Justification Complex Purification Technology Open-pit Mines Wastewater

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In 2012 the total volume of coal mining in the Kuzbass was about 200 million tons. In 2013, it was produced 203 million tons of coal. In addition, there is no reason to believe that in the near future volume of coal will declines. Accordingly, the volume of wastewater discharged by enterprises will increase. So, from 2006 to 2009, there was an increase of polluted water discharge coal mines from 217 to 245 million m³. Therefore, the problem of water pollution mines governmental waters and career is very important.

Despite its advantages, open coal mining does more than the damage to the environment than underground. The most significant impact has opened a way to develop on the hydrosphere and land resources, where the share of the total environmental damage to all elements of the biosphere is 66.4% versus 33.6% for underground mining.

The main contaminants quarry waters Kuzbass mines are suspended solids, oil, iron, etc. For an example, Table. 1 shows the composition of the water discharged from the sectors of the open-pit mine “Chernigovets”.

tons, including 116 million tons (60.3%) produced on open way, Fig.1.

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Fig. 1: Dynamics of mining of coal in Kuzbass

Table 1: Consist of water discharged from the sectors of the open-pit mine “Chernigovets”

Indexes	Sectors			
	1	6	7	8
Color	grey	grey	grey	grey
Transparency, cm	2,0	6,5	5,3	4,5
Suspended solids, mg/l	52	200	31	11
Ammonia Nitrogen, mg/l	1,0	1,0	2,0	1,0
Chlorides, mg/l	8,0	14,0	5,0	7,0
Sulfates, mg/l	35,9	40,5	29,1	34,3
Iron, mg/l	0,11	0,88	0,8	0,8
Stiffness, mEq/l	6,5	6,5	5,7	3,3
Calcium, mg/l	2,8	2,8	4,0	3,0
Magnesium, mg/l	3,7	3,7	1,7	0,3
Petroleum products, mg/l	0	0,08	0	0,04
pH	7,0	7,0	7,0	7,0

To date, relatively deeply explored career cleaning wastewater suspended solids, which are the main contaminants. Back in the late 1970s in conjunction with Kuzbass Politechnical Institute workers began the development of production technology open-pit mining wastewater purification by filtration through artificial filter arrays of mining waste – overburden (AFA). This technique ^[1] in the future is widespread not only in the Kuzbass region, but also in sections of the Far East, Sakhalin, etc. Later this method was improved, in particular, has been proposed and is protected by patents of a Russian Federation design artificial filter array with waterproof jumpers ^[2], provides increasing degree of purification of water from suspended solids with no additional cost. Also in ^[3] the mass-transfer of dispersed particles in wastewater filtration described.

Due to the deteriorating environmental situation in industrialized regions, as well as increased penalties for discharge of insufficiently treated effluent very urgent problem of development of technology integrated wastewater purification career at which the cleaning is not only from the main contaminant - suspended solids, but also from other impurities. Brief

description of existing technology can be summarized as follows.

Mining waste - overburden - no pre-sorting and preparation of artificial sleeps off filter array with the calculated parameters. In fact, artificial filter array is a bedrock dump, backfilled by peripheral technology with vehicles and a bulldozer. The difference is that being part of AFA path length calculation necessary filtering on the basis of the concentration of suspended matter in the polluted water; tests the ability of the transmission of all incoming water through the array; defined lifetime of the array and other parameters.

Currently, most design institutes and project organizations are calculated^[4] AFA parameters according to the "Guidelines on calculation of AFA", approved by Ministry of Coal Industry of the USSR. As an example, on Fig. 2 location of AFA, currently existing on open-pit mine “Prokopievsky”. The main advantages of this method of cleaning quarry waters are low capital and operating costs. Cost of construction of such an array is comparable to the cost of dumping.

In our paper, we propose to use AFA to clean up oil without increasing capital

costs for the construction of sewage treatment plants.

The most common methods of purifying water using the effect of the oil adsorption filter, i.e. technology involves the use of various kinds of adsorbents -

activated carbon, zeolites, shungites and synthetic filter materials. To the main drawback of this technology, in our view, should include the increase in value of the water purification.

Fig. 2: Location of AFA in the area of "Prokopievsky" open-pit mine

According to the analysis of career wastewater after cleaning through AFA (laboratory "West Siberia Geology", etc.), it was concluded that the content of virtually all contaminants in varying degree-reduced. In other words, we have a qualitative picture of a suitable origin - the effectiveness of AFA is provided not only in the cleaning of suspended solids. Therefore, conducted laboratory studies to-setting nature of the change of oil products.

Found that in the case when the AFA sleeps off entirely from the overburden (sandstone, siltstone, claystone, mudstone) - reduced oil content minimum. If AFA present carbonaceous rocks and coal formed in the conduction of mining operations, the oil content will decrease sharply.

In our opinion, this is due to the fact that coal is a powerful adsorbent. Sorption capacity of the activated carbon can be up to 250 mg/g or more. Sorption capacity of coals up to 10 mg/L [5], and found that the lower the degree of metamorphism of coal, the higher its sorption capacity.

We made calculations cleaning efficiency effluent from oil in artificial filter arrays with different amounts of water discharge, the oil content in the treated water and the percentage of coal in the AFA.

In the conduct of open pit mining loss rate of coal can vary from 5-6% to 15% or more. The loss of coal depends on the room is switched coal seams, their disturbance, structure, and used excavation equipment. For example, when developing thick beds of simple structure with steep bedding, using hydraulic excavators losses amount to 6-

7%, while at working inclined strata complex structure with 1-3 sublayers of overburden inside them, complicated disjunctive violations, the loss rate up to 20%. Accordingly, if the construction of AFA use overburden coming from the mining faces, the share of coal in the AFA will increase significantly, which will provide a more efficient cleanup for

petroleum products. Fig. 3 shows examples of the dependences obtained the required volume of the filter array V_{AFA} the percentage of coal in it with different concentrations of oil C_{oil} at constant annual volume of discharge (17.1 million m^3 - the data in the open-pit mine "Kedrovsky").

Fig. 3. Dependencies required volume of the filter array V_{AFA} percentage in it coal at different concentrations of oil products C_{oil} .

Thus, we can control the degree of purification of water, changing the composition of the rocks used for the construction of artificial filter array.

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