ISSN 2518-1483 (Online),
ISSN 2224-5227 (Print)

2019 • 6

ҚАЗАҚСТАН РЕСПУБЛИКАСЫ
ҰЛТТЫҚ ҒЫЛЫМ АКАДЕМИЯСЫНЫҢ

БАЯНДАМАЛАРЫ

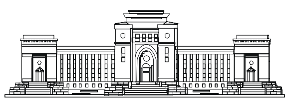
ДОКЛАДЫ

НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК
РЕСПУБЛИКИ КАЗАХСТАН

REPORTS

OF THE NATIONAL ACADEMY OF SCIENCES
OF THE REPUBLIC OF KAZAKHSTAN

PUBLISHED SINCE 1944



ALMATY, NAS RK

ҚАЗАҚСТАН РЕСПУБЛИКАСЫ
ҰЛТТЫҚ ҒЫЛЫМ АКАДЕМИЯСЫНЫҢ
БАЯНДАМАЛАРЫ **2019 • 6**

«Қазақстан Республикасы Ұлттық ғылым академиясының баяндамалары»
ISSN 2518-1483 (Online),
ISSN 2224-5227 (Print)

Меншіктенуші: «Қазақстан Республикасының Ұлттық ғылым академиясы» Республикалық қоғамдық бірлестігі (Алматы қ.)
Қазақстан республикасының Мәдениет пен ақпарат министрлігінің Ақпарат және мұрағат комитетінде 01.06.2006 ж. берілген **№5540-Ж** мерзімдік басылым тіркеуіне қойылу туралы куәлік

Мерзімділігі: жылына 6 рет.
Тиражы: 500 дана.

Редакцияның мекенжайы: 050010, Алматы қ., Шевченко көш., 28, 219 бөл., 220, тел.: 272-13-19, 272-13-18,
http://reports-science.kz/index.php/en/archive

Типографияның мекенжайы: «Аруна» ЖК, Алматы қ., Муратбаева көш., 75.

ДОКЛАДЫ **2019 • 6**
НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК
РЕСПУБЛИКИ КАЗАХСТАН

Доклады Национальной академии наук Республики Казахстан»
ISSN 2518-1483 (Online),
ISSN 2224-5227 (Print)

Собственник: Республиканское общественное объединение «Национальная академия наук Республики Казахстан» (г. Алматы)
Свидетельство о постановке на учет периодического печатного издания в Комитете информации и архивов Министерства культуры и информации Республики Казахстан **№5540-Ж**, выданное 01.06.2006 г.

Периодичность: 6 раз в год.
Тираж: 500 экземпляров

Адрес редакции: 050010, г.Алматы, ул.Шевченко, 28, ком.218-220, тел. 272-13-19, 272-13-18
http://reports-science.kz/index.php/en/archive

Адрес типографии: ИП «Аруна», г.Алматы, ул.Муратбаева, 75

REPORTS **2019 • 6**
OF NATIONAL ACADEMY OF SCIENCES OF THE
REPUBLIC OF KAZAKHSTAN

Reports of the National Academy of Sciences of the Republic of Kazakhstan.
ISSN 2224-5227
ISSN 2518-1483 (Online),
ISSN 2224-5227 (Print)

Owner: RPA "National Academy of Sciences of the Republic of Kazakhstan" (Almaty)
The certificate of registration of a periodic printed publication in the Committee of Information and Archives of the Ministry of Culture and Information of the Republic of Kazakhstan N 5540-Ж, issued 01.06.2006

Periodicity: 6 times a year
Circulation: 500 copies

Editorial address: 28, Shevchenko str., of.219-220, Almaty, 050010, tel. 272-13-19, 272-13-18,
http://reports-science.kz/index.php/en/archive

Address of printing house: ST "Aruna", 75, Muratbayev str, Almaty

REPORTS OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN
ISSN 2224-5227 **https://doi.org/10.32014/2019.2518-1483.177**
Volume 6, Number 328 (2019), 118 – 125

UDC338.242.2

P.S. Dmitriyev, T.N. Lyssakova, M. M. Tayzhanova

North Kazakhstan State University named after M. Kozybaeva
pavel.dmitriyev.72@list.ru, tanya.lyss72@mail.ru, mukaramt@list.ru

POSSIBLE WAYS OF USING ASH AND SLAG WASTE

Abstract. A lot of TPPs operate on coal, as there are large coal reserves in the world. Particularly cheap are multi-ash coals. As a result, in addition to the impact of energy enterprises on the atmosphere, there arises the problem of the need to store the ash and slag formed, as a result, huge ash dumps appear. Ash and slag dumps occupying vast territories alienate them from economic use. The lack of land leads to an increase in the height of ash dumps, which accelerates the ingress of ash into the air basin due to wind erosion. As a result, ash dumps become a source of complex environmental pollution, endanger public health, pose a threat to the animal and plant world. Particularly dangerous are ash dumps located near water bodies, since the risk of the rapid spread of ash and slag with water flows in case of emergency increases sharply.

Keywords: waste, ash and slag, reserves, pool, environment, ways of use.

INTRODUCTION

Currently, there is a growing energy consumption in the world. TPPs prevail in the structure of energy generation, their share is about 60-65%. This figure correlates depending on the region, for example, in Latin America about 75% of energy is generated at hydroelectric power stations, the share of nuclear power plants is higher than the global average in foreign Europe and North America. There are also countries in which up to 98-99% of energy is generated at thermal power plants. An increase in energy production at TPPs entails an ever greater burning of fuel: coal, shale, peat, etc. Therefore, one of the main tasks in the operation of thermal power plants is the development of environmentally friendly and resource-saving technologies, reducing the negative impact of enterprises on the environment [1].

One of the ways to solve the problem is to utilize the formed ash dumps. To clarify the ways of utilizing ash and slag in this paper, we review the experience of other countries. It was found that the most successful countries in this area are the countries of the European Union, where all the ash and slag waste generated is almost completely utilized. Approximately half of them are used to fill spent mines, the remaining part is in the production of cement, building materials, in residential and road construction.

MAINPART

The increased interest in the use of recycled materials in developed countries is determined by economic considerations, as well as stringent environmental laws regarding the processing of production and consumption waste. In China, ash and slag is also used quite widely, mainly in the production of cement, concrete, bricks, aggregates for various purposes, in the construction of roads, as fertilizers. Particular attention should be paid to India. The share of coal prevails in the fuel balance of the country's energy sector (about 70%), the ash content of the used coal reaches 45%. This fact caused the formation of large volumes of ash and slag. In 1994, to solve this problem, the government created the Fly Ash Mission, which demonstrated the economic attractiveness of ash and slag plants. As a result of the Mission's activities, ash and slag utilization increased from 1.2 million tons (3% of the education volume) in 1994 to 80 million tons (50%) in 2008 [2].

One of the most acute problems in the North Kazakhstan region is the presence of ash dumps, which were formed as a result of the main source of heat and electricity in the region - Petropavlovsk CHP-2 (PTEC-2). Ekibastuz coal, the ash content of which reaches 40%, is used as the energy carrier at this TPP. This is a problem in many regions and countries in which coal-fired power plants are the source of energy [3].

Ash and slag of thermal power plants are of great interest for use as fertilizers or replacement of lime flour, to normalize acidic soils. Most of these works claim that ash is highly effective in improving the physicochemical properties of soils. In the studies of the Krasnoyarsk Research Institute of Agriculture, it was found that in the field, brown ash from the Achinsk and Krasnoyarsk thermal power plants was slightly inferior to limestone flour in neutralizing soil acidity. In an experiment with clover, ash increased the pH from 4.7 to 5.3, and lime flour - up to 5.6. Hydrolytic acidity when using these ameliorants decreased from 6.2 to 3.2-3.9 mEq / 100 g of soil. In the experiment with barley, ash and lime increased the pHKCl from 4.9 to 5.6-5.8; in another experiment, from 5.3 to 5.8-6.1 [4.5].

The data on the high efficiency of brown coal ash of the Kansk-Achinsk fuel and energy complex (KATEK) are presented: under the influence of these ashes against the background of N90P90K90, the pH increases from 4.5 to 6.2 in the variant on dark gray soil. A noticeable neutralization of hydrolytic acidity is observed - from 8.9 to 3.5 mEq / 100 g of soil [6].

Rudogo's research indicates the superiority of KATEK brown coal ash in terms of its effect on rapeseed over lime and belite flour.

Some authors, by contrast, did not reveal a significant effect of KATEK brown coal ash during chemical reclamation of dark gray forest soils on the productivity of barley and rape [7,8].

The results of the study by Andreeva S.G., which studied the coal ash of the Kansk-Achinsk basin from an environmental and hygienic point of view, showed that the ash contains highly and moderately hazardous minerals and polycyclic aromatic hydrocarbons involved in natural cycles due to migration into groundwater, soil and air. A study of the toxicological effect showed that coal ash of the main deposits of the Kansk-Achinsk basin does not have local irritating effects on the mucous membranes and skin of laboratory animals. Intra-gastric administration of ash at a dose of 5000 mg / kg caused in some cases in the first day the death of mice. Also, according to the results of pathomorphological studies, the following were revealed in surviving animals: in the kidneys and liver, an increase in size, changes in granulation and color; in the spleen - resizing; bloating and necrosis in the stomach; along the digestive tract, the expansion of blood vessels. When seeding ash from the burned coals of the Irsha-Borodinsky and Berezovsky deposits, pathomorphological changes were more pronounced. Andreeva S.G. it was found that under the acute action of ash, the minimum effective dose that causes statistically significant changes in the blood (increased hemoglobin, erythrocytosis, leukocytosis), as well as pathomorphological changes in the blood vessels, stomach, liver and kidneys, is a dose of 92 mg / kg (Nazarovskoye field) and dose of 50 mg / kg [9, 35c].

The use of Ekibastuz coal as an ameliorant has not been fully studied, it must be borne in mind that with large amounts of ash and slag applied to the soil, ecological balance may be disturbed, an excess of MPC for some trace elements contained in large quantities in ash and slag may appear (according to the results of the analysis commissioned by Ecosphere »Ekibastuz coal, they found a significant content of the following micro and macro elements: Mn (0.07%), Zn (0.0065%), Fe (3.89%), Cu (0.0062%), Co (0 , 0066%) Se (1.49 mg / kg), P (0.07%), K (0.4%), N (0.11%)), since the plants m Gut accumulate certain elements. It is also possible that the introduction of more ash and slag will not lead to an adequate increase in yield. The limits of the introduction of ash and slag volumes into the soil should also be determined experimentally and by biochemical analysis of the obtained crop, including using various crops, which will take more than one growing season.

Thus, an analysis of literary sources has shown that the use in agriculture of ash and slag waste generated during the burning of solid fuels abroad gives positive results. There is a decrease in soil acidity, an increase in the content of exchange potassium, mobile phosphorus and calcium, an increase in the yield of grain and vegetable crops while maintaining the quality of the products obtained. However, before the intended use of ash and slag waste in agriculture, a comprehensive hygienic assessment should be carried out with a comprehensive study of the toxicological, sanitary, chemical, and radiological characteristics of ash and slag: effects on warm-blooded animals, determination of the toxicity index, phytotoxicity, effects on aquatic organisms, determination of irritating and sensitizing activity . According to their physicochemical properties, the ash and slag of CHPP-2 is an erosion-hazardous material, finely dispersed and poorly connected. By granulometric composition, they are mainly represented by dust particles. The purpose of the study was the feasibility study of the reuse of ash and slag waste PTEC-2. During the study, emphasis was placed on the possibility of using ash and slag waste when growing crops. The characteristics of ash and slag and agricultural soils were compared. The chemical composition of ash and slag was studied with a view to not exceeding the MPC of certain substances presented to agricultural soils according to Valuy (for European and Mediterranean countries) standards [10]. The results are shown in the table (table 1).

Table 1 - Analysis of ash and slag PTEC-2 conducted by the company "Ecorem"

Sample Characteristics		Polycyclic aromatic hydrocarbons (mg / kg)	
Dry matter (%)	65	naphthalene	0,043
Metals (mg / kg)		acenaphthylene	0,07
As	11	acenaphthene	0,26
Cd	<0,5	phenanthrene	1,6
Cr	<15	anthracene	0,44*
Cu	51*	fluorantent	0,6
Hg	<0,1	pyrene	0,39
Ni	6,2	benz [a] anthracene	0,11
Pb	14	chrysene	0,16
Zn	45	benzo [b] fluorantent	0,092
Volatile Aromatic Hydrocarbons (mg / kg)		benzo [k] fluorantent	0,046
benzene (mg / kg)	<0,02	benzo [a] pyrene	0,11
toluene	<0,02	dibenzo [a] anthracene	0,062
ethylbenzene	<0,02	benzo [g, e] perylene	0,13
o-xylene	<0,02	indeno [123-cd] pyrene	0,096
m, r-xylene	<0,04	Mineral oils	
xylenes (general)	<0,06	fraction EC> C10-12	<12
		fraction EC> C12-16	370
		fraction EC> C16-21	
		fraction EC> 21-35	26
		Total	410

According to the results of the analyzes, no significant excess for any parameters was found in the soil (recorded excesses of permissible concentrations in the table are marked with an asterisk *).

Similar studies have been conducted previously. Assumptions about the possibility of using ash and slag in crop production as fertilizer were made during the Soviet era, namely in the works of Lev Vladimirovich Tauson, a geologist and geochemist, academician of the USSR Academy of Sciences. He made the assumption that, in the previously existing low-temperature fuel combustion processes, coal ashes could not be introduced into the soil due to the presence of large amounts of such harmful impurities as arsenic, mercury, cadmium, zinc, lead, cobalt. In modern high-temperature combustion processes, the listed hazards in the ash do not exceed the MPC, which was already confirmed in the results of the analysis of the PTETs-2 ash in the Test Chemical-Analytical Center of GU “RNMTSAS" Ministry of Agriculture of the Republic of Kazakhstan (Shortandy), and was repeatedly confirmed in the studies of Ecorem company ".

In contrast to the Belgian company’s research, the Shortand study compared the ash composition with soil samples from the agricultural centers of the North Kazakhstan oblast (Table 2).

Table 2 - Results of analysis of ash from Ekibastuz coal of the Test Chemical and Analytical Center of the State Institution "RNMTSAS" Ministry of Agriculture of the Republic of Kazakhstan"

Name of the farm	Humus %	N-NO3 мг/кг	P2O2 mg/kg	K2O, мг/кг	pH	Cu, mg/kg	Zn, mg/kg	Pb, mg/kg	Cd, mg/kg	Mn, mg/kg	Co, mg/kg	Fe, mg/kg
Chernozem soils	4.3	6.5	17	429	7.2	8.6	7.8	14.9	0.3	243	9.5	177
Rost-Expert LLP	3.3	5.8	50	362	8.1	5.2	6.2	9.7	0.3	238	8.4	84
Chernozem soils	4.4	9.2	55	392	7.9	4.9	9	18.6	0.3	231	8.3	53
GSU Novokamensky	5.9	16.3	264	820	7.7	16.2	136	40	0.5	236	7.4	88
Chernozem soils	3.8	12.3	88	322	8.4	10.8	28.8	21	0.3	241	7.1	24
LLP S. lebur-Agro	5.2	17.2	114	822	8.1	6.0	13.2	10	0.4	242	9.1	31
Chernozem soils	6.6	1.9	30	151	8.4	7.2	3.8	5.5	0.2	142	3.2	350

It follows from the table that the indices of the content of chemical compounds of elements in the ash are close to the indices of soils of the named farms, generally fitting into the interval of their dispersion, excluding iron. Significantly less potassium oxide in the ash. The most surprising fact was the detection of humus in the ash and slag of the PTETs-2, moreover, in an amount significantly exceeding its content in the chernozems of the indicated farms. In practice, the humus content in ash is 1.5 times higher than its average level in the soil cover of the North Kazakhstan Oblast. It can be assumed that humus appeared in the ash during the transformations accompanying its presence in the ash dump for decades. In the process of studying this extremely interesting fact, ash samples were taken at different sites of ash dumps and sent to the specialized chemical laboratory "Centrgeoanalit" (Karaganda). Despite the fact that the dependence of the humus content on the age of the ash is not visible, in all samples the humus content is high - 5.8-7.3%.

It should be noted that the old reclaimed dumps of PTEC-2 on the surface are covered with perennial thickets of sea buckthorn, which also grows on recently reclaimed dumps, which indicates the fertility of ash and slag. Sea buckthorn is growing at an accelerated pace, growing instantly on recently reclaimed dumps. There is abundant flowering and the densest thickets in places, even where the restoration layer is minimal [11].

Table 3 - the results of the analysis of ash of Ekibastuz coal (Test Center LLP "Centrgeolanalit")

№ lab	Shelf life, лет	Pb, %	S, %	Mo, %	Cd, %	Na, %	Ca, %	Mn, %	Zn, %	Fe, %	Cu, %	Co, %	Se, мг/кг	Mg, %
1	ash up to 1 g	0.0019	0.078	0.00065	<0,0005	0.53	0.94	0.070	0.0065	3.89	0.0062	0.0066	1.49	0.53
2	ash 5-10 l	0.0021	0.072	≤0,0005	<0,0005	0.37	0.94	0.075	0.0074	3.86	0.0064	0.0045	2.60	0.48
3	ash 10-15 l	0.0014	0.078	≤0,0005	<0,0005	0.32	0.94	0.084	0.0083	4.35	0.0056	0.0066	2.00	0.48
4	ash 15-20 l	0.0022	0.034	≤0,0005	<0,0005	0.32	0.78	0.066	0.0081	3.41	0.0055	0.0044	2.97	<0,3

№ lab.	Shelf life years	P (gross) %	TO (gross) %	N, (gross), %	humus %
1	ash up to 1 g	0.170	0.40	0.110	5.88
2	ash 5-10 l	0.190	0.42	0.080	6.48
3	ash 10-15 l	0.200	0.44	0.110	7.26
4	ash 15-20 l	0.196	0.53	<0,010	5.69

A comparison of the quantitative data of the above definitions shows that there is a spread in the common components: copper, zinc, manganese, iron. Significant scatter can be caused by the quality of ash samples taken from its different generations, different methods of analysis (or even the error of the analyst) (table 3).

It is also possible that leaching or other transformations of elements and their compounds occur during prolonged storage of ash. From this point of view, the composition of the ash has not yet been studied. The cobalt content at the MPC equal to 5 mg / kg in ash is lower, and in the soils of the analyzed areas it is higher (9.5-7.1) of this value. In the ash, the lead content is also lower than the MPC, while on the lands of PE Burashnikov a certain excess of MPC (up to 40 mg / kg).

Based on the results of two analyzes of the ash and slag of the PTETs-2, a table was compiled that shows the indicators of metal content, MPC for these elements in the Republic of Kazakhstan and according to the Valuy standard (table 4).

An excess in this indicator is observed only in the Cu content (according to the Valuy standard). It should be noted that the results of analyzes on Cu, Zn, Pb are contradictory, the content of some elements is determined only in one of the studies, if defined in two studies, there could also be contradictions. Such contradictory data confirm that ash and slag have an uneven composition, and significant fluctuations in the content of some elements are often observed. The heterogeneity of the composition of ash and slag waste is also noted by studies of previous scientists who studied the ash and slag waste of other coal besseyn.

Table 4 - Results of analysis of Ekibastuz coal ash and soil samples for metal content (mg / kg)

Chemical element (mg / kg)	As	Cu	Cd	Cr	Zn	Pb	Co	Fe	Mn	Hg	Ni
Ash and Slag (Ecorem)	11	51	< 0,5	< 15	45	1	-	-	-	<1	6,2
Valui Standard	30	20	1	85	155	200	-	-	-	1	65
Ash and Slag (Shortandy)	-	7,2	0,2	-	3,8	5,5	3,2	350	142	-	-
MPC *	-	-	5	-	23	30	5,0	-	150	-	-

Note *: MPC approved by the chief state sanitary doctor of the RK on November 29, 1997; MPC for iron in Kazakhstan has not been established.

As noted above, in addition to the analysis of Ekibastuz coal ash and soil samples for the content of heavy metals in the “Test Chemical Analytical Center of the State Institution“ RNMTSAS ”of the Ministry of Agriculture of the Republic of Kazakhstan”, an analysis was carried out for the content of biogens and, as already noted above, the presence of humus in the amount close to , and often exceeding the humus content in the analyzed samples of soil of the North Kazakhstan region (Figure 1). The presence of humus, the absence of an excess of the content of heavy metals by MPC, the presence of macro- and microelements necessary for plant growth and life make it possible to consider the PTETs-2 ash as an alternative to the use of organo-mineral fertilizers [12].

It was decided to take ash samples of different ages to determine the humus content. It was expected that the longer the ash was stored, the higher the humus content. Analysis of ash samples of different ages was carried out in the Testing Center of Centrgeolanalit LLP (Karaganda). Analysis of ash samples of different ages was carried out in the Testing Center of Centrgeolanalit LLP (Karaganda). These data are shown in table 3.

The determinations were carried out by titrimetric, photometric, atomic absorption, fluorimetric. The expected regularity associated with the dependence of the humus level on the age of the ash has not yet been confirmed: it is possible that differences in the primary composition of coal make their adjustments. However, it was confirmed that in ash of different ages, the humus content is quite high (6-7%) (Figure 4), and ash can thus support soil fertility [13].

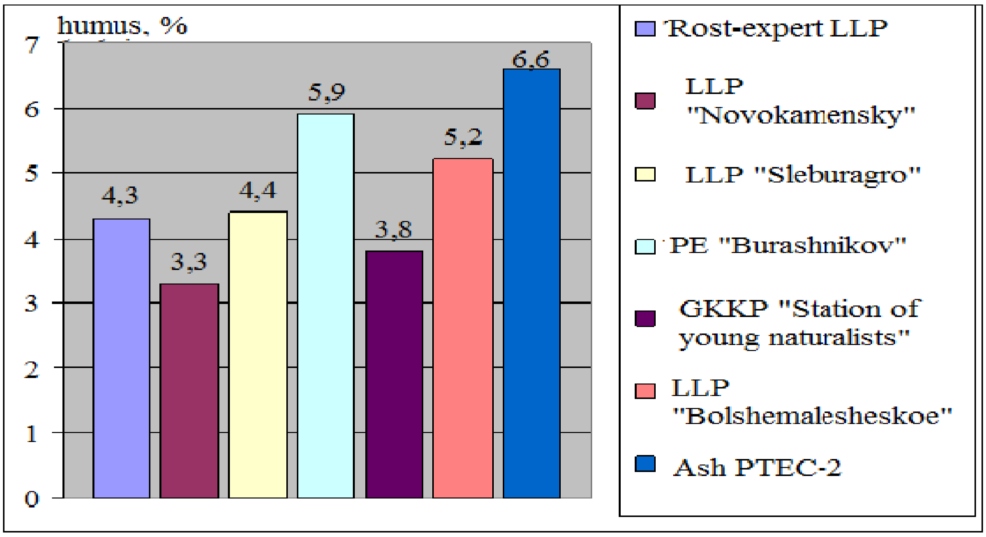


Figure 1 - Humus content in the ash of PTEC-2 and analyzed samples of soils of farms

Despite the fact that heavy metals are toxic when MPC is exceeded, many of them are necessary elements for all higher plants and animals. The composition of any plant tissue includes organic and mineral compounds. They form dry matter in plants. In addition to it, water enters the plant tissue. The ratio of these two components varies depending on the age, physiological state of the organ and plant, as well as on the growing conditions. The bulk of dry matter (about 90%) is made up of three elements assimilated during photosynthesis: carbon (45%), oxygen (40-42%) and hydrogen (6-7%). These elements are absorbed by plants from air and water. The remaining 5-8% of plant substances account for nitrogen, phosphorus, potassium, calcium, magnesium and iron, which come from the soil[14].

Elements of mineral nutrition, which are part of plants in significant quantities, ranging from a few percent to hundredths of it, are called macroelements. These include nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese. If there are chemical elements in plants from thousandths to hundredths of a percent, then they are called trace elements - these are boron, zinc, copper, cobalt, molybdenum, nickel, vanadium, iodine. The dense thickets of sea buckthorn on the surface of ash dumps testify to the rich trace element composition (Figure 2).

Figure 2 - Thick thickets of sea buckthorn on the surface of the ash dump PTEC-2

The results of chemical and agrochemical analyzes, as well as experiments, showed that the ash and slag waste of Ekibastuz coal generated during the operation of the PTEC-2 can be used in the national economy:

- agrochemical analyzes of the material composition of the Ekibastuz coal ash showed that ash is a real storehouse of valuable elements for plants. The content of heavy metals in the ash does not exceed the MPC, and the presence of the necessary nutrients allows us to recommend the ash as a valuable fertilizer for growing crops.

- Utilization of ash and slag waste through the use in the national economy is beneficial not only economic, but also environmental. Since, at the same time, the negative impact of ash dumps on the environment will be reduced.

CONCLUSION

Thus, if subsequent determinations of the level of humus content are confirmed, then ash can be useful for replenishing humus in the soil cover, and therefore can be used to increase crop yields. It can be of particular importance on depleted, humus-poor soils depleted in trace elements.

П.С. Дмитриев, Т.Н. Лысакова, М.М. Тайжанова

Атындағы Солтүстік Қазақстан мемлекеттік университеті Қозыбаева

ШЛАК ҚАЛДЫҚТАРЫН ҚОЛДАНУДЫҢ МҮМКІН ЖОЛДАРЫ

Аннотация. Әлемде көмірдің үлкен қоры бар болғандықтан, көптеген ЖЭС көмірмен жұмыс істейді. Әсіресе арзан - көп күлді көмір. Нәтижесінде, энергетикалық кәсіпорындардың атмосфераға әсерінен басқа, қалыптасқан күл мен қожды сақтау қажеттілігі туралы мәселе туындайды, нәтижесінде үлкен күл үйінділері пайда болады. Кең аумақты алып жатқан күл мен қож үйінділері оларды шаруашылық мақсатта пайдаланудан айырады. Жердің жетіспеуі күл үйінділерінің биіктігінің өсуіне әкеледі, бұл жел эрозиясына байланысты күлдің ауа бассейніне енуін тездетеді. Нәтижесінде күл үйінділері қоршаған ортаны кешенді ластау көзіне айналады, халықтың денсаулығына қауіп төндіреді, жануарлар мен өсімдіктер әлеміне қауіп төндіреді. Әсіресе су объектілерінің жанында орналасқан күл үйінділері қауіпті, өйткені апаттық жағдайда су ағындары бар күл мен шлактың тез таралу қаупі күрт артады.

Түйін сөздер: қалдықтар, күл мен шлактар, қорлар, бассейн, қоршаған орта, пайдалану тәсілдері.

П.С. Дмитриев, Т.Н. Лысакова, М.М. Тайжанова

ВОЗМОЖНЫЕ ПУТИ ИСПОЛЬЗОВАНИЯ ЗОЛОШЛАКОВЫХ ОТХОДОВ

Аннотация. Много ТЭС работает на угле, так как в мире имеются большие запасы угля. Особо дешевыми являются многозольные угли. В итоге помимо воздействия предприятий энергетики на атмосферу появляется проблема необходимости складирования образовавшихся золошлаков, вследствие появляются огромные золоотвалы. Золошлаковые отвалы занимая огромные территории, отчуждают их от хозяйственного использования. Нехватка земель ведет к увеличению высоты золоотвалов, что ускоряет попадание золы в воздушный бассейн вследствие ветровой эрозии. В итоге золоотвалы становятся источником комплексного загрязнения окружающей среды, подвергают опасности здоровье населения, представляют угрозу животному и растительному миру. Особую опасность представляют золоотвалы находящиеся вблизи водоемов, так как резко повышается риск быстрого распространения золошлаков с потоками воды в случае чрезвычайных ситуаций.

Ключевые слова: отходы, золошлак, запасы, бассейн, окружающая среда, пути использования.

Information about the authors:
Pavel Dmitriyev - North Kazakhstan State University named after M. Kozybaeva, pavel.dmitriyev.72@list.ru, https://orcid.org/0000-0003-2549-9218
Tatyana Lyssakova - North Kazakhstan State University named after M. Kozybaeva, tanya.lyss72@mail.ru, https://orcid.org/0000-0002-1925-6570
Tayzhanova Mukaram Murzatovna - North Kazakhstan State University named after M. Kozybaeva, mukaramt@list.ru, https://orcid.org/0000-0003-4175-5541

REFERENCES

[1] Borisenko L.F., Delitsyn L.M., Vlasov A.S. Prospects for the use of ash from coal-fired thermal power plants. Geoinformmark CJSC, Moscow: 2001-68s.
[2] Dmitriev P.S., Aytzhanov E.R. Ash and slag PTETs-2 as a mineral additive in the soil during the cultivation of watercress (lepidium sativum), varieties "Skorospely" in the laboratory // Resp. scientific and methodological Journal "REPORTER of the Republican nominal school for geography." Almaty, 2014. No. 1 (9). C 6-8.
[3] Rudoy N.G., Benina R.D. The effect of Kansk-Achinsk coal ash on the properties of acidic soils // Efficiency of the use of reclaimed land in the conditions of Vost. Siberia. Krasnoyarsk, 1976. Issue 2. S. 89-97.
[4] Rudoy N.G. The influence of Kansk-Achinsk coal ash on rape productivity // Sib. herald s.kh. Sciences. 1983. No. 4. S. 60-65.
[5] Trubnikov Yu.N. Leonova T.P. The use of KATEK ash on gray forest soils of the Achinsk-Bogotol forest-steppe. Abstracts conference “The integrated use of ash from coal of the USSR in the national economy.” Irkutsk, 1989. S. 48-49.
[6] Grebenshchikova EA, Chernakov Yu.S., Pykhteeva MA Changing the properties of brown forest soil when making ash and slag as an ameliorant // Agrochemistry. 2007. No.1. S. 13-16.
[7] Kitaev I.V. The possibility of using brown coal ashes of the Far East as trace mineral fertilizers. Thes. doc. 1 year conference Geochemistry of technogenesis. Irkutsk, 1985. T.1. S. 200-203.
[8] Andreeva S.G. Hygienic assessment of ash and slag waste generated during the burning of coal of the Kansk-Achinsk basin // Abstract of dissertation for the degree of candidate of medical sciences. - Kemerovo, 2006 - 21 p.
[9] Feasibility study related to the implementation of "Clean Coal Technologies" in Kazakhstan / Fly ash reuse and analyses results. Ecorem plc. November 2013. 16 s.
[10] Nikitina I.A. The use of ash from Ekibastuz coal as a cleaning. Petropavlovsk: NKSU. 2013. 58 p.
[11] Microelements / Per. Yu. V. Bukin; Ed. M.V. Katalymov. M.: Publishing House of Foreign Countries. literature, 1962-512s.
[12] Alekseev Yu.V. Heavy metals in soils and plants. M.: Agropromizdat, 1987. 142 s.
[13] Official site of the State Institution "Department of Agriculture of the North Kazakhstan Region" [Electronic resource]: database. - Access mode: http://www.dsh.sko.kz.
[14] Karatabanov R.A., Dzhanalieva K.M. Assessment of natural-resource factor of geopolitical security of the Republic of Kazakhstan. REPORTS OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN. Volume 4, Number 326 (2019), 89 – 93. ISSN 2224-5227 https://doi.org/10.32014/2019.2518-1483.121

Publication Ethics and Publication Malpractice
in the journals of the National Academy of Sciences of the Republic of Kazakhstan

For information on Ethics in publishing and Ethical guidelines for journal publication see http://www.elsevier.com/publishingethics and http://www.elsevier.com/journal-authors/ethics.

Submission of an article to the National Academy of Sciences of the Republic of Kazakhstan implies that the work described has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis or as an electronic preprint, see http://www.elsevier.com/postingpolicy), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder. In particular, translations into English of papers already published in another language are not accepted.

No other forms of scientific misconduct are allowed, such as plagiarism, falsification, fraudulent data, incorrect interpretation of other works, incorrect citations, etc. The National Academy of Sciences of the Republic of Kazakhstan follows the Code of Conduct of the Committee on Publication Ethics (COPE), and follows the COPE Flowcharts for Resolving Cases of Suspected Misconduct (http://publicationethics.org/files/u2/New_Code.pdf). To verify originality, your article may be checked by the originality detection service Cross Check http://www.elsevier.com/editors/plagdetect.

The authors are obliged to participate in peer review process and be ready to provide corrections, clarifications, retractions and apologies when needed. All authors of a paper should have significantly contributed to the research.

The reviewers should provide objective judgments and should point out relevant published works which are not yet cited. Reviewed articles should be treated confidentially. The reviewers will be chosen in such a way that there is no conflict of interests with respect to the research, the authors and/or the research funders.

The editors have complete responsibility and authority to reject or accept a paper, and they will only accept a paper when reasonably certain. They will preserve anonymity of reviewers and promote publication of corrections, clarifications, retractions and apologies when needed. The acceptance of a paper automatically implies the copyright transfer to the National Academy of sciences of the Republic of Kazakhstan.

The Editorial Board of the National Academy of sciences of the Republic of Kazakhstan will monitor and safeguard publishing ethics.

Правила оформления статьи для публикации в журнале смотреть на сайте:

www:nauka-nanrk.kz

ISSN 2518-1483 (Online), ISSN 2224-5227 (Print)

http://reports-science.kz/index.php/en/archive

Редакторы *М. С. Ахметова, Т.А. Апендиев, Д.С. Аленов*
Верстка на компьютере *А.М. Кульгинбаевой*

Подписано в печать 12.12.2019.
Формат 60х881/8. Бумага офсетная. Печать – ризограф.
15,3 п.л. Тираж 500. Заказ 6.

Национальная академия наук РК
050010, Алматы, ул. Шевченко, 28, т. 272-13-18, 272-13-19