ORGANIC-MINERAL FERTILIZERS BASED ON PROCESSING OF THE NITRIC-SULFURIC ACID BROWN COAL AND PHOSPHORITES

Abstract: The results of the study process of producing complex fertilizers by oxidation of the Angren brown coal with a mixture of nitric and sulfuric acids, and subsequent decomposition of oxidation products with mineralized mass and slime phosphorite of Central Kyzylkum. The result highly organic-mineral fertilizers were obtained. The commodity properties of the resulting product of fertilizers were defined. They are not compressed, even with a high moisture content will remain full their friability.

Keywords: organic-mineral fertilizers, Angren brown coal, the oxidation of a mixture of nitric and sulfuric acids, mineralized mass, slime phosphorite.

At present it is worsen more that world food problems determined with high rate of population growth reduction such resources as arable land suitable, fresh water reserve. One of main tasks of agriculture food industry is in securing country population with food. In this connection, fertilizer industry makes important attention.

During there are performed the wide fields activities on ensuring population by quality food. In this area special attention is given, including quality nitrogen, phosphorus and potash fertilizer productivity, growth of efficiency of mineral fertilizer and increasing humus in soil is base of its fertility. Moreover, organic fertilizer application in agriculture has singular importance, increases productivity and improvement of physico-chemical and land reclamation condition of soil [1, p. 15-16].

The soils of Uzbekistan on the content of this important element related to low income. The meter layer of black soil, for example, on one hectare 350-700 tons of humus contains, while the best cotton soil zone of black soil, for example, on one hectare 350-700 tons of humus contains, while the best cotton soil zone

The soils are in the process dehumification. It was found that the decrease of humus content in the soil by 1% leads to lower crop yields by about 700 tons [8, p. 137-150]. The soils are in the process dehumification. It was found that the decrease of humus content in the soil by 1% leads to lower crop yields by about 700 tons

Scientific research directed on processing coal and development of technology based on it organic-mineral fertilizers (OMF) and plant growth stimulant is performed in the leading research centers and high centers of the world including «Concho Petroleum Co», «Scientific and Applied Processes Pty., Ltd» (USA), Oesterreichisch-Alpine Montangesellschaft, «Simmering-Graz-Panker AG fur Maschinen-, Kessel und Waggonban» (Austria), «Rheinische Braukohlenwerke AG» (Germany), «Kamishimo Kagaku Kogyo Kabushiki Kaisha», «Nihon kase Kogyo Kabushiki Kaisha», Kogyo gidzyutsu intyo (Japan), Indian Institute of Technology (India), Iran University of Science and Technology (Iran), Scientific and research institute of fertilizer and insectofungicide SRIFI (Russia), Institute of General and Inorganic Chemistry (Uzbekistan).

As a research result conducted in the world on production both the organic, organic-mineral fertilizer and plant growth stimulant based on oxidized coal with high content of humic acid and improvement there were obtained the number of findings, including: stimulator – ammonium humate has been produced based on when interaction ammonium hydroxide with lignite («Concho Petroleum Co.», USA and «Kogyo gidzyutsu intyo», Japan), humic fertilizer has been synthesized by brown coal treated with nitric acid and subsequent neutralization of the slurry by ammonia in optimal variant («Scientific and Applied Processes Pty., Ltd», USA and «Oesterreichisch-Alpine Montangesellschaft», Austria), coal is oxidized preliminarily by nitric acid and nitrohumic acid then calcium cyanamide or superphosphate, melt phosphate is added into it, and the result solid organic fertilizer has been generated («Kamishimo Kagaku Kogyo Kabushiki Kaisha», «Nihon kase Kogyo Kabushiki Kaisha», Japan), there are developed the organic-mineral fertilizer by processing mixture coal and phosphorite in the disintegrator («Simmering-Graz-Panker AG fur Maschinen-, Kessel und Waggonban», Austria), there has been produced the organic-mineral fertilizer by processing mixture coal with phosphorite in presence of different mineral salt («Rheinische Braukohlenwerke AG», Germany) [2-7].

In the world scientific research for obtaining humates and development of humic containing fertilizer technology production were conducted by scientists such as W.Klempt, O.Grosskinsky, A.Amberger, F.Kortmann, E.Petzold, F.Petermeise (Germany), M.Shizunori, N.Kinsaku, H.Kodzo, N.Yutaka, Motohisa (Japan) D.Felix, M.Antoine, P.Echivard, G.Isambert (Франция), C.J.Karcher, L.C.Canfield, M.A.Coley, R.C.Snively (USA), K.Entzmann (Austria), G.Zoltan, K.Laszlo, S.Agnes, S.Janos (Венгрия), S.Heng, G.J.Perry (Australia).

The soils of Uzbekistan on the content of this important element related to low income. The meter layer of black soil, for example, on one hectare 350-700 tons of humus contains, while the best cotton soil zone - gray soils contain only 65-85 tons [8, p. 137-150]. The soils are in the process dehumification. It was...
found that the decrease of humus content in the soil by 1% leads to lower crop yields by about 5 quintals of grain units per hectare [9, p. 117-127].

The aim of research work is to develop a technology of organic-mineral fertilizer on the basis of oxidized brown coal from the Angren deposit using Kyzylkum phosphates.

In this study, a representative sample of fine coal grade BOMSSH (brown, walnut, small, seed, rubble) has been used, which has, after drying, to air dryness and grinding in a ball mill to a particle size of 0.25 mm, the following composition (wt.%): moisture 14.1, the ash 13.7, organics 72.2, humic acid 4.1% on organic matter. To carry out laboratory experiments the following CK phosphorites were used mineralized mass (MM) containing (wt.%): P$_2$O$_5$ total 14.68; CaO 40.80; Al$_2$O$_3$ 1.17; Fe$_2$O$_3$1.37; MgO 0.53; F 1.85; CO$_2$12.84; and slime phosphorite (SP) containing (wt.%): P$_2$O$_5$ total 11.57; P$_2$O$_5$accep. 1.29; CaO 41.08; Al$_2$O$_3$ 1.84; Fe$_2$O$_3$.1.42; MgO 0.61; F 1.52; CO$_2$.20.91; P$_2$O$_5$accep. : P$_2$O$_5$total. = 9.01%.

X-ray diffraction analysis has established (fig.1) diffraction bands 2.77; 2.74; 2.69; 2.62; 2.28; 2.24; 1.93; 1.83; 1.72; 1.72 A° belongs fluorine carbonatapatite. The presence of calcite confirms the interplanar distances 3.86; 3.03; 2.49; 2.28; 2.09; 1.92; 1.91; 1.87; 1.62; 1.60 A°, dolomite – 1.54A°, gypsum -3.07; 3.17; 2.77; 2.24; 1.42 A°, three calcium phosphate - 3.45 A°. Bands 3.81; 3.35; 2.49; 1.93; 1.87 A° indicate insoluble residue – quartz. X-ray diffraction analysis has established. In the SF (fig. 2) there are also diffraction bands with values of 2.77; 2.70; 2.62; 2.28; 1.93; 1.83 A°, which include fluorine carbonateapatite. There are calcite interplanar distances - 3.86; 3.03; 2.49; 2.28; 2.09; 1.91; 1.87; 1.62; 1.60 A°, gypsum -2.84; 2.77; 1.42 A°, three calcium phosphate -3.45; 2.49 A° and quartz-3.35; 2.49; 1.93; 1.87; 1.42A°.

Oxidation process of coal was carried out by 30% nitric acid in which sulfuric acid had been entered in an amount to its concentration in the nitric acid solution was 5%. The weight ratio of the organic portion of coal to nitric acid monohydrate was taken 1: 1.6 and 1: 2.0. Coal oxidation process was conducted at a temperature of 40°C for 2 h. The obtained samples of the oxidation products were treated by different types of Kyzylkum phosphorites. The amount of phosphate raw material (PR) was calculated based on the amount originally taken on the coal oxidation in the mixture of the nitric and the sulfuric acids. Norm of these acids on decomposition of the phosphate raw materials were taken in the range from 40 to 80% of the stoichiometry on calcium oxide in the raw material. The decomposition was carried out at 40°C for one hour. Then the resulting acid mass was ammoniated to pH = 3.9-4.3, dried at 70-75°C to 4-6% of the moisture content in the product.

Experimental results have shown that it is independent on the ratio of the organic portion of coal: HNO$_3$: H$_2$SO$_4$ increase of acids norm by decomposition PR from 40 to 80% of stoichiometry leads to a decrease in content of the total form of P$_2$O$_5$ in the
products and increasing the relative content of acceptable \( \text{P}_2\text{O}_5 \), nitrogen, organic substances and humic acids in the fertilizers.

In the case of using MM, highest content of humic acids (14.03%) contains fertilizer obtained at a weight ratio to the organic portion of coal to nitric acid monohydrate 1:1.6, concentration of sulfuric acid in the nitric acid solution is 5% and acid norm on the decomposition of the phosphorite flour is 80% from stoichiometry. The result is shown in the Table 1.

This fertilizer also contains 7.37% of \( \text{P}_2\text{O}_{\text{total}} \), 6.71% of nitrogen, 24.86% of organic matter, and the relative content of acceptable form in it is 85.62%. It also contains 8.04% of CaO in water-soluble form is also very important as calcium is the six most essential plant nutrients.

There have been found the optimal conditions for obtaining OMF based on use of other types of SP. For SP acid norm is 80%, the composition of fertilizers (wt.%): \( \text{P}_2\text{O}_{\text{total}} \) 5.74; 5.03% of nitrogen, 20.62% of organic matter and humic acids 11.05%.

Table 1

<table>
<thead>
<tr>
<th>The weight ratio of the coal: ( \text{HNO}_3: \text{H}_2\text{SO}_4: \text{MM} )</th>
<th>Norm of the acids on ( \text{CaO}% )</th>
<th>Chemical composition, %</th>
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| 10:20:3,33:66,1 | 40 | \( \text{P}_2\text{O}_{\text{total}} \) 10.65 \( \text{P}_2\text{O}_{\text{acccep}} \) 5.36 \( \text{CaO}_{\text{total}} \) 29.69 \( \text{CaO}_{\text{w,s}} \) 8.75 \( \text{N} \) 5.01 \( \text{Organic} \) \( \text{Humic} \)
| 10:20:3,33:52.9 | 50 | 9.72 5.45 27.15 9.07 5.42 14.74 8.95
| 10:20:3,33:44.1 | 60 | 9.04 6.00 25.02 9.61 5.83 16.08 9.80
| 10:20:3,33:37.8 | 70 | 8.31 6.92 23.31 9.82 6.11 16.79 10.22
| 10:16,2:67,52.9 | 40 | 10.20 4.91 28.80 7.43 6.58 16.65 9.34
| 10:16,2:67,42.3 | 50 | 9.32 5.05 26.36 8.27 5.35 19.81 11.23
| 10:16,2:67,35.3 | 60 | 8.75 6.19 24.18 8.67 5.66 21.02 11.92
| 10:16,2:67,30.2 | 70 | 8.03 6.46 22.35 8.45 5.97 22.94 12.90

There have been found the optimal conditions for obtaining OMF based on use of other types of phosphorite. Commodity properties of fertilizers were defined. They are not be compressed. Even with high moisture content the fertilizer retain complete friability. The strength of the granules exceeds the requirements of GOST. Increased hygroscopicity requires packing of the product in bags.

Based on the results of laboratory experiments and experimental work in the model laboratory plant it was installed that basic technological parameters of the process of obtaining OMF. The basic technological scheme has been proposed, the material balance has been compiled and the economic indexes for production of one ton of OMF have been calculated.

Thus, the resulting organic-mineral fertilizers possess considerable advantages. In the first they are concentrated and they can be transported in the long distance and export. The second the economic effect will be not only of benefit when production organic-mineral fertilizers, and form application them in the agriculture.

When application humic containing fertilizers unconditionally will increase humic in soil, as well as the structure, physico-chemical properties of soil will improve significantly, using coefficient nutrients of applied fertilizers will increase, the crop of the agriculture plants will raise.

Thus, nitric-sulfuric acid processing of brown coal of Angren deposits and phosphorite of Central Kyzylkum allows to obtain highly effective organic-mineral fertilizers.

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