at 70% concentration was neutralized in ratios from 1.33 to 1.95, and the pH was found to increase from 3.01 to 7.1.

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Table 1
Analysis of a sample of magnesial containing magnesium sulfate

№	Acid concentration,%	pH_{beg} *(Based on 10% suspension)*	Amount of for P_2O_5neutralization,	The main nutrient components of the sample						pH_{end} *(Based on 10% suspension)*
				The amount of P_2O_5 in the sample,%		The amount of MgO in the sample,%		The amount ofCaO in the sample,%		
			$\frac{MgO_{gen}}{P_2O_{5gen}}$	P_2O_{5gen}	P_2O_{5ass}	MgO_{gen}	$MgO_{w.s}$	CaO_{gen}	CaO_{ass}	
1	40	1,63	3,24	6,24	4,35	20,24	17,98	13,15	7,95	3,6
			1,62	8,81	5,54	14,29	11,78	21,37	14,32	5,8
			1,11	9,83	6,12	10,63	8,68	21,78	16,31	7,7
2	50	1,30	2,90	6,21	4,17	18,12	15,65	13,21	8,01	3,5
			1,45	8,73	5,53	12,74	10,48	19,87	13,12	5,5
			0,99	9,91	6,16	9,64	7,65	23,43	17,52	7,7
3	60	1,07	3,20	6,15	3,92	19,77	16,56	13,54	8,23	3,2
			1,60	8,56	5,47	13,76	11,23	18,56	12,01	5,3
			1,10	10,02	6,18	10,74	8,68	25,68	18,98	7,7
4	70	1,06	3,90	6,01	4,03	23,49	21,65	13,98	8,54	3,01
			1,95	8,41	5,41	16,43	14,62	17,98	11,48	5,15
			1,33	10,39	6,45	13,54	10,98	27,52	20,51	7,4
5	80	1,04	3,22	5,91	4,05	19,11	18,65	14,21	8,71	2,8
			1,61	8,65	5,61	13,99	12,54	16,65	10,45	4,9
			1,10	10,68	6,45	11,51	9,96	28,87	21,65	7,3
6	90	1,02	3,08	5,87	4,06	18,06	16,98	15,12	9,30	2,6
			1,54	9,01	5,89	13,86	12,54	15,87	9,81	4,7
			1,05	11,02	6,46	11,3	9,98	29,98	22,23	7,2
7	96	1,01	2,90	5,74	3,95	16,63	15,98	15,42	9,47	2,6
			1,45	9,45	6,21	13,69	12,23	15,54	9,61	4,8
			0,99	11,38	6,87	10,99	9,65	30,53	22,63	7,2

The samples obtained by decomposing with highly concentrated (80-96%) acids had pH_{end} ratios of up to 2.6-2.8, MgO_{gen} in experiments with ratios of P_2O_5 to magnesium oxide (MgO_{gen}/P_2O_{5gen})- 1.45-1.61. Semi-finished products neutralized with ratios of 2,90-3.22 have pH_{end} values between 4.7-4.9 and samples with neutralization MgO_{gen}/P_2O_{5gen} 0.99-1.10 have pH_{end} values of 7.2-7,3 respectively.

The results of experiments show that a decrease in the ratio of P_2O_5 to magnesium oxide from 3.24 to 0.99 neutralizes the magnesium sample in an acidic environment, but the pH of the sample decomposed with low concentration acid in the order of magnesium sampling increases by 40-96%. 1.07 times less was observed.

In this process, the water-soluble form of MgO was found to decrease from 17,98% to 9,65%, corresponding to an increase in acid concentration of 40-96% in the samples., which was 11.78% when the ratio was 1.62, and 8.68% when the ratio was 1.11. In this experiment, it was also found that as the MgO_{gen}/P_2O_{5gen} ratio value decreased (i.e., the phosphorite content increased), the water-soluble forms of MgO in the samples increased. This relationship was maintained in samples 2 and 3 as well.

When the acid concentration used in the decomposition of the primary raw material is 70% (sample 4), the MgO_{gen}/P_2O_{5gen} ratio is 3.90, the MgO_{gen} form is 21.65%, the 1.95 ratio is 14.62%, and the 1.33 ratio is 10.98%. When high concentrations of H_2SO_4 are used (samples 5-7) when the MgO_{gen}/P_2O_{5gen} ratios are increased from 0.99 to 3.22; In sample 5, it was found to decrease by 1.88 times to 9.96%, in sample 6 to decrease by 1.70 times to 9.98%, and in

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sample 7 to decrease by 1.66 times to 9.63%, decomposition rates were also studied. The results of the experiment are given in Table 2.

Table 2.

Degradation rates of the major nutrients in the process of neutralizing the magnesium sample

№	Acid concentration,%	pH_{beg} *(Based on 10% suspension)*	The amount of to neutralize P_2O_5, $\frac{MgO_{gen}}{P_2O_{5gen}}$	The degree of decomposition of the main nutrient components in the sample, k_d, %.		pH_{end} *(Based on 10% suspension)*
				$k_d = \frac{P_2O_{5ass}}{P_2O_{5gen}}$	$k_d = \frac{CaO_{ass}}{CaO_{gen}}$	
1	40	1,63	3,24	69,71	60,46	3,6
			1,62	62,88	67,01	5,8
			1,11	62,26	74,89	7,7
2	50	1,30	2,90	67,15	60,64	3,5
			1,45	63,34	66,03	5,5
			0,99	62,16	74,78	7,7
3	60	1,07	3,20	63,74	60,78	3,2
			1,60	63,90	64,71	5,3
			1,10	61,68	73,91	7,7
4	70	1,06	3,90	67,05	61,09	3,01
			1,95	64,33	63,85	5,15
			1,33	62,08	74,53	7,4
5	80	1,04	3,22	68,53	61,29	2,8
			1,61	64,86	62,76	4,9
			1,10	60,39	74,99	7,3
6	90	1,02	3,08	69,17	61,51	2,6
			1,54	65,37	61,81	4,7
			1,05	58,62	74,15	7,2
7	96	1,01	2,90	68,82	61,41	2,6
			1,45	65,71	61,84	4,8
			0,99	60,37	74,12	7,2

When phosphorite with aMgO_{gen}/P_2O_{5gen} ratio of 3.24 was added to a sample of magnesite feedstock at an acid concentration of 40%, the total amount of P_2O_{5gen} was found to be 6.24% and the absorption form was 4.35%, with a decomposition rate of 69.71%. The amount of phosphorite, when neutralized with a ratio of 1.62, and P_2O_{5gen} 8.81% and its absorption form is 5.54%, the decomposition rate is k_d 62.88%, when the sample is introduced into the process at a ratio of 1.11 to completely neutralize P_2O_{5gen} 9.83% and its absorption while the shape was 6.12% and the decomposition rate was 62.26% k_d.In samples 2–4, the degree of decomposition of phosphorites during the neutralization process decreased 1.08 times. When using a high concentration of sulfuric acid (samples 5-7) when increasing the MgO_{gen}/P_2O_{5gen} ratios from 0.99 to 3.22; In sample 5, it decreased by 1.14 times to 60.39%, and in samples 6 and 7, it decreased by from 1.13 and 1.17 times to 58.62-60.37%.

It was observed that the resulting semi-finished products also contain absorbable calcium oxides. To neutralize the absorbable form of CaO_{ass} when the ratio of MgO_{gen}/P_2O_{5gen} is 3.24 to 3.95% when the acid concentration in the process is 40%, when the phosphorite content is neutralized to 1.62, the absorbable form of $CaO_{ass}$is 14.32% and the pH to 7.7. When the phosphorite was introduced into the process at a ratio of 1,11, the absorbable form of CaO_{ass} was 16.31%. With a decrease in the amount of P_2O_{5gen} (MgO_{gen}/P_2O_{5gen}=1.62; MgO_{gen}/P_2O_{5gen}=3.24) it was observed an increase in the assimilation form of CaO_{ass} in it and the acidity of the resulting semi-finished product.

It was observed that high values of the absorbable form of CaO_{ass} are formed when the semi-finished products are completely neutralized. In samples 2–4, when the pH increased from 3.01 to 7.7,CaO_{ass} increased by 2.12 to 2.40 times. When using a high concentration of sulfuric acid (samples 5-7), the values of the samples obtained when the pH

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increased from 2.8 to 7.3; In Sample 5, it increased by 2.48 times to 21.65%, and in Samples 6 and 7, it increased by 2.39 times to 22.63%.

It was also found that depending on the acid concentration, the moisture content of the products formed in the ascending order of the amount of introduced P_2O_5 for neutralization, when the MgO_{gen}/P_2O_{5gen} ratio is small, decreased from 30.93% to 9.65%. The analysis of the experimental processes is given in Table 3.

Table 3.
Moisture content of the resulting semi-finished products

№	Acid concentration, %	pH of semi-finished products (Based on 10% suspension)		Amount of P_2O_5 for neutralization, $\frac{MgO_{gen}}{P_2O_{5gen}}$	Moisture content of semi-finished products, W%
		pH_{beg}	pH_{end}		
1	40	1,63	3,6	3,24	30,93
		1,63	5,8	1,62	27,52
		1,63	7,7	1,11	20,92
2	50	1,30	3,5	2,90	30,02
		1,30	5,5	1,45	25,43
		1,30	7,7	0,99	19,65
3	60	1,07	3,2	3,20	24,65
		1,07	5,3	1,60	19,23
		1,07	7,7	1,10	16,48
4	70	1,06	3,01	3,90	19,67
		1,06	5,15	1,95	17,98
		1,06	7,4	1,33	15,01
5	80	1,04	2,8	3,22	18,65
		1,04	4,9	1,61	15,98
		1,04	7,3	1,10	13,89
6	90	1,02	2,6	3,08	16,65
		1,02	4,7	1,54	14,01
		1,02	7,2	1,05	11,65
7	96	1,01	2,6	2,90	14,05
		1,01	4,8	1,45	11,45
		1,01	7,2	0,99	9,65

When P_2O_{5gen} was added to the neutralization process of sample 1 (40%, H_2SO_4) in the amount of MgO_{gen}/P_2O_{5gen}3.24, its moisture content was 30.93%, the moisture content of the product neutralized with MgO_{gen}/P_2O_{5gen}1.62 was 27.52% and $MgO_{gen}/P_2O_{5gen}$was 1.11. The moisture content of the semi-finished product formed when neutralized with P_2O_5 was found to be 20.92%. In Sample 2 (50%, H_2SO_4), the MgO_{gen}/P_2O_{5gen}ratio was reduced from 2.90 to 0.99, the humidity decreased by 1.53 times to 19.65%, and in Sample 3 (60%, H_2SO_4) it increased to 1.49 times, decrease was detected. The moisture content of the semi-finished products obtained in the process with an acid concentration of 70-96% was found to be 1.57 times lower than that of the original samples. Samples obtained with high concentrations of acids showed a decrease of 1.33 to 1.46 times, respectively, when the MgO_{gen}/P_2O_{5gen}ratios were reduced from 3.08 to 0.99.

IV.CONCLUSION

In conclusion, when neutralizing magnesite waste with high acidity magnesium samples processed with sulfuric acid with low-grade high-carbon Central Kyzylkumphosphorite, the lower the ratio of MgO_{gen}/P_2O_{5gen}introduced in the process, the lower the moisture content of the resulting product and vice versa. an increase in the absorbent form is observed. Also, the content of magnesium phosphates, the main nutrient components of the process, the total and assimilated forms of P_2O_5 increases and MgOdecreases, and their content in the samples is P_2O_{5ass}-6.12-6.87%, $MgO_{w.s}$-8.68-9.65% and CaO_{ass}-16,31-22,63%.

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As a result of the research, new types of low-cost, high-efficiency phosphorus, calcium and magnesium complex fertilizers were created on the basis of secondary magnesite and low-grade local phosphorites separated by flotation from the raw material containing Zinelbulak talc-magnesite. The inclusion of magnesium sulfate in the composition stimulates the flow of soluble phosphorus and increases its assimilation. Magnesium ions in turn improve the absorption of calcium, phosphorus and nitrogen by the plant. The role of sulfur in the composition is also very important. Sulfur is necessary for the assimilation of nitrogen by the plant, the lack of this element slows down the assimilation of nitrogen, the effect of nitrogen fertilizers is reduced.

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