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Reclamation of Tailings's Dusting Surface by Beneficiation Plants

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ABSTRACT

The object of research is a technology to produce physiologically active human materials from coal, methods for preparing aqueous solutions, the effectiveness of their impact on the seeds of wild plants, defined species of halophyte plants, which have been tested in harsh soil and climatic conditions of the arid zone of Kazakhstan where numerous processing factories of industrial production. The waste, so-called tailing dumps can catastrophically reduce the area of pastures, arable land and also cause various diseases of adults and children.
Therefore, the purpose of the work is significantly reducing dust and gas emissions from the surface of tailing dumps, rock dumps and ash and slag from thermal power plants by means of biotechnical reclamation, which involves sowing seeds of wild plants, after pretreating with a solution of a drug - a plant growth stimulator obtained brown coal from the Kiyakty deposit.
The article presents the results of tests of an experimental sample of a preparation made from coal, as well as by the method of biotesting, the optimal concentrations of aqueous solutions of a humic preparation for treating seeds of wild plants, the optimal technological parameters for preparing seeds for sowing (duration of treatment with a humic preparation, seed maturation, etc.) have been determined: the optimal conditions for sowing seeds on the surface of the tailing dump (substrate moisture, temperature, salinity).
The installation of a pilot plant for obtaining a humic preparation was carried out, on which 550 kg of the preparation was obtained. Its chemical and toxicological properties have been determined; received a certificate of compliance with environmental standards. It has been established that the physiological effect of the drug is most effectively manifested on highly saline soils in extreme soil and climatic conditions.
The selected varieties of shrubs of alabota, wormwood, which give rapid growth on the surface of a dusty substrate, for example, at a wind speed of 2-10 m / s, the amount of dust emitted decreased by 85%.

Keywords
unconditional brown coal, alkaline solutions, substrate, ecology, aqueous solution of a humic preparations

Introduction

Extraction of minerals from the depths of mining causes a change in the environment: a violation of the earth's surface, the formation of waste dumps leads to the formation of dusty objects. The impact is particularly noticeable in arid regions — in dry weather with wind, the dust arising in quarries and dumps is carried far beyond the limits of the mining allotment.
In Kazakhstan, more than 50 billion tons of waste from mining enterprises that pollute the atmosphere with various gases and dust are stored. Fine-grained and dust-like wastes are a source of pollution of all components of the natural environment. This dust-like pollution is carried by air streams from one layer of the atmosphere to the other (from the troposphere to the stratosphere). The average duration of stay of non-deposited dust (light) is about 2 years in the stratosphere, 1-4 months in the upper troposphere, and 6-10 days in the lower troposphere. As a result, areas of pastures and arable lands are reduced, and various diseases of adults and children also appear [1]. Coal-mining enterprises and coal preparation plants of the CIS emit up to 2 million tons of dust per year.
All this testifies to the need to develop a strategy to ensure the environmental safety of the development of the subsoil, to increase the efficiency of use and reproduction of

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georesourcepotential. The solution to this problem contributes to the creation of efficient technologies for the extraction and processing of coal [2].

First of all, cadastral works have to be conducted in the places of the industrial development of the minerals, and the sediments samples in the particular. And new progressive technologies must be introduced in the development of the perspective mineral places [3-4].But we have a trable with present industrial field places, so, have to resolve this.

Numerous laboratory, vegetation, field and production experiments conducted in different countries of the world show the high agronomic activity of natural-oxidized coals and especially carbon-humic preparations obtained on the basis of oxidized brown coal, the release of humic acids from them [2, 5].

Humic acids make up a significant and sometimes the predominant part of brown, oxidized brown and black coal. A characteristic feature of humic acids is their physiological activity. It has been established that humic acids contribute to the moisture capacity of soils, their clodiness, buffering, improve the flow of minerals into plants, the concentration of carbon dioxide around the roots. Salts of monovalent metals of humic acids, entering the cell at low concentrations, stimulate the germination and energy of seed germination, the formation and growth of the roots of the underground part of plants, the growth and vital activity of soil organisms, accelerate the time of maturation. The positive role of humates in the activity of agricultural plants when exposed to increased doses of radiation and pesticides, the ability of humic preparations to remove the allelopathic intensity of substrates and soil fertility are revealed.

The use of humic stimulants in agriculture opens up wide possibilities for increasing the yield of grain, vegetable, fruit, berry and melon crops and industrial crops. The action of humic preparations is especially effective in the initial period of plant development and in the period of greatest stress of biochemical processes, as well as when the external growing conditions of plants deviate from the norm during droughts and frosts, excess nitrogen in the soil, etc.

Coal contains humus, which is used as a fertilizer for the production of biologically active drugs that stimulate plant growth and increase animal productivity. Consequently, for the purpose of the integrated use of Kiyaktinsk coal, it is possible at first to produce from it biologically active preparations and other useful products.

The results of tests of an experimental sample of the product obtained according to the developed technology and agricultural methods on various types of low-productive soils of arid zones of Kazakhstan are presented.

The reclamation process is generally divided into mining and biological (agrobiological) reclamation. The goal of mining technical remediation is to combine disturbed lands with the surrounding landscape by planning the surface of the dumps, imparting a stable state to the slopes of the dumps and quarries and performing other types of work. Detecting their state on shifts in open mining is most effectively provided through the observation station, which is a network of long-term and temporary observing benchmarks [6].Mining and technical reclamation includes those activities that can be carried out on dumps before the start of biological remediation: isolation of dumps as sources of pollution of the adjacent undisturbed land, water sources: strengthening the surface of the dumps to prevent water and wind erosion, creating conditions that prevent chemical decomposition of rocks.The durability of mineral rocks depends on the hardness of mineral grains, the bond between the mineral grains and their thickness. Fine-grained rocks are more durable than coarse-grained with the same mineralogical composition [7].

An important practical goal of mining and biological remediation is the gap between the beginning of the alienation of land and their subsequent use in a transformed form. Reclamation of disturbed lands is directed not only at their return to the agricultural or forestry fund, at

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preventing landslides or erosion, but also at creating an environmentally balanced system of economic and aesthetic value. Biological recultivation provides for the formation of a humus layer, which is usually formed within 15-30 years. The process of biological recultivation is considered complete only if the content of humus in the new soil corresponds to the conditions of normal growth of the planted plants. However, this period can be significantly reduced if a layer of mineral organic exploration, such as brown coal, is applied to the disturbed land allotments prepared by mining methods [8].

Literature Review

One of the promising areas of coal processing is to obtain humic acids from them. According to Professor Khristova LA the physiological effect of humates is more effectively manifested when adverse external influences on plants or their habitat (excess or lack of moisture, light, heat, batteries) [9].

According to the data of authors G. D. Chimitdorzhiev and others, the work "Humic acids with low peat and brown coal" gives the composition and properties of humic acid preparations isolated from samples of brown coal with low content, formed in different geological epochs, the possibility of using this information for monitoring properties, as biological plant growth stimulants [10].

The article authors A.V. Butyugin and others "Reclamation of coal preparation dumps" presents the results of experimental work on improving the preparation of preperates from coal for the purpose of recultivation and utilization of mountain wastes. The technology of processing and utilization of mining wastes with humic preparations turned out to be possible with the recultivation of dusting enrichment facilities. The authors Tsvetkova and Katysheva state that integrated use of mineral raw materials of a deposit also contributes tothe self-supporting economic effect due to the replacement of primary raw materials with production wastes and thus saving costs for transporting production wastes to storage sites (dumps, tailing dumps), costs for storage of waste and maintenance of storage sites [12]. Besides, the lean technogenic wastes, received in the course of industrial materials production constitute alternative sources of rare-earth metals. These include: converter dusts, slags, red muds from aluminum production; lean mineral raw materials [13-14].

The author of the article "Agricultural use of plant biostimulants" Pamela Calva and others propose plant biostimulants and microorganisms to enhance plant growth. The global market for biostimulants is projected to increase by 12% per year and reach more than $ 2,200 million by 2018. Despite the growing use of biostimulants in agriculture, many in the scientific community believe that biostimulants lack a peer-reviewed scientific assessment [16].

Materials and Methods

In carrying out the work, an integrated research method was used, including the analysis and synthesis of scientific and technical information, environmental and economic monitoring, physical and chemical analysis, physical and mechanical tests, mathematical statistics methods and regression analysis, pilot testing of humic preparations, enlarged tests of the hydrogenation process. coal on the bench flow installation.

The study, development and testing of agromeliorative methods of pre-sowing treatment of seeds of agricultural crops with the studied preparation were carried out by setting up laboratory, field, stationary and production experiments.

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Laboratory experiments were performed by the method of biotesting according to B.P. Strogonov [17] in glasses with a capacity of 0.5 liters in accordance with the requirements of GOST (GOST 10250-80, GOST 12038-84).
Vegetation and field stationary experiments were established by the method of F.A. Yudin [18].
The energy capacity of the working solutions of the humic preparation was determined using a highly sensitive instrument PRE-2.
The method of biotesting determined the optimal concentration of aqueous solutions of the humic preparation for treating seeds of agricultural crops, the optimal technological parameters of seed preparation for sowing (the duration of treatment with a humic preparation, seed extraction, drying, etc.); optimal conditions for sowing seeds into soil (substrate moisture, temperature, salinity) are determined. Investigations were carried out in the laboratory in the winter time at the phytotron and with nastupuleny spring at the experimental plots in a number of farms of the Almaty region (Kazakhstan).

Results and Discussion

The Institute of Mining named after D. Kunaev developed a technology for obtaining humic preparations from brown coal, which was investigated in the laboratory and tested on an experimental industrial site as a stimulator of the growth of various plants and crops. The aim of the study was to develop a technology for the preparation of the drug and its agricultural techniques for increasing crop yields in extreme soil and climatic conditions based on laboratory and field tests, biophysical monitoring, and also adjustments to the main technological parameters.
As a result of the work performed, the effectiveness of the preparation obtained by the developed technology on low-productive soils with a salinity level of 0.8-2.2% was established. The yield increase of grain crops was 24.2 – 42.1%, rice 76.2 – 78.6%, and soybean – 34.8%. The authors used this experience for the purposes of dust suppression at the objects of the mining complex[20-21].
Significant reduction of dust and gas emissions from the surface of industrial waste (tailings of enrichment plants, dumps of rocks and ash and slag from thermal power plants) is achieved by biotechnical reclamation, which involves planting seeds of cultivated plants using physiologically active preparations - plant growth stimulants. Therefore, the characteristics of coal deposits in Kazakhstan were studied and two coal mines (Kiyakti and Oykaragay) were selected with medium reserves, but with a high content of humic acids.
In the process of mining, transportation and storage of coal, small coal (0-6 mm) is formed from 20 to 80% of the total coal. In the process of layered combustion of such coal, about 40% of the stubble wakes up along with the ash through the grate and 20%, along with the smoke, flies out through the chimneys, polluting the soil and the atmosphere. In addition, due to the large surface of contact with oxygen in the air, coal is prone to spontaneous combustion, and because of the increased ash content and humidity, the heat of combustion is reduced.
Kiyakty coal has the following quality indicators: ash content - 18-21%, heat of combustion - 28 MJ or 6683 kcal/kg, sulfur content - 0.8%, -3.0-7.5% and bitumen – 0.3-1.3% and refers to the brand B3, i.e. to brown coal last degree of metamorphism. The specific efficiency of radionuclides does not exceed 370 Bq/kg.
To prevent dust formation at tailing dumps, the seeds of wild plants of the arid zone were examined, which were germinated in a thermostat in 5-fold repetition on strongly saline soil substrates in accordance with the standards adopted in Kazakhstan. Pre-sowing seed treatment

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with a humic preparation made it possible to identify its high efficiency on substrates of tailings, usually provided by the gray sands of enrichment of manganese ores [22-23].
Thus, the use of the humic preparation on low-productive soils in the foothill desert-steppe and desert zones of Kazakhstan provides a steady increase in yield and quality of the target products of grain, leguminous plants by 20-70% compared with the control. The physiological effect of the drug is most effectively manifested in the adverse effects of extreme factors directly on the plants or their habitat, which confirms its adaptogenic properties. The drug enhances the bioenergy of plant seeds, during ontogenesis changes the quality of interaction of crops with the environment. The physiological activity and adaptogenic properties of the drug depend on the soil-reclamation conditions of the varietal and biological characteristics of the crops.
The climate of the region is continental in nature and belongs to the type of semi-deserts of Central Asia. The absolute maximum temperature is +42°C, and the average temperature of the coldest period is -20°C. By the amount of precipitation, the area belongs to the zone of dry semi-desert. The average annual precipitation is 219 mm, the average wind speed is 5.3 m/s. Often winds blow at speeds of up to 20 m/s. The vegetation cover in this area is quite diverse with the predominance of forb-grass, gray-wormwood, black-wormwood and teresken vegetation [23-24].
Laboratory studies were conducted on the substrate of the tailings of the Zhezdinsky concentrator using seeds of plants growing in this region – black wormwood, wheat grass, parsnip, brunec, etc. The seeds were soaked in aqueous solutions of the humic preparation with a concentration of 0.1-0.9% for 60 minutes, then dried at a temperature of 20-40°C to air-dry state for 2-3 hours and sown in the prepared sand in the substrate of the tailings. During the observation it was found that among the tested plants the most promising for biological recultivation of tailings of enrichment is wormwood and brunec (Table 1).

Table 1. Effect of presowing treatment on seed germination

Plant variety	Seed germination,%	Medium
Wormwood-control	24	3
Wormwood processed	90	4
Wheat-control	16	-
Processed grass	34	14
Brunec-control	26	5
Brunecprocessed	91	6

The pilot test scheme included the following conditions: soil preparation, i.e. cultural survey; sowing rate for wormwood at the rate of 4 kg/ha, for sow grass – 15 kg/ha; depth of seeding of seeds of grains is 2-3 cm, wormwood – without seeding; The method of sowing wormwood and grains is ordinary with a row spacing of 15 cm. Based on the results of laboratory studies, the consumption rate of wormwood seeds, brunec, is set at 4 kg/ha. The results of observations showed that on the control plots sown with seeds of wormwood not treated with the preparation, germination was 18-21%, and on the experimental plots with the use of the drug - 87%.

Conclusion

The tests of the agro-method of pre-sowing treatment of seeds with a humic preparation made it possible to reveal its high efficiency on tailing storage substrates, usually represented by ore dressing sands.

The proposed technology can also be used in the biotechnical reclamation of the dusting surface of overburden dumps and ash and slag waste of thermal stations of mining enterprises.

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