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# APPLIED SCIENTIFIC AND TECHNICAL RESEARCH

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during storage significantly reduces the environmental load on the environment. Partial replacement of activated carbon used for water post-treatment with sludge for water treatment reduces the cost of sorbent acquisition.

This production waste is generated in large quantities, and the estimated calorific value of the sludge saturated with trapped petroleum products is comparable to the calorific value of fossil fuels (22–23 kJ / kg).Therefore, a rational technological solution is the rejection of regeneration of the spent sorbent and its utilization by adding to the main fuel during combustion at thermal power plants. This eliminates the danger of secondary water pollution associated with regeneration, additional energy appears for the needs of thermal power plants, and natural resources are saved.

**Conclusions.** The use of water treatment sludge for adsorption of oil products from waste water from TPPs allows to comprehensively solve the problem of preventing oil pollution of water bodies and recycling waste water treatment.

УДК 504

## POLLUTION OF THE TERRITORIES OF BOARD`S PRODUCTION

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The environment is considered to be safe when its condition meets the criteria, standards, limits and norms in the legislation concerning cleanliness (not pollution), non-exhaustion, environmental sustainability, sanitary requirements, ability to satisfy the interests of citizens.

The problem of industrial and household wastes` utilization is becoming more important nowadays because the volume of waste generation is constantly increasing, while the rate of their processing is incomparably small. As a result, hundreds of millions of tonnes of various solid wastes have been accumulated to date, which must be recycled and disposed of. The scale of annual production and accumulation of solid waste requires the creation of powerful recycling plants with a capacity of millions of tonnes per year for their industrial development. It is good to carry out on the basis of already existing projects developed by advanced countries. The specificity of solid waste production is that in small quantities they do not have a significant impact on the environment, and in large concentrations become environmental disasters. Therefore, research and development of technique and technologies of recycling and waste disposal are actively pursued worldwide. The problem is that bringing the proposals to practical implementation in industry is connected with numerous financial, social and technical difficulties.

The analysis of sludges of galvanic industries, production of printed circuit boards and sludges from sludge collectors showed a high content of metals in them. Under the influence of fallout, especially acid rain, there is a gradual secondary pollution of the environment with this waste. Great watering of the territory, loose water permeable soils complicate the choice of industrial waste landfills and limit their area, create conditions for heavy metal ions contamination not only adjacent to the soil and surface water storage sites, but also groundwater horizons.

At this time, many countries around the world are still using the disposing method of toxic waste by dumping in special landfills using protective materials made of clay, polyethylene, polyvinyl chloride and other waterproof materials. An economic method of sediment burial is often chemical fixation, which is dosed in the sludge of special agents such as sodium silicate, cement. As a result, toxic substances are fixed in the solid mass, but may subsequently wash out.

Among the waste liquids there is a large group of heavy metals that are widely used in various industrial production, and, despite used methods for purification, heavy metal compounds penetrate industrial wastewater. A significant number of these compounds also enter the water through the atmosphere. The environmental hazard of heavy metals is that they are actively absorbed by phytoplankton, and then fall into the human food chain.

Enterprises that use PCB manufacturing processes to make modern electronic technology work are contributing to environmental degradation. Such enterprises include the production of: household appliances; military, cosmodrome equipment; spacecraft, radio and television.

For example, let`s take a look at the state of sludge formation while working the lines of etching of printed circuit boards. With a digestive line productivity of 12 $м^2$/h, the amount of sludge in 8 hours will reach a value of approximately 100 kg, which in the case of monthly one-shift work will complete to 2200 kg.

Today's best-in-class enterprises have produced approximately $4 \cdot 10^3$ m2 of boards, accumulating 2000-3000 tonnes or more of waste on their territory in the form of sludge, which are stored in containers, plastic bags and fall under the act of atmospheric sediment. In the process of action of atmospheric sediments on them, salts are washed out and transferred to soil, surface water, polluting the environment and increasing the level of environmental danger.

To avoid the accumulation of sludge on the territory of enterprises it is proposed to use the technology of regeneration of waste digestion solutions, in which the isolated metal is used as a secondary raw material for copper production, and the recovered solvent is reused for etching of printed circuit boards.

The soil and rock contamination forecast in the sludge storage area (prior to the implementation of the proposed solutions) is proposed to be performed on the basis of the provisions set out below.

As we said before, we have made the forecast for the salinization of soils and rocks of the aeration zone in the technogenically disturbed territory for different periods. Salts from the earth's surface move to the lower horizons of the aeration zone according to the laws of molecular diffusion. According to the theory of physicochemical hydrodynamics of porous media, this process can be described by the equation of motion and conservation of mass of matter in partial derivatives for vertical mass transfer.

The analytical solution of the equation for the problem in this formulation looks like this:

$$Cx = (Cn - Co) erfc \frac{x}{2\sqrt{\frac{D_m t}{n}}}$$

where *Cx* - the estimated salinity at a depth of $x_m$ from the earth's surface, %; *Cn* - salinity on the surface (bulk layer of salts), %; *Co* - soil salinity before the beginning of storage, %; *x* - distance of the calculated points from the origin, ie from the surface of the earth, m; *t* - term of the estimated calculation, 24-hour period; *erfc* - tabulated exponential function; *n* - volume humidity.

The scheme of the salt transfer area can be represented as follows: the movement of salts is carried out only in pore space. The pores occupy 0.4 units of rock volume, so the maximum *Cn* value will be 40% at the boundary of 1 genus-surface of the earth. In our case, we choose to calculate the calculation points after 0.5 m to the groundwater level.

To understand the process let's determine the magnitude of salinity: in the presence of salts less than 0.3% soils are considered saline, 0.3 ... 0.5% - soils poorly saline. All soils contain a certain amount of salts. Salinity is measured as a percentage of dry soil.

When salt is lying on the soil surface, it corresponds to the first-order boundary condition. The following initial data are taken for the forecast calculation:

*Co* - soil salinity before the beginning of storage will be 0.2%;

*Dm* - molecular diffusion coefficient $(1\text{-}9) \cdot 10^{-5}$ $m^2$/day. In the calculations of moving salts, the values are taken to be maximum, that is, the value $9 \cdot 10^{-5} = 0{,}00009$ $m^2$/day.

*x* - the distance of the calculated points from the origin, that is, from the surface of the earth, will be 0.5 m

*t* - the estimated period is 1 year (365 days).

The magnitude of the calculation shows that in 1 year after salting the upper half-meter layer of the aeration zone will go into the category of low and medium saline. In next years, salt content will increase in time and depth.

With this content of salts, the complete absence of any living organisms and plants is guaranteed for many years and after the liquidation of the composition.

**Conclusions**

All above allow to understand the loss of sludge storage on the territory of the enterprise and give the direction of work for the development of technologies for processing and reuse of etching solutions in the process of etching of printed circuit boards.

УДК 622.2

# IMPROVEMENT OF ORE RAGGING QUALITY USING INITIAL POTENTIAL IN BREAKING MASS

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At present, various effects on ore (physical, mechanical, chemical, biological) used to intensify the leaching process, most of which aimed at accelerating the valuable components transfer from ore to productive solution, with ore size playing an important role [1]. In order to obtain the necessary grain size composition for heap leaching of ore coming from the pit, several crushing stages are carried out, which is from 8 to 16-18% of ore extraction and processing costs.

In order to improve the breaking ore quality and reduce the crushing costs before leaching, the breaking technology using the preliminary stressed state of the massif has been developed.

The object of the study is the "Belaya Gorka" section of the Rodnikovoye field administratively located in the northern part of the Kokpektinsky district territory (on the border with the Zharminsky district) of the East Kazakhstan region. Based on mining technical conditions of development, the method of vertical well charges with short-circuited blasting adopted: at ore mining - on subbenchs with height of 5 m, at opening - on benchs with height of 10 m, drilling diameter of 110 mm. Igdanite, grammonite are used as explosives. The value of the line of least resistance along the bench bottom at production is 4.8 m, and at opening operations - 6.6 m.

For the this deposit conditions, the blasting chamber is a well with a depth of 6 meters, the capacity of 1 m of the well P = 9.5 kg, the charge weight in the well $Q_{well}$ = 27.6 kg. Energy released by 1 kg of used explosive $E_u$ = 1025 kcal/kg. Then the total potential energy of one well is $E_u$ = 11844.57kJ/kg, with a detonation rate of 3500 m/s, which is the rate of the initial load increase on the well walls.

On one side of the well, this pressure applied to the rock mass volume, one side of which is the slope of the bench, i.e. is free from pressure. On the opposite side, an explosive shock wave coming from the explosion sets pulse to the soil particles. The particle velocity allows us to calculate the kinetic energy spent in the explosion kick of the first soil layer with volume V = 56 $m^3$, which is $E_c$ = 29.8 kJ. Volume of well charge released energy $E_{well}$ = 11844.57 kJ.

In order to determine the explosion energy amount consumed to destroy the half-space opposite the discarded part of the dump, from the total explosion energy, we subtract the consumed energy in the form of kinetic energy and obtain $E_{excess}$ = 11814.77 kJ.

Determining the energy amount consumed per half-space makes it possible to determine its further dispersion. According to [2], as well as taking into account the breaking stress $\sigma_{str}$ of aleurolite (the main rocks constituting the massif), it is possible to determine the amount of energy E spent on mechanical action in three zones [3] of the explosion wave action: $E_1 = S_1 \sigma_{str}$ = 0.087 kJ; $E_2 = S_2 \sigma_{str}$ = 1.49 kJ; $E_3 = S_3 \sigma_{str}$ = 1.87 kJ.

Further, from $E_{excess}$ - $E_1+E_2+E_3$ = 11811.32 kJ - the obtained amount of energy spent on elastic deformations beyond the $R_3$ - are initial stresses. As can be seen, the initial stress $\sigma_{str}$ = 11811.32 kJ is the majority of the explosion energy transferred to the internal initial stress of the rock mass, which changes the soil characteristics. Taking into account the level of initial stresses formed as a result of the previous explosion, it will be possible to reduce the size of the grain size composition of the rock.

Knowing the blast wave zones' radiuses and the initial stresses level in the elastic region, it is possible to obtain the necessary ragging quality by adjusting the deceleration interval in case of short-circuited blasting.

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