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Properties of a chemical agents study of the Bayaldyr tailing dams lead – zinc oresspoil dump

Abstract: With the development of mining and metallurgical industries on a soil surface there is a constant accumulation of technogenic waste from processing of minerals. These include tailing, sludges, slags and other substandard varieties of mineral resources. These elements of human origin can reach high local concentrations, in some cases up to toxic or scatter over large aqueous spaces or air currents. Thus the aim of the current research was to study the properties of a chemical agents of the Bayaldyr tailing dams lead – zinc oresspoil dump.

Key words: chemical agents, dump, technogenic waste, study.

Introduction

With the development of mining and metallurgical industries on a soil surface there is a constant accumulation of technogenic waste from processing of minerals. These include tailing, sludges, slags and other substandard varieties of mineral resources. The bulk of this waste comes from waste dumps, landfills which occupy vast areas (in the volume of world dumps of more than 2000 km³) and a negative impact on the environment. These elements are of human origin can achieve high local concentrations, in some cases up to toxic or scattered over large aqueous spaces or air currents. Such deposit may include lead-zinc mine combine «Achpolimetall» with its Bayaldyr tailing dams waste tailings. Combine «Achpolimetall» was founded in 1955 on the basis of Mirgalimsay village for Achisay polymetallic deposit development [1-3].

After a while the village was transformed into a city of regional subordination Kentau in the Southern Kazakhstan region. Located at the foot of the Karatau, 30 km north-east of the city of Turkestan (Figure 1).

Materials and methods

Objects. To study the chemical composition of the solid sample tailing dump Bayaldyr tailings were taken away from the pumping station (point No. 1), north-eastern direction (point No. 2), the south-east side (point No. 3) and north-west side (point No. 4) (Figure 2).

Sampling methods. Samples of tailings were taken in May 2014. When sampling sought to ensure that the chemical composition of bulk materials Bayaldyr tailings correctly reflects the composition of the analyzed object.

Sampling granular materials used shovels with rims that have gone in in the portion of the material is taken from one place. We tried not to select a sample in small portions, repeating several times a selection of one and the same place. The width of the shovel was four times greater than the width of large pieces. Too big shovel did not apply, since they are hard to gain equal portions from different places. The amount of portion was depended on the pieces size the larger pieces of the material, the greater the portion of the bleed. For the value of the portion of the particulate material ranged from 0.2 to 0.5 kg. Samples were collected in special boxes a la carte. These boxes are filled a spade portion up to a point.

Method of analysis. Chemical analysis of the composition and the number of elements were performed on a gas chromatograph «model 3700» with detectors, flame ionization, thermal conductivity, electron capture, intended for mass analysis of organic and inorganic gaseous and liquid compounds.

Results and their discussion

Climatic conditions over the whole territory of the South Kazakhstan region are sharply continental [4].

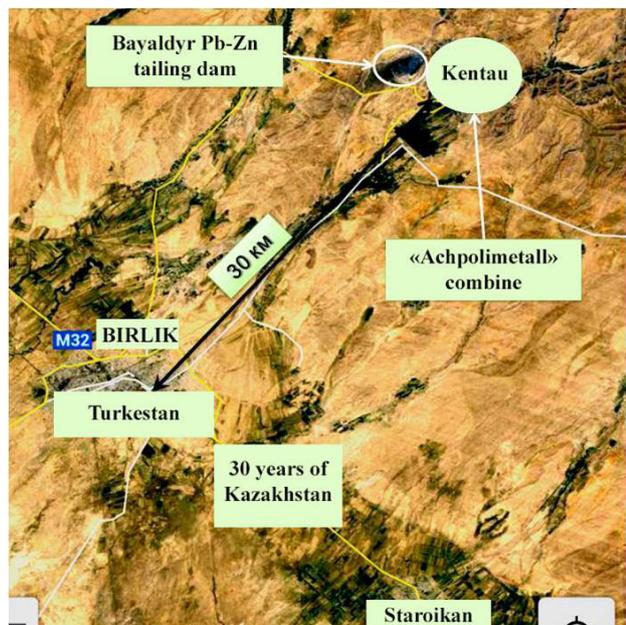
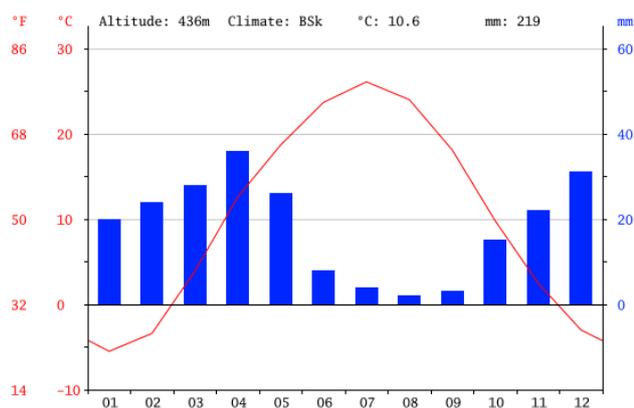


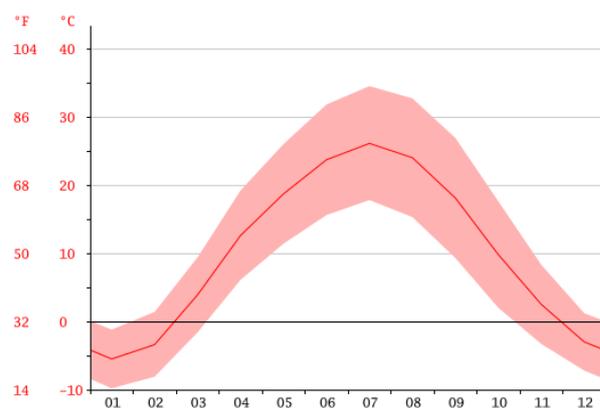
Figure 1 – Geographical location of «Achpolimetal» combine (Kentau).



Figure 2 – The sampling points for chemical analysis (May, 2014)



The driest month is August with 2 mm of precipitation. Most of the precipitation falls in April, an average of 36 mm.



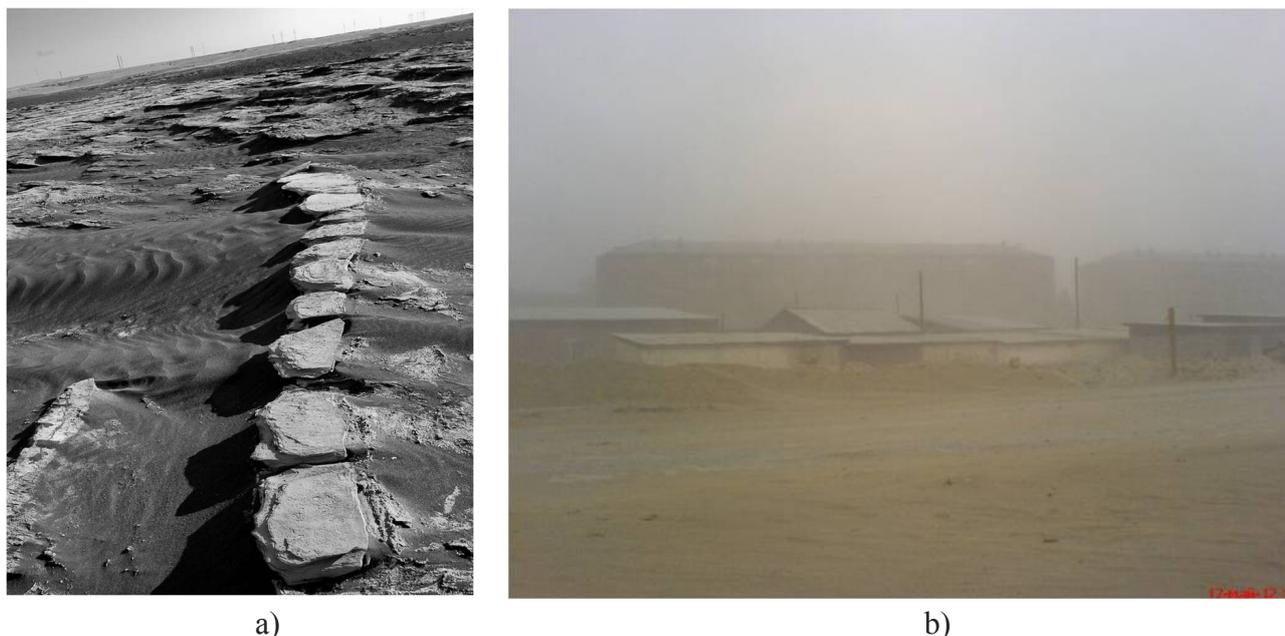
The warmest month of the year – July, with an average temperature of 26.1°C. The average temperature in January – -5.5°C. This is the lowest average temperature for the year.

Figure 3 – Climatic conditions of the South Kazakhstan region

Winters are warm and mild with air temperature of -8°C. Spring is characterized by bright, vivid colors. Summer is usually hot and dry. In July the temperature surpasses the mark of 40 °C. Autumn is long and mild (Figure 3).

Refinement tailings of lead-zinc ores in Bayaldyr tailing dump of Kentau concentrating mill are about 170 million tons, which contain copper, zinc, cadmium, manganese, lead, nickel, cobalt, iron, strontium, and other nonferrous and precious metals.

Lead – zinc ores are extracted from the mines «Mirgalimsay» and «Deep» and enriched in the concentrating mill. After the flotation tailings were stored in Bayaldyr tailing dump. The surface of the tailings are not reinforced by any of the currently available methods of stabilization or reclamation. Consequently, it is exposed to wind and water erosion and the effects of physical – chemical and biological factors and leads to air pollution by dust and solid particles with high concentrations of heavy metals (Figure 4).



a)

b)

Figure 4 – Surface appearance of Bayaldyr tailing dump (a) and clouds of toxic dust of Bayaldyr tailing dump (b). (May, 2014)

Waste processing contains inclusions to 20 reagents, including 12 particularly toxic substances – heavy metals, copper, lead, zinc. Earlier Bayaldyr tailing dump contained in the so-called wet concentration – the entire storage area (333 hectares) is constantly filled with water. Thanks to it toxins didn't disappear from the tailing dump, constantly being on a place in the form of the solid moistened slags. With the liquidation of the mine tailing dump has stopped being moisten. Now, clouds of toxic dust rises on Bayaldyr tailing dump with the slightest breeze, which cover up with sand not only Kentau and Turkestan, but a dozen villages.

We have studied the geo-ecological status and chemical composition of the refinement tailings of Bayaldyr tailing dump of «Deep» and «Myrgalym-say» lead and zinc ore deposit.

In the study of mineral and chemical composition of tailings was considered necessary to determine their quality, their content of useful components and harmful impurities [5, 6].

The chemical composition of samples taken from the surface dam of Bayaldyr tailing is dump shown on Figure 5. Chemical analysis of tailings that the dominant elements in the samples selected in the area of the pumping station are copper (108 mg/kg), cobalt (92.5 mg/kg) and nickel (65.6 mg/kg), while zinc, manganese, cadmium, lead, iron and strontium are present in small quantities.

However, the amount of copper, nickel and cobalt are contained in a large amount. This is probably due to the views of flotation reagents used. Thus, as a depressant and sulphidizer floatable ore added in a large amount of these elements sulfide reagents.

At one time, in Kentau concentrator lead-zinc ore floated froth flotation, whereby through the particle mixture with water passed small air bubbles, particles of certain minerals are collected at the interface «air-liquid» adhere to the air bubbles and was carried with them surface composed of a three-phase foam (with the addition of a foaming agent which regulates foam stability). The foam was further concentrated. As the liquid is water.

Lead-zinc ore of Kentau combine enriched by the scheme of direct selective flotation. Feature reagent regime is applied using a mixture of ethyl xanthogenate in a ratio of 2:1, as well as combinations of sodium sulfide and ammonium sulphate minerals to sulphidization oxidized. In order to reduce lead content in the pyrite concentrate to the lead flotation pulp is mixed with lime at pH 9.0 ... 9.5, and then reducing the pH value to 8.3 ... 8.8. A mixture of sodium sulfide and zinc sulfate is using for depression sphalerite. Lead concentrate produced at the enrichment of sulfide ores contain 74 ... 75% of the lead when removing the 93 ... 95% of lead: zinc concentrates containing 52 ... 53% zinc extraction at 92 ... 94%.

Thus we consider that low levels of lead and zinc tailings in a natural, because it is connected by a major amount of lead and zinc goes to concentrate on the process of ore flotation.

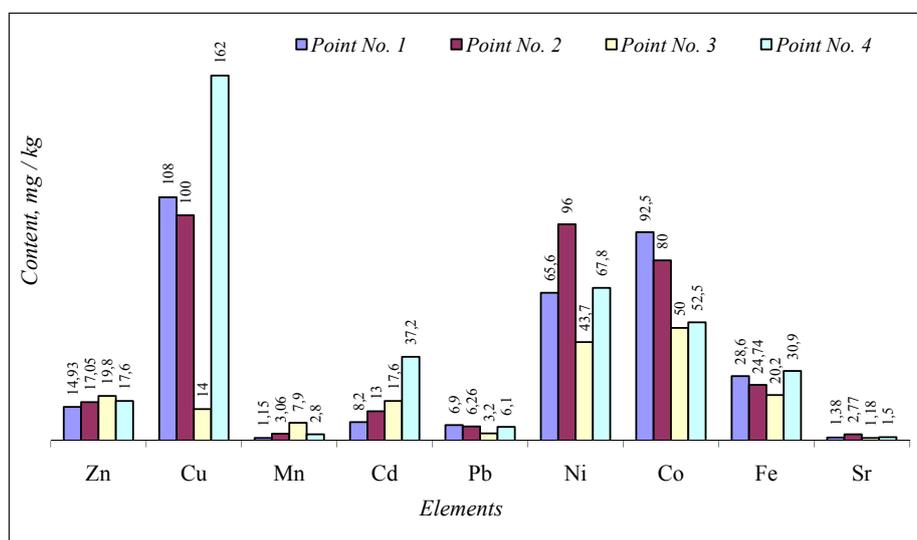
Tailings are the terock particles, resulting from the mechanical processing of ores (crushing, grinding, classification, flotation). Solid phase tailings slurry is a mixture of mine ralparticles of different sizes – from 3 mm to submicron.

The material composition of the tailings particles Bayaldyr and their densitydependson the mineral composition of the rocks. Size distribution of the particles with a size of 0.01 mm have a shape similar to a sphere. Since the composition of tailings in large quantities mostly contain flotation re-

agents. In this regard it necessary to elaborate on their characteristics.

Potassium butyl xanthate hate intended for use as a collector reagent in the beneficiation of ores by flotation and in the hydrometallurgical industry [7].

It is a powder from light gray to yellowish-green color and odor, is highly soluble in water. In the presence of moisture decomposes, especially at temperatures above 30°C. Harmful by inhalation (weakness, headache, dizziness, shortness of breath, palpitations, chest pain, nausea, vomiting, cyanosis of the skin and mucous membranes), in contact with skin (redness, swelling) and eyes (pain in the eyes). Works through the uninjured skin. In case of hit and mucous renders an irritant action on skin.



Note: Point No. 1 – injection pump station pipe, point No. 2 – the southeastern part, point No. 3 – north-eastern part, point No. 4 – north-western part

Figure 5 – The chemical composition of samples taken from the surface dam of Bayaldyr tailing dump

Table 1 – Physical and chemical properties of butyl xanthate

Indicator name	Standard for STO 00204168-003-2009		
	High grade	First grade	Second grade
Appearance	Powder from light gray to yellow-green		
Mass fraction of main substance,%, not less	91.5	90.0	87.0
Mass fraction of free potassium hydroxide (KOH),%, not more	0.1	0.2	0.2
Mass fraction of volatile substances,%, no more	2	3	5

Note: Indicator 3 is determined only at the request of the consumer

Prolonged contact celebrated drug reaction and appearance of eczema, dermatitis. If you get inside the predominantly affects the central nervous system that is associated with the release of carbon disulfide and its toxic effects.

In the course of the flotation of «Mirgalimsay» and «Deep» lead-zinc oxide ores deposits sodium sulfide, as component flotation, used as sulphidizer. Sodium sulfide inhalation causes consequences in the form of cough, chest tightness, runny nose, watery eyes and dangerous to other mucous membranes, causes damage to the eyelids, conjunctiva, and iris of the eye. The sharp effect on unprotected skin high concentration of sodium sulfide can cause a chemical burn.

Also ammonium sulfate has used for the sulphidation of oxidized minerals as flotation reagents. Human has severe irritation and inflammation of the airways in case of Inhalation of ammonium sulphate. In that case, if the person used the ammonium sulfate into the causes irritation of the gastrointestinal tract, accompanied by nausea, vomiting and diarrhea. When ammonium sulphate contact with skin or eyes occurs irritation, redness, itching and pain.

As mentioned above, in the process of flotation concentrator KOOF-1c was used as a depressant of sphalerite zinc sulfate, which in high concentrations is toxic effect on the human body.

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