ABSTRACT AND REFERENCES

ECOLOGY

STUDY OF FIRE–EXTINGUISHING EFFICIENCY OF ENVIRONMENTALLY FRIENDLY BINARY AEROSOL-NITROGEN MIXTURES (p. 4-11)

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It was theoretically grounded and experimentally confirmed that adding nitrogen to the aerosol of inorganic potassium salts considerably increases efficiency of the fire-extinguishing of the obtained binary mixture. As a result of the studies we determined that the addition of nitrogen to the aerosol reduces the fire-extinguishing concentration of the components of the final binary mixture by 30 %. Experiments confirmed that the optimal ratio of the components in the mixture of a binary mixture, which consists of the aerosol is 10 g/m^3 and nitrogen – 12.1 %. It is fire-extinguishing for the diffusion flame of heptane and simultaneously provides life-safe concentration of oxygen. It was found that high efficiency of binary aerosol nitrogen mixture is achieved due to the synergy of the components of the mixture. We defined the value of intensity and decrease in the temperature of the diffusion and kinetic flame with its presence in the aerosol-nitrogen mixture. The study of fire-extinguishing efficiency of the aerosol-nitrogen mixtures is necessary to determine the conditions and methods of the fire extinguishing by the mixture in closed areas.

Received dependencies and specifications of aerosol-nitrogen mixtures can be the foundation for the creation of ecologically clean, cheap, and simple in the production and operation fire-fighting tools with high fire-suppression efficiency, which can be used for the fire suppression in the areas of temporary stay of people and living organisms without an apparent damage to them as a result of volumetric fire extinguishing by the described mixtures.

Keywords: nitrogen, gases phlegmatizers, inhibitors of combustion, aerosol fire extinguishing.

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SIMULATION OF THE SOLID WASTE LANDFILL SETTLEMENT TAKING INTO ACCOUNT UNDERLYING SOIL (p. 12-17)

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As the closed landfills occupy 7 % of the territory of Ukraine, there is a question about the possibility of their use in future as a foundation for different constructions. The goal is to establish a dependency of the settlement of a closed landfill on the properties of the underlying soil and on the angle of inclination of a landfill. This will allow forecasting the possibility of using a polygon as a foundation for a variety of purposes.

The mathematical simulation and the finite elements method were used. The mathematical simulation of the settlement of a landfill was carried out with consideration of geometric, physical and mechanical parameters of a landfill and its ground foundation. It was established that the ground foundation of a landfill considerably affected the value of the settlement. As a result of the studies it was found that with the decrease in the angle of inclination of the landfill's slope the settlement significantly decreased. Thus, by reducing the angle of inclination from 75° to 30°, the settlement decreased by 5–22 % depending on the type of the underlying soil. Also, the largest decline was observed for the least dense soil (sand). With a decrease in the angle, the difference between the settlement of landfills with different ground foundations decreases. The results obtained can be used for forecasting the settlement of a polygon with different geometric and physical-mechanical parameters for evaluation of the possibility of their further use as a foundation for structures with a variety of purposes.

Keywords: solid household waste polygon (landfill), settlement, biodegradation, finite elements method.

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LOW-WASTE ION EXCHANGE TECHNOLOGY OF EXTRACTION OF NITROGEN COMPOUNDS FROM WATER (p. 18-23)

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The processes of sorption of nitrates on a low-base anionite Dowex Marathone from acidic and neutral solutions were researched. It is shown that the application of the anionite in the main form provides effective extraction of nitrates from acidic solutions in the presence of chlorides and sulfates at high values of exchanging dynamic capacity of anionite by nitrates. The use of solutions of ammonia for the regeneration of anionite provides a complete restoration of the capacity of anionite with non-significant remnants of ammonia. Exhausted solutions after the regeneration and neutralization contain mostly ammonium nitrate, therefore they are suitable for the production of liquid fertilizers.

It was found that the extraction of the hardness ions from water on the cationites in acidic form increases the exchanging capacity of cationites on ammonium ions. During the process of water treatment it is advisable to use a two-stage cationization while applying sub-acid cationite in acidic form during the first stage and highly-acid cationite also in acidic form. This scheme is reasonable during the water purification with high hydrocarbonate alkalinity. In other case the application of a sub-acid cationite is not effective.

It is shown that the cationite in the ammonium form is advisable to regenerate by the solutions of nitric acid, which provides the recycling of exhausted regenerative solutions with obtaining liquid fertilizers.

The conceptual technological scheme of a low-waste technology of water purification from nitrogen compounds was designed, based on a two-stage cationization of water on the cationites in acidic form and extraction of anions on the low-base anionite in the main form, which provides an effective extraction of nitrogen compounds from the water.

Keywords: waste recycling, regeneration, ammonium, nitrates, ion exchange.

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RESULTS OF EXPERIMENTAL STUDIES OF AMBER EXTRACTION BY HYDROMECHANICAL METHOD IN UKRAINE (p. 24-28)

Zinovii Malanchuk, Valerii Korniyenko, Yevhenii Malanchuk, Andriy Khrystyuk

Patterns of interrelation between the amber-containing mining mass and vibrohydraulic intensifier were defined with the substantiation of its technological parameters for creating the required density of the medium, which provides for maximal extraction of amber.

Existing methods and methods for the extraction of amber were analyzed and a new method for the extraction of amber out of amber-containing sand field was proposed, providing for higher efficiency of its recovery while negative impact on the natural environment is reduced.

Laboratory and field studies were carried out on amber-containing sand fields in Rivnensky-Volynsky region with the purpose of improvement of existing technologies of extraction of amber.

When carrying out experimental research, we determined the main technological parameters of hydromechanical method of amber extraction and determined the patterns of influence of water and air on the liquefaction of amber-containing sandy media when an array is exposed to the action of a vibrohydraulic intensifier, during which a maximal speed of amber recovery to the surface is achieved.

In the process of field research, we implemented the latest technology and achieved maximum extraction of amber in the deposit, which is 90–95 % of the total mass.

Keywords: amber, liquefaction, segregation, hydromechanical method, vibrohydraulic intensifier, vibration emitter.

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DEVELOPING OF EFFECTIVE TREATMENT TECHNOLOGY OF THE PHENOLIC WASTEWATER (p. 29-34)

Irina Klymenko, Dmytro Yelatontsev, Anna Ivanchenko, Olga Dupenko, Nikolay Voloshyn

It is found that a high degree of purification from emulsified coal tar is achieved in the phenolic wastewater treatment using 88 mg/dm^3 of sodium bentonite with the addition of 8 mg/dm^3 of cationic flocculant in conditions the closest to industrial. This innovative method of phenolic wastewater treatment is cost-effective because of the low cost of bentonite. It is shown that the deposit formed during the wastewater treatment with bentonite floats to the liquid surface and can be separated by a scraper device for further utilization in construction. The process of biological treatment of phenolic wastewater in the combined aerator-clarifier unit is shown. It is determined that the optimum time for efficient phenol extraction from wastewater is 6 hours. It is experimentally proved that the use of this unit makes the biological treatment process 4 times faster giving significant economic benefits by reducing energy consumption for aeration. The flow diagram of complex wastewater purification from coal tar and phenol is developed. The use of it at coke and chemical plants will significantly increase the treatment efficiency and product profitability.

Keywords: bentonite, coal tar, flocculation, biological treatment, phenol, activated sludge, aerator-clarifier unit.

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TECHNOLOGY OF ANAEROBIC-AEROBIC PURIFICATION OF WASTEWATER FROM NITROGEN COMPOUNDS AFTER OBTAINING BIOGAS (p. 35-40)

Natalia Golub, Olexandr Kozlovets, Dariya Voyevoda

The technological parameters, by which the concentration of nitrogen containing compounds can be reduced to 75 % in the process of purification of the waste water from methane tanks after the process of the anaerobic fermentation of the poultry remainder were determined.

The influence of the co-substrate structure on the change of the concentration of nitrogen compounds in wastewater in the process of obtaining biogas from the remainder was shown. The co-substrate, which contains more lignin, contributes to double increase in the content of ammonium ions, in relation to the substrates, the content of lignin in which does not exceed 25 %; besides, it does not increase the content of organic compounds in wastewater. The lower content of lignin leads to the fact that the content of organic substances in wastewater is 70 % higher.

The technological parameters (time of hydraulic retention, the ratio of the flows in the process of wastewater purification) of the anaerobic-aerobic process of wastewater purification were defined.

The obtained laboratory results provide an opportunity to develop the technology of the anaerobic fermentation of the wastes of livestock breeding industry with wastewater reusing in the technological process of anaerobic waste processing. This technology is attractive in cases when in the process of fermentation it is necessary to add water for bringing the content of the methane tank to the optimum humidity; the fermentation of poultry breeding wastes is a good example of such use.

Keywords: fermentation of remainder, co-substrate, wastewater, nitrification – denitrification, anaerobic – aerobic processing.

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A METHOD DEVELOPED TO INCREASE TECHNOLOGICAL AND ECOLOGICAL EFFICIENCY OF GAS PRODUCTION FROM HYDRATE DEPOSITS (p. 41-47)

Sergiy Oveckiy, Vladyslav Savchuk

Despite some international experience in gas production from gas hydrate deposits, mining companies are faced with a number of issues that have not been resolved so far. Among these issues, the particularly complex ones are technological problems and environmental efficiency. In the present article, there is a substantiation of the need to consider the particular structure of primary (marine) and secondary (land) gas hydrate deposits while choosing the method of extracting gas from them.

The analysis of the practical experience of extracting gas from gas hydrate deposits has proved that one of the most effective methods of ecological production of methane from marine gas hydrate deposits might be the method of substitution. The method of decompression (reduced pressure) is the most effective one for development of secondary (land) deposits.

The suggested method of technological planes has helped estimate the effectiveness of using hydrate substitutes such as hydrogen sulphide and carbon dioxide. This method has proved a certain advantage of hydrogen sulphide over carbon dioxide due to a larger conventional area of the technological plane and, therefore, a safer range of values of the technological parameters of gas extraction.

The obtained results can be used in implementing the technology of gas extraction from hydrate deposits, especially in applying the substitution method to developing offshore deposits.

Keywords: gas hydrate deposits, marine hydrates, extraction of methane, hydrogen sulphide, carbon dioxide recycling.

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A STUDY OF SIGNIFICANT FACTORS AFFECTING THE QUALITY OF WATER IN THE OSKIL RIVER (UKRAINE)(p. 48-55)

Alexander Vasenko, Olga Rybalova, Oksana Kozlovskaya

The study has explored climate shifts in the Kharkiv region and changes in the hydrological indices of the Oskil river in Ukraine. Predictive models were constructed by the Holt-Winters method. The findings show an expected gradual increase in temperature by 1.9 °C – from 7.8 °C to 9.7 °C – in 2020, which can lead to a decrease in precipitation, the runoff volume, and water consumption. It also has a significant adverse impact on the formation of surface water quality and on the development of infestations. Natural and anthropogenic factors that have the most significant effects on the hydrochemical characteristics of the Oskil river were specified by a multivariate correlation and regression analysis.

The research findings show that the quality of aquatic sites is most affected by wastewater discharges and an increase in air temperature, which testifies to the need of reducing loads from industrial facilities and utilities. The study takes into account landscape and environmental characteristics of the river basin. We have assessed rationality of using the basin catchment area on the basis of exponents such as tillage, urbanization, the volume of water consumption, forest cover, meadow cover, lake cover, and changes in the hydrological characteristics that influence the development of the intensity of degradation processes. The assessment of the processes of ravine formation, land erodibility, silting and waterlogging of small rivers in the Oskil river basin has shown a significant increase in the intensity of the degradation processes compared to 1990, which requires applying environmental protection measures to improve the situation. The ranking of the small rivers in the Oskil river basin by the index of process development helps prioritize the funding of environmental protection measures.

Keywords: quality, degradation processes, climate change, hydrological parameters, correlation.

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