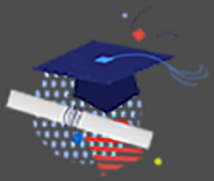
SUSTAINABLE DEVELOPMENT: MODERN THEORIES AND BEST PRACTICES



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Reviewers:
Doctor of Pedagogical Sciences, Professor Inna Osadchenko, Pedagogy and Educational Management Department, Pavlo Tychyna Uman State Pedagogical University, Uman, Ukraine
Doctor of Economics, Professor Olena Sadchenko, Department of Marketing and Business Administration, Odessa I.I. Mechnikov National University, Odesa, Ukraine

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ENVIRONMENTAL AND TECHNICAL ISSUES OF SUSTAINABLE DEVELOPMENT

REGIONAL FEATURES OF SUSTAINABLE DEVELOPMENT

INTERNATIONAL COOPERATION FOR SUSTAINABLE DEVELOPMENT

ENVIRONMENTAL AND TECHNICAL ISSUES OF SUSTAINABLE DEVELOPMENT

ESTABLISHING THE POSSIBILITY OF REUSING THE SPENT SORBENT OF THE FOOD INDUSTRY

Olha Khudoiarova, PhD, Senior lecturer of the Department of Chemistry and Methods of Chemistry Teaching
Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University, Ukraine

The issue of conservation of water resources, which have recently been constantly polluted by untreated industrial and domestic wastewater, is relevant today in Ukraine. Various physicochemical methods are used for water purification, among which the most popular is the method of adsorption using a variety of both natural and synthetic sorbents.

Sorption methods are widely used for purification of industrial water of food production from organic impurities, purification of washing water of copper process from copper (II) ions and sulfide-alkaline solutions of chemical and petrochemical productions from sulfide and hydrosulfide ions. It is important to not only purify water and reuse it in closed production cycles, but also to obtain, as another component of the water purification process, the final products.

However, as a result of cleaning, solid waste is formed, which is often buried or stored in dumps. Significant amounts of activated carbon (AC) and diatomaceous earth (K) used in the food industry are not reused. The problem of accumulation of spent sorbents is partially solved by restoring their sorption properties for reuse in purification processes.

The possibility of regeneration of the spent (after the stage of sugar syrup purification) industrial sorbent (AC + K) consisting of activated carbon (AC) of Decolar A brand and diatomaceous earth (K) of industrial brands Bekogur 200 and Bekogur 3500, with the purpose of its further use for local sorption wastewater treatment of individual industries has been found.

The condition for reuse of spent industrial sorbent (AC + K) was its regeneration.

In work [1] it has been shown that the stepwise treatment of the spent industrial sorbent (AC + K) with water, and then 1.25 % NaOH (or successively 1 % NaOH and 4 % HCl) allows to 100 % restore the sorption capacity of the investigated sorbent. Rational parameters of the regeneration process of the industrial sorbent (AC + K) ahave been established: mass ratio (AC + K) : H_2O = 1 : 4; regeneration time 45–60 minutes; process temperature 50–60 °C; the stirring intensity of the reaction mass is 200 rpm. X-ray phase examination of the surface of the samples of industrial sorbent (AC + K) confirmed that the recovery after regeneration of its sorption capacity is associated primarily with the passage of acid-base chemical reactions on the matrix surface of the sorbents. The possibility of effective usage of the regenerated industrial sorbent (AC + K) for purification of water solutions of production of soft drinks from organic impurity

has been established [1]. The basic technological scheme of the regeneration area of the spent industrial sorbent (AC + K) and purification of industrial water in closed cycles of production of soft drinks from organic impurity has been developed [2]. The refractometric method has determined the residual amount of sugar in water solutions after regeneration of the spent industrial sorbent (AC + K) and has found that the amount of organic impurities in one cycle is reduced by 2.9 times, which indicates the effectiveness of the proposed method of purification.

In order to establish the possibility of using regenerated industrial sorbent (AC + K) for local sorption treatment of sulfide-alkaline wastewater of chemical (petrochemical) industries from S^{2-}, HS^{-}-ions, the adsorption treatment of model sulfide-alkaline solutions, which are close to the wastewater of the Kremenchug Refinery (PJSC "Ukrtatnafta") by sulfur concentration [3,4].

It has been shown that at a ratio of solution: (AC + K) = 100 : 40 at a temperature of 20–25 ºC and an exposure time of 24 h, the degree of extraction of total sulfur (S_g) from solutions is 96.6 %, which confirms the effective use of regenerated industrial sorbent (AC + K) and the possibility of its practical usage. It has been found that the amount of adsorption of sulfide- and hydrosulfide- ions on the investigated industrial sorbent significantly depends on the initial concentration of sodium sulfide in solution. In the case of a more concentrated solution, accept the adsorption on the surface of the sorbent, there is adsorption, which is associated with intradiffusion processes. X-ray phase analysis of the surface of the industrial sorbent (AC + K) has confirmed the amorphous composition of activated carbon and the presence of the main cristobalite SiO_2, 4.02, as well as a number of peaks of different modifications (cubic, orthorhombic) Na_2S.

The possibility of using regenerated sorbent (AC + K) for purification of washing waters of electrochemical copper plating from copper (II) ions has been established [5].

It has been found that the degree of extraction of copper(II)-ions from the studied solutions with a concentration of 150 mg/dm^3 is only 23.3 %. The obtained data indicate insignificant adsorption of Cu^{2+} by regenerated industrial sorbent (AC + K), which is explained both by the nature of the adsorbate and the morphology of the adsorbent after its acid-base activation. In the region of low pH values, the degree of sorption is small, as the carboxyl and phenolic groups of the sorbent are protonated; at relatively low concentrations of copper(II) hydrogen ions compete free sorption centers. It has been established that without additional activation (modification) of the matrix surface of sorbents (AC + K) the use of this method is not expedient.

In order to increase the efficiency of extraction of copper(II) cations from the galvanic wash water of the copper plating process, the sorption surface of the regenerated industrial sorbent (AC + K) was modified with sulfide-alkaline solutions. It has been found that the use of a industrial sorbent, the surface of which is modified with sulfur-containing ions (S^{2-}, HS^{-}), increases the degree of extraction of copper(II) cations from the washing galvanic waters of the copper-plating process by 60 %. The possibility of undergoing topochemical transformations has been established by IR spectral and X-ray phase studies [5].

The obtained modified surface of the investigated sorbents [(AC + K) + CuS + S] was used as an active component of plastic lubricants as the final industrial product [3].

1.Ranskiy, A. P., Khudoyarova, O. S., Gordienko, O. A., Titov, T. S., & Kryklyvyi, R. D. Regeneration of Sorbents Mixture after the Purification of Recycled Waterin Production of Soft Drinks. J. Water Chem. Technol. (2019). 5, 318-321. Date of visit: 06.04.2022. URL: https://link.springer.com/article/10.3103/S1063455X19050084
2.Khudoyarova, Olga, Gordienko, Olga, & Ranskiy, Anatoliy. Technology of complex sorption treatment of industrial wastewater from sulphide and Copper (II)-iones. Water and Water Purification Technologies. Scientific and Technical News. (2021). Vol. 30,№ 2: 18–26. Date of visit: 06.04.2022. URL: http://wpt.kpi.ua/article/view/237814
3.Khudoyarova, Olga, Gordienko, Olga, Blazhko, Alina, Sydoruk, Tetiana, & Ranskiy, Anatoliy. Desulfurization of industrial water-alkaline solutions and receiving new plastic oils. Journal of Ecological Engineering. (2020). 6, 61–66. Date of visit: 06.04.2022. URL: file:///C:/Users/user/Downloads/9_Khudoyarova_Desulfurization_JEE_2020_6.pdf
4. Khudoyarova, Olga, Gordienko, Olga, Sydoruk, Tetiana, Titov, Taras, & Prokopchuk, Serhii. Adsorptive desulfurization of sewage of industrial. Environmental problems. (2020). 2, 102–106. Date of visit: 06/04/2022. URL: https://science.lpnu.ua/sites/default/files/journal-paper/2020/jun/21772/8.pdf
5. Khudoyarova,Olga, Gordienko,Olga, Sydoruk,Tetiana, Titov, Taras, & Ranskiy, Anatoliy. Surface modification of mixed sorbents with sulfide ions for purification of galvanic wash water of copper plating process. Proceedings of the NTUU “Igor Sikorsky KPI”. Series: Chemical engineering, ecology and resource saving. (2020). 2, 36-46. Date of visit: 06.04.2022. URL: http://chemengine.kpi.ua/article/view/208054