ABSTRACT AND REFERENCES

ECOLOGY

DOI: 10.15587/1729-4061.2017.101736

RESEARCH INTO PROCESSES OF WASTEWATER TREATMENT AT PLANTS OF MEAT PROCESSING INDUSTRY BY FLOTATION AND COAGULATION (p. 4-9)

Lyudmyla Savchuk
Lviv Polytechnic National University, Lviv, Ukraine
ORCID: http://orcid.org/0000-0002-5396-4546

Zenoviy Znak
Lviv Polytechnic National University, Lviv, Ukraine
ORCID: http://orcid.org/0000-0002-3871-4063

Oksana Kurylets
Lviv Polytechnic National University, Lviv, Ukraine
ORCID: http://orcid.org/0000-0002-5691-9222

Roman Mnykh
Lviv Polytechnic National University, Lviv, Ukraine
ORCID: http://orcid.org/0000-0003-3248-919X

Roman Olenych
Lviv Polytechnic National University, Lviv, Ukraine
ORCID: http://orcid.org/0000-0002-5990-4958

The aim of present research was to select the rational method of purification of highly concentrated wastewater of meat processing enterprises. For this purpose, the optimal parameters of flotation and reagent treatment were determined. The study was conducted with two types of wastewaters. The first was formed within a week during washing meat and the equipment. Another, more concentrated and highly alkaline, was formed once a week during washing meat-smoking facilities.

Less polluted wastewater should be cleaned by flotation, followed by the reagent deposition. Flotation within 1.5...2 hours eliminates almost half of the chemical consumption of oxygen. By the reagent method, using hydrated calcium oxide, previously activated by ultrasound, and the coagulant sulfate $FeSO_4$, we achieved a decrease in the CCO practically to standard indicators.

For the purification of more concentrated wastewater with high alkalinity, only reagent treatment is required, because of very intense foaming and carrying out the liquid phase (50...70 %) during flotation. Calcium hydroxide, activated by acoustic oscillations of ultrasonic range, should be used as reagents and iron (II) sulfate should be used as a coagulant.

Based on the performed studies, the technology of wastewater treatment at meat processing enterprises with incomplete production cycle was proposed. It covers the following main stages: wastewater neutralizing, preliminary rough treatment on the bulk filter, stage-by-stage reagent treatment, filtering, and decontamination.

Keywords: highly concentrated wastewater, mechanical treatment, floatation, coagulants, cavitation, biological treatment.

References

1. Kovalchuk, V. A., Kovalchuk, O. V., Samelyuk, V. I. (2010). Biotekhnolohiya ochystky stichnykh vod pidpryyemstv kharchovoyi promyslovosti. Kommunalnoe khozyaystvo horodov. Ser.: Tekhnicheskie nauki i arhitektura, 93, 182–187.
2. Botis, M. (2015). Purification of the wastewater from meat industry. Journal on processing and Energy in Agriculture, 19 (1), 21–23.
3. Pintor, A. M. A., Vilar, V. J. P., Botelho, C. M. S., Boaventura, R. A. R. (2014). Optimization of a primary gravity separation treatment for vegetable oil refinery wastewaters. Clean Technologies and Environmental Policy, 16 (8), 1725–1734. doi: 10.1007/s10098-014-0754-3
4. Teerlink, J., Martinez-Hernández, V., Higgins, C. P., Drewes, J. E. (2012). Removal of trace organic chemicals in onsite wastewater soil treatment units: A laboratory experiment. Water Research, 46 (16), 5174–5184. doi: 10.1016/j.watres.2012.06.024
5. Loloei, M., Nekonam, G., Alidadi, H., Kor, Y. (2014). Study of the coagulation process in wastewater treatment of dairy industries. International Journal of Environmental Health Engineering, 3 (1), 12. doi: 10.4103/2277-9183.132684
6. Ukiwe, L. N., Ibeneme, S. I., Duru, C. E., Okolue, B. N., Onyedika, G. O., Nweze, C. A. (2014). Chemical and electro-coagulation techniques in coagulation-flocculation in water and wastewater treatment – a review. Journal of Advances in Chemistry, 9 (3), 1988–1999.
7. Tansengco, M., Herrera, D., Tejano, J., Yao, M., Beraye, J. R., Esguerra, R. (2015). Biological Treatment of Meat Processing Wastewater using Anaerobic Sequencing Batch Reactor (ASBR). International Research Journal of Biological Sciences, 4 (3), 66–75.
8. Neoh, C. H., Noor, Z. Z., Mutamim, N. S. A., Lim, C. K. (2016). Green technology in wastewater treatment technologies: Integration of membrane bioreactor with various wastewater treatment systems. Chemical Engineering Journal, 283, 582–594. doi: 10.1016/j.cej.2015.07.060
9. Chakinala, A. G., Gogate, P. R., Burgess, A. E., Bremner, D. H. (2009). Industrial wastewater treatment using hydrodynamic cavitation and heterogeneous advanced Fenton processing. Chemical Engineering Journal, 152 (2-3), 498–502. doi: 10.1016/j.cej.2009.05.018
10. Doosti, M. R., Kargar, R., Sayadi, M. H. (2012). Water treatment using ultrasonic assistance: a review. Proceedings of the International Academy of Ecology and Environmental Sciences, 2 (2), 96–110.

DOI: 10.15587/1729-4061.2017.101848

USING THE ASSESSMENT METHOD OF ENVIRONMENTAL RISK OF A PROJECT IN STRATEGIC TERRITORIAL PLANNING (p. 11-17)

Tatyana Boyko
National Technical University of Ukraine «Igor Sikorsky Kyiv Polytechnic Institute», Kyiv, Ukraine
ORCID: http://orcid.org/0000-0002-9710-8055

Iryna Dzhygyrey
National Technical University of Ukraine «Igor Sikorsky Kyiv Polytechnic Institute», Kyiv, Ukraine
ORCID: http://orcid.org/0000-0002-8360-447X

Alla Abramova
National Technical University of Ukraine «Igor Sikorsky Kyiv Polytechnic Institute», Kyiv, Ukraine
ORCID: http://orcid.org/0000-0003-3475-8584

Considering the growing need for using strategic approaches to evaluation of ecological safety on the stage of project designing, the methods of assessment of impacts on the environment (EIA)

need radical revision. Such changes are necessary to be directed to supplementing existing methods with the standards and regulations of development of territorial and strategic EIA. Therefore, the studies in the field of strategic environmental analysis (SEA), aimed at establishing relationships between SEA and EIA were conducted. It was found that it is a challenge that SEA bears a descriptive character, and at present, the intense work on drafting the laws on SEA in Ukraine is in process.

The tool of supporting strategic environmental assessment of projects of development of territorial formations and urbo-ecosystems of different scales in conjunction with the EIA was proposed. This procedure is based on the application of techniques based on the use of indices and environmental risks, as well as the project approach. The applied approach will allow us to establish a relationship between a project, ecosystem and the territory.

Keywords: strategic environmental assessment, assessment of impacts on environment, environmental risk.

References

1. Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment. Avilable at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32001L0042
2. Dalal-Clayton, B., Sadler, B. (2005). Strategic Environmental Assessment: A Sourcebook and Reference Guide to International Experience. OECD, UNEP and IIED in association with Earthscan Publications. London, 24. Available at: http://pubs.iied.org/pdfs/G02193.pdf
3. SEA Protocol to the UN ECE Convention on Environmental Impact Assessment in a Transboundary Context. Available at: http://www.unece.org/env/eia/welcome.html
4. Zakon Ukrayiny «Pro ratifikatsiyu Protokolu pro strategichnu ekologichnu otsinku do Konventsiyi pro otsinku vplivu na navkolishne seredovishche u transkordonnomu konteksti» (2015). Verkhovna Rada Ukrayiny, No. 562-19. Available at: http://zakon5.rada.gov.ua/laws/show/562-19
5. Boyko, T. V., Dzhygyrey, I. M. (2016). An analysis of planning objects for strategic environmental assessment based on indicator approach. Komp'yuterne modelyuvannya v himiyi i tehnologiyah ta sistemah stalogo rozvitku. Kyiv: NTUU «KPI», 219–225.
6. Kuybida, V. S., Bilokon, Yu. M. (2009). Teritorialne planuvannya v Ukrayini: evropeyski zasadi ta natsionalniy dosvid. Kyiv: Logos, 108.
7. DBN A.2.2-1-2003. Zmina No. 1. Proektuvannya. Sklad i zmist materialiv otsinki vpliviv na navkolishne seredovishche (OVNS) pri proektuvanni i budivnitstvi pidpriemstv, budinkiv i sporud (2010). Kyiv: DP «Ukrarhbudinform» Minregionbud, 10.
8. Rudenko, L. H., Lisovs'kyy, S. A., Marunyak, Ye. O. (2016). Experience of strategic environmental assessment in the planning process in Ukraine. Ukrainian Geographical Journal, 2, 3–12. doi: 10.15407/ugz2016.02.003
9. Sharifzadegan, M. H., Gollar, P. J., Azizi, H. (2011). Assessing the Strategic Plan of Tehran by Sustainable Development Approach, using the Method of "Strategic Environmental Assessment (SEA)." Procedia Engineering, 21, 186–195. doi: 10.1016/j.proeng.2011.11.2003
10. Strategic Environmental Assessment. Guidance Notes on Tools for Pollution Management. Available at: http://siteresources.worldbank.org/INTRANETENVIRONMENT/Resources/244351-1279901011064/GuidanceNoteonSEA.pdf
11. Dagonneau, J., Rocks, S. A., Prpich, G., Garnett, K., Black, E., Pollard, S. J. T. (2017). Strategic risk appraisal. Comparing expert- and literature-informed consequence assessments for environmental policy risks receiving national attention. Science of The Total Environment, 595, 537–546. doi: 10.1016/j.scitotenv.2017.03.293
12. Postanova «Pro zatverdzhennya Programi pereglyadu derzhavnih budivelnih norm i pravil na period do 2015» (2011). Kabinet Ministriv Ukrayini, No. 471. Available at: http://zakon5.rada.gov.ua/laws/show/471-2011-%D0%BF/page
13. Rozporyadzhennya «Pro zatverdzhennya Kontseptsiyi realizatsiyi derzhavnoyi politiki z normativnogo zabezpechennya budivnitstva v Ukrayini na period do 2015» (2010). Kabinet Ministriv Ukrayini, No. 1436-p. Available at: http://old.minregion.gov.ua/attachments/content-attachments/1907/koncepcianormzabezbud.pdf
14. Abramova, A. O. (2016). Perspektivni napryamki rozvitku protseduri otsinki vpliviv na navkolishne seredovishche. Naukova Ukrayina. Available at: http://globalnauka.com/naukova_ukraina/1490.html
15. Boyko, T. V., Abramova, A. O. (2016). System analysis of interaction of man-made object of industrial and environmental. Komp'yuterne modelyuvannya v himiyi i tehnologiyah ta sistemah stalogo rozvitku. Kyiv: NTUU «KPI», 226–231.
16. Boyko, T., Abramova, A. (2014). Definition of environmental risk as integral criterion in assessing of man-caused load. Eastern-European Journal of Enterprise Technologies, 3 (10 (69)), 4–7. doi: 10.15587/1729-4061.2014.24316
17. Abramova, A. (2012). Index estimation of environmental safety for designing industrial facilities. Technology audit and production reserves, 6 (1 (8)), 39–40. doi: 10.15587/2312-8372.2012.5468

DOI: 10.15587/1729-4061.2017.101657

DEVELOPMENT OF THE UNIFIED TECHNIQUE FOR THE MONITORING OF OCCUPATIONAL HAZARDS AT KRYVBAS MINING ENTERPRISES (UKRAINE) (p. 18-27)

Darya Zaikina
Kryvyi Rih National University, Kryvyi Rih, Ukraine
ORCID: http://orcid.org/0000-0002-9485-2524

The basic indexes of efficiency of the HSE management system were estimated. The algorithm is the basis for mathematical modeling of a control occupational health and safety management system. The developed algorithm, in contrast to the existing ones, involves a series of steps to determine the effectiveness of the system of labor protection management and identification of the factors of injury at an enterprise. The essence of the method lies in the fact that the resulting method makes it possible to determine the level of the OH and the effectiveness of the HSE management system.

We have formed a mathematical optimization model to increase the security of the working environment, taking into account the nonlinearity of the dependencies between the effectiveness of measures, which normalize the factors of the work environment, and their cost.

The analysis of seniority and age groups was conducted, as well as dust, noise, vibration, and temperature gradients in the underground conditions. The analytical relations between the coefficients of the state of occupational health and safety and risk levels were established, which provides an opportunity to determine the effectiveness of the occupational health and safety management system in the future. It has been shown that the social effect when using the proposed method is 11 %.

The developed unified technique differs from the existing ones by the next proposed additional steps:

– the of hazardous and harmful production factors were proposed;

– a generalized ratio of the condition of occupational health and safety was proposed.

All of these components, in turn, will allow improving the assessment of working conditions at an enterprise and determining whether the HSE management system is functioning properly.

The developed method is useful in the development of mathematical and software modeling in occupational health and safety management. The results of the study can be used by implementing the recommendations proposed for the mining industry and other industries.

Keywords: production factors, industrial injuries, occupational diseases, occupational risk management.

References

1. Tudor, V., Denuntzio, R., Alecu, I. N., Micu, M. M., Temocico, G., Condei, R. (2014). Quality – social accountability – health and safety integrated management system audit according to the requirements of ISO 9001:2008, SA 8000:2008, OHSAS 18001:2007 and ISO 19011:2011 standards. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 14 (2), 325–330.
2. Karczewski, J. (2000). System zarzadzania bezpieczens twem pracy. Gdansk, 310.
3. Horberry, T. (2012). The Health and Safety Benefits of New Technologies in Mining: A Review and Strategy for Designing and Deploying Effective User-Centred Systems. Minerals, 2 (4), 417–425. doi: 10.3390/min2040417
4. Badri, A. (2015). The Challenge of Integrating OHS into Industrial Project Risk Management: Proposal of a Methodological Approach to Guide Future Research (Case of Mining Projects in Quebec, Canada). Minerals, 5 (4), 314–334. doi: 10.3390/min5020314
5. Badri, A., Nadeau, S., Gbodossou, A. (2011). Integration of OHS into Risk Management in an Open-Pit Mining Project in Quebec (Canada). Minerals, 1 (1), 3–29. doi: 10.3390/min1010003
6. Bao, J., Johansson, J., Zhang, J. (2017). Comprehensive Evaluation on Employee Satisfaction of Mine Occupational Health and Safety Management System Based on Improved AHP and 2-Tuple Linguistic Information. Sustainability, 9 (1), 133. doi: 10.3390/su9010133
7. Kafel, P. (2016). The place of occupational health and safety management system in the integrated management system. International Journal for Quality Research, 10 (2), 311–324.
8. Wolany, W., M. Spilka (2011). Influence of safety culture on the safety level in chosen enterprise. Journal of Achievements in Materials and Manufacturing Engineering, 49 (2), 507–513.
9. Piktushanskaya, T. E. (2009). Ocenka aposteriornogo professional'nogo riska shahterov-ugol'shchikov. Medicina truda i promyshlennaya ehkologiya, 1, 32–37.
10. Lysychenko, H. V., Zabulonov, Iu. L., Khmil, H. A. (2008). Pryrodnyi, tekhnohennyi ta ekolohichnyi ryzyky: analiz, otsinka, upravlinnia. Kyiv: Naukova dumka, 543.
11. Vodianyk, A. (2006). Ryzyky travmuvannia na pidpryiemstvakh obrobnoi promyslovosti Ukrainy, prychyny ta rekomendatsii z profilaktyky. Kyiv: NNDIOP, 43.
12. Piktushanskaya, T. E., Semenihin, V. A. (2011). Sravnitel'nyj analiz riska razvitiya professional'nyh zabolevaniy u shahterov dvuh ugledobyvayushchih regionov s razlichnymi sposobami dobychi uglya. Medicina truda i promyshlennaya ehkologiya, 12, 12–17.
13. STP 581-6.7-001-2006. SUOT. Rukovodstvo po sisteme upravleniya okhranoy truda (2006). Minsk: OAO «RPZ», 22.
14. STP SUOT 4.3.1-01-2011. Identifikatsiya opasnostey, otsenka riskov i opredeleniya mer upravleniya (2011). Minsk: Uchrezhdeniye obrazovaniya «Belorusskiy gosudarstvennyy universitet informatiki i radioelektroniki», 20.
15. Rukovodstvo po upravleniyu riskami dlya sistem informatsionnykh tekhnologiy. Rekomendatsii Natsional'nogo instituta Standartov i tekhnologiy. E-Government Competence Center. Available at: http://library.egov.ifmo.ru/sites/default/files/Risk_management.pdf
16. Murtonen, M. (2007). Ocenka riskov na rabochem meste. Tampere, 66.
17. Lys, Iu. (2016). Otsinka ryzykiv v systemi upravlinnia okhoronoiu pratsi. Systemy obrobky informatsii, 9, 193–196.
18. Zaikina, D. (2017). Cause-effect relations of occupational diseases at Kryvbas mining enterprises. Mezhdunarodnyy nauchnyy zhurnal «Internauka», 1.
19. Zaikina, D. (2017). Improving the performance of traditional occupational health and safety management system based on the use the concept for occupational hazard management. Mezhdunarodnyy nauchnyy zhurnal «Internauka», 2.
20. Kislenko, A., Veretennikov, P., Arkhilayev, M. (2007). Vliyaniye vibroakusticheskikh faktorov trudovogo protsessa na organizm rabotnika. Vestnik Altayskogo gosudarstvennogo agrarnogo universiteta, 7, 54–58.
21. Turgiyev, A., Lukovnikov, A. (2003). Okhrana truda v sel'skom khozyaystve. Moscow: Izd-y tsentr, 320.
22. Zaikina, D. P., Domnichev, M. V. (2016). Prychyny travmatyzmu ta profesiinoi zakhvoriuvanosti na hirnychykh pidpryiemstvakh Kryvbasu. Problemy ta perspektyvy rozvytku okhorony pratsi. Lviv: LDU BZhD DSUNS Ukrainy, 83–84.
23. Shvaher, N. Iu., Zaikina, D. P. (2016). Analiz profesiinoi zakhvoriuvanosti na hirnychovydobuvnykh pidpryiemstvakh Kryvbasu. Hirnychyi visnyk, 101, 88–93.
24. Shvaher, N. Iu., Zaikina, D. P. (2016). Analiz profesiinoi zakhvoriuvanosti na hirnychovydobuvnykh pidpryiemstvakh Kryvbasu. Stalyi rozvytok promyslovosti ta suspilstva, 101, 173.
25. Shvaher, N. Iu., Zaikina, D. P. (2016). Analiz system upravlinnia okhoronoiu pratsi zarubizhnykh krain. Visnyk Kryvorizkoho natsionalnoho universytetu, 41, 69–74.
26. Shvaher, N. Iu., Zaikina, D. P. (2016). Identyfikatsiia ta upravlinnia ryzykamy na promyslovykh pidpryiemstvakh, yak odyn iz metodiv polipshennia rezultativ diialnosti. Aktual'ni problemy modelyuvannya ryzykiv i zahroz vynyknennya nadzvychaynykh sytuatsiy na ob'yektakh krytychnoyi infrastruktury, 150–156.
27. Lapshin, A. E., Shapovalov, V. A., Pishchikova, E. V. (2000). Bezopasnost' i ehkonomicheskaya ocenka sostoyaniya ohrany truda na gornyh predpriyatiyah. Nauchnye chteniya «Belye nochi-2000». Sankt-Peterburg: MANEHB, 2, 119–122.

DOI: 10.15587/1729-4061.2017.101725

MODELING OF DESTRUCTION PROCESSES DURING RECYCLING OF RUBBER-TECHNICAL WASTE USING THE TECHNOLOGY OF MULTI-CONTOUR CIRCULATION PYROLYSIS (p. 28-35)

Serhiy Ryzhkov
Admiral Makarov National University of Shipbuilding, Mykolaiv, Ukraine
ORCID: http://orcid.org/0000-0001-9560-2765

Lyudmila Markina
Admiral Makarov National University of Shipbuilding, Mykolaiv, Ukraine
ORCID: http://orcid.org/0000-0003-3632-1685

Marharyta Kryva
Admiral Makarov National University of Shipbuilding, Mykolaiv, Ukraine
ORCID: http://orcid.org/0000-0001-9492-3268

We performed modeling of the processes of destruction during recycling of rubber-technical waste in line with the technology of multi-contour circulation pyrolysis. The purpose of the present

study is to develop a mathematical model for the process of thermal recycling of rubber-technical waste in line with the technology of multi-contour circulation pyrolysis.

We developed a scheme of destructive transformations of the starting mass of waste, taking into account kinetics of the process of thermal decomposition of rubber and material flows of the formed phases in the equipment.

We constructed a mathematical model of kinetic regularities and of the rate of destruction of rubber-technical waste depending on the concentration of original and resulting components. Kinetic parameters and the reaction rate are used for subsequent modeling of the recycling process and for determining the end products of waste decomposition.

Result of present research and theoretical modeling is the calculations of the concentration of gaseous and condensed substances – products of thermal decomposition of the original mass of waste, formed in the range of 450–600 °C.

Application of the given model is necessary when optimizing temperature modes of the equipment. The use of the model might be promising while creating industrial plants with a set productivity. It could also provide the possibility of recycling of different types of organic waste and their mixtures in line with the technology of multi-contour circulation pyrolysis.

Modeling that was performed justifies the reasons and foundations to control the process of repeated condensation and recirculation of heavy condensed flows of vapor and gas mixture. Therefore, if one knows the original composition of vapor and gas mixture from the reactor, it is possible to optimize cooling temperatures in contours to obtain the end product of required quality.

Keywords: thermal destruction, recycling of rubber-technical wastes, material balance, concentration of vapor and gas mixture.

References

1. Markina, L. M. (2008). Modeling research of processing organic waste by multicircuit circulatory pyrolysis obtaining alternative fuels. Collection of Scientific Publications NUS, 4, 101–109.
2. Osayi, J. I., Iyuke, S., Ogbeide, S. E. (2014). Biocrude Production through Pyrolysis of Used Tyres. Journal of Catalysts, 2014, 1–9. doi: 10.1155/2014/386371
3. Ani, F. N., Mat Nor, N. S. (2012). Microwave induced fast pyrolysis of scrap rubber tires. AIP Conference Proceedings, 1440 (1), 834–841. doi: 10.1063/1.4704294
4. Rofiqul Islam, M., Parveen, M., Haniu, H., Islam Sarker, M. R. (2010). Innovation in Pyrolysis Technology for Management of Scrap Tire: a Solution of Energyand Environment. International Journal of Environmental Science and Development, 1 (1), 89–96. doi: 10.7763/ijesd.2010.v1.18
5. Zhang, X., Wang, T., Ma, L., Chang, J. (2008). Vacuum pyrolysis of waste tires with basic additives. Waste Management, 28 (11), 2301–2310. doi: 10.1016/j.wasman.2007.10.009
6. Islam, M. N., Nahian, M. R. (2016). Improvement of Waste Tire Pyrolysis Oil and Performance Test with Diesel in CI Engine. Journal of Renewable Energy, 2016, 1–8. doi: 10.1155/2016/5137247
7. Kalitko, V. A. (2010). Steam thermolysis of tire shreds: modernization in afterburning of accompanying gas with waste steam. Journal of Engineering Physics and Thermophysics, 83 (1), 179–187. doi: 10.1007/s10891-010-0333-3
8. Kalitko, U. (2012). Waste Tire Pyrolysis Recycling with Steaming: Heat-Mass Balances & Engineering Solutions for By-Products Quality. Material Recycling – Trends and Perspectives. doi: 10.5772/31535
9. Brems, A., Baeyens, J., Vandecasteele, C., Dewil, R. (2011). Polymeric Cracking of Waste Polyethylene Terephthalate to Chemicals and Energy. Journal of the Air & Waste Management Association, 61 (7), 721–731. doi: 10.3155/1047-3289.61.7.721
10. Zaitseva, T. A. (2010). The landfill for solid domestic waste (tbo) is an anthropogenic ecological system. Research and Innovation, 4, 35–43.
11. Ryzhkov, S. S., Markina, L. M., Kryva, M. S., Hlyniana, V. V. (2015). Analysis of the main thermodynamic parameters of multistage circulation pyrolysis of organic waste. Collection of Scientific Publications NUS, 4, 104–112. doi: 10.15589/jnn20150415
12. Ryzhkov, S. S., Markina, L. M., Kryva, M. S. (2012). Features analysis of physical and chemical processes of multicircuit circulatory pyrolysis of organic waste. Collection of Scientific Publications NUS, 5-6, 125–131.
13. Aisien, F. A., Ebewele, R. O., Hymore, F. K. (2011). Mathematical Model of Sorption Kinetics of Crude Oil by Rubber Particles from Scrap Tyres. Leonardo Journal of Sciences, 18, 85–96. Available at: http://ljs.academicdirect.org/A18/085_096.pdf
14. Ryzhkov, S. S., Markina, L. M., Kryva, M. S. (2013). Research of kinetics of thermal destraction of organic waste. Ecological safety, 2, 82–88.

DOI: 10.15587/1729-4061.2017.101400

STUDY OF USING THE ANIONITES IN LOW-WASTE PROCESSES OF WATER PURIFICATION FROM PHOSPHATES (p. 36-41)

Nikolai Gomelya
National Technical University of Ukraine «Igor Sikorsky Kyiv Polytechnic Institute», Kyiv, Ukraine
ORCID: http://orcid.org/0000-0003-1165-7545

Alona Petrychenko
National Technical University of Ukraine «Igor Sikorsky Kyiv Polytechnic Institute», Kyiv, Ukraine
ORCID: http://orcid.org/0000-0002-0499-1468

Anna Trokhimenko
Admiral Makarov National university of Shipbilding, Mykolaiv, Ukraine
ORCID: http://orcid.org/0000-0002-0835-3551

Yana Martyniuk
National Technical University of Ukraine «Igor Sikorsky Kyiv Polytechnic Institute», Kyiv, Ukraine
ORCID: http://orcid.org/0000-0002-9747-969X

Among the existing methods for removing the phosphates from water, the most effective and cheap is the method of ion exchange. The advantage of this method is the possibility to process regeneration solutions with obtaining the liquid fertilizers or other useful products.

The processes of sorption of phosphates on the weak-base and strong-base anionites are investigated. We examined the dynamics of sorption of phosphates from the model solutions in the distilled and tap water depending on the form of ionite. The influence is established of the competing compounds of sulphates and chlorides in tap water on the effectiveness of removal of phosphate-anions. We explored the processes of regeneration of strong-base anionite in the phosphate and phosphate-sulfate form. The regeneration of anionite in the phosphate form was carried out with the 10 and 15 % solutions of sodium chloride and the 10 % solution of ammonium chloride. In order to regenerate anionite in the sulphate-phosphate form, the solutions of sodium chloride were used at concentration 10 %. The regeneration solutions contained sodium phosphate or ammonium phosphate, sodium phosphate-sulphate, respectively.

We established that the effective sedimentation of phosphates occurs at molar ratio $(NH_4)_3PO_4$ and $MgCl_2$ 1:1, at optimum value pH=9. The optimal dosage of magnesium chloride and the value of pH are determined. This will provide 99.99 % sedimentation of phosphates from the regeneration solutions in the form of insoluble sediment. We proposed a method for removal from the regeneration solutions of the interfering compounds of sulphates in the form of gypsum, which will make it possible to repeatedly use these solutions for the regeneration of anionite. The essence of this method is the addition of chloride calcium to the solution, resulting in gypsum falling out into the sediment. The excess of calcium is removed in the form of calcium carbonate when soda is added.

Keywords: ion exchange, anionite, selectivity, phosphate-ions, sulphate-ions, ammonium chloride, regeneration of ionite.

References

1. Cornel, P., Schaum, C. (2009). Phosphorus recovery from wastewater: needs, technologies and costs. Water Science & Technology, 59 (6), 1069. doi: 10.2166/wst.2009.045
2. Prokopchuk, O. I., Grubinko, V. V. (2013). Fosfaty u vodnykh ekosystemakh. Naukovi zapysky Ternopil's'koho natsional'noho pedahohichnoho universytetu imeni Volodymyra Hnatyuka. Ser. Biolohiya, 3 (56), 78–85.
3. Van der Perk, M. (2013). Soil and water contamination. CRC Press, 428.
4. Grady Jr, C. L., Daigger, G. T., Love, N. G., Filipe, C. D. (2011). Biological wastewater treatment. CRC Press, 1022.
5. Khentse, M., Armoes, P., Lia-Kur-Yasen, Y. (2009). Ochistka stochnykh vod. Moscow: Mir, 480.
6. Baker, R. W. (2012). Membrane technology and applications. Wiley, 588. doi: 10.1002/9781118359686
7. Seminskaya, O. O., Balakina, M. N., Kucheruk, D. D., Goncharuk, V. V. (2016). Main regularities of reverse-osmotic water purification of phosphates. Journal of Water Chemistry and Technology, 38 (1), 39–44. doi: 10.3103/s1063455x16010070
8. Trus, I. M., Gomelia, M. D., Radovenchik, V. M. (2013). Vplyv poperednogo mekhanichnogo doochyshchennia vody na efektyvnist zvorotnoosmotychnogo oprisnennia vody. Visnyk Skhidnoukrainskogo natsionalnogo universytetu imeni Volodymera Dalia, 9 (198), 197–202.
9. Bhuiyan, M. I. H., Mavinic, D. S., Koch, F. A. (2008). Phosphorus recovery from wastewater through struvite formation in fluidized bed reactors: a sustainable approach. Water Science & Technology, 57 (2), 175. doi: 10.2166/wst.2008.002
10. Gomelya, M., Trokhymenko, G., Shabliy, T. (2016). Low-waste ion exchange technology of extraction of nitrogen compounds from water. Eastern-European Journal of Enterprise Technologies, 3 (10 (81)), 18–23. doi: 10.15587/1729-4061.2016.72328
11. Trus, I. N., Gomelia, N. D., Shablii, T. A. (2014). Razdelenie khloridov I sulfatof pri ionoobmennom obezsolivanii vody. Metalurgicheskaia i gornorudnaia promyshlennost, 5, 119–122.

DOI: 10.15587/1729-4061.2017.101388

ASSESSMENT OF THE POLLUTION DEGREE OF THE DNEPR RIVER AND DEVELOPMENT OF MEASURES FOR ITS DECREASE (p. 41-49)

Aleksandr Kasimov
Ukrainian Research Institute of Metals, Kharkiv, Ukraine
State Enterprise «Ukrainian Scientific and Technical Center of Metallurgical Industry «Energostal», Kharkiv, Ukraine
ORCID: http://orcid.org/0000-0003-2882-6843

Iryna Stalinska
O. M. Beketov National University of Urban Economy in Kharkiv, Kharkiv
ORCID: http://orcid.org/0000-0003-4199-3793

Kateryna Sorokina
O. M. Beketov National University of Urban Economy in Kharkiv, Kharkiv, Ukraine
ORCID: http://orcid.org/0000-0002- 9086-6961

The basin of the Dnepr river (Ukraine) has more than 350 ponds for industrial waste water and sludge, which, in the absence of environmental protection measures, have a significant negative impact on the environment.

The results of studies to determine the degree of the negative impact of ponds for industrial waste water and sludge on the water basin of the Dnepr river were given. It is revealed that the average annual concentrations of main pollutants exceeded the maximum permissible concentrations. The connection of pollution of the water basin with the flow of filtrates and surface flows from the territory of ponds for industrial waste water and sludges was defined.

The migration path of filtrates with soluble compounds of heavy metals in soil was studied. The obtained data were used to develop the scheme of entry of heavy metal ions from industrial waste water into surface and ground waters, the volume of the pond for industrial waste water and sludge.

The analysis of measures to improve the water quality in the Dnepr river in the area of location of one of the largest metallurgical enterprises in Ukraine – "Zaporizhstal" – was carried out.

It is shown that to reduce the negative impact of waste water and sludges from the main processes of "Zaporizhstal" on the water basin of the Dnepr river, it is expedient to modernize the gas cleaning equipment of the sinter plant and hydrotechnical facilities of recirculating water supply cycle for wet gas cleaning of blast furnaces.

The necessity of performing a set of research works for studying the properties of accumulated deposits of scale in the areas of its discharge into the sludge pond with the purpose of its further utilization is proven.

Keywords: water basin protection, waste water treatment, heavy metals, sludge utilization.

References

1. Farkas, A., Erratico, C., Vigano, L. (2007). Assessment of the environmental significance of heavy metal pollution in surficial sediments of the River Po. Chemosphere, 68 (4), 761–768. doi: 10.1016/j.chemosphere.2006.12.099
2. Saleem, M., Iqbal, J., Shah, M. H. (2014). Dissolved Concentrations, Sources, and Risk Evaluation of Selected Metals in Surface Water from Mangla Lake, Pakistan. The Scientific World Journal, 2014, 1–12. doi: 10.1155/2014/948396
3. Kumar, M., Ramanathan, A., Tripathi, R., Farswan, S., Kumar, D., Bhattacharya, P. (2017). A study of trace element contamination using multivariate statistical techniques and health risk assessment in groundwater of Chhaprola Industrial Area, Gautam Buddha Nagar, Uttar Pradesh, India. Chemosphere, 166, 135–145. doi: 10.1016/j.chemosphere.2016.09.086
4. Burgass, M. J., Halpern, B. S., Nicholson, E., Milner-Gulland, E. J. (2017). Navigating uncertainty in environmental composite indicators. Ecological Indicators, 75, 268–278. doi: 10.1016/j.ecolind.2016.12.034
5. Ebrahimi, M., Gerber, E. L., Rockaway, T. D. (2017). Temporal performance assessment of wastewater treatment plants by using multivariate statistical analysis. Journal of Environmental Management, 193, 234–246. doi: 10.1016/j.jenvman.2017.02.027

6. Malik, O. A., Hsu, A., Johnson, L. A., de Sherbinin, A. (2015). A global indicator of wastewater treatment to inform the Sustainable Development Goals (SDGs). Environmental Science & Policy, 48, 172–185. doi: 10.1016/j.envsci.2015.01.005
7. Ogunkunle, C. O., Mustapha, K., Oyedeji, S., Fatoba, P. O. (2016). Assessment of metallic pollution status of surface water and aquatic macrophytes of earthen dams in Ilorin, north-central of Nigeria as indicators of environmental health. Journal of King Saud University – Science, 28 (4), 324–331. doi: 10.1016/j.jksus.2015.11.005
8. Islam, S., Islam, S., Habibullah-AL-mamun, Islam, S. A., Eaton, D. W. (2016). Total and dissolved metals in the industrial wastewater: A case study from Dhaka Metropolitan, Bangladesh. Environmental Nanotechnology, Monitoring & Management, 5, 74–80. doi: 10.1016/j.enmm.2016.04.001
9. Liao, J., Chen, J., Ru, X., Chen, J., Wu, H., Wei, C. (2017). Heavy metals in river surface sediments affected with multiple pollution sources, South China: Distribution, enrichment and source apportionment. Journal of Geochemical Exploration, 176, 9–19. doi: 10.1016/j.gexplo.2016.08.013
10. Kasimov, A. M. (2011). Osnovnye meropriyatiya po likvidacii ushcherba okruzhayushchei prirodnoi srede v raione razmeshcheniya nakopitelei othodov metallurgicheskih zavodov. Chernaya metallurgiya, 12 (1344), 70–72.
11. Kasimov, A. M. (2013). Migraciya ionov tyazhelyh i redkih metallov v pochvah vokrug zoloshlakovyh otvalov ryada ugol'nyh TEHS Ukrainy. Mater. 1X Mezinarodni vedecko-praktika Konference «Vedecky Promysl Evropskeho kontinentu-2013. 27.11.2013-05.12/2013». Praha, 75–81.
12. Lomsadze, Z., Makharadze, K., Pirtskhalava, R. (2016). The ecological problems of rivers of Georgia (the Caspian Sea basin). Annals of Agrarian Science, 14 (3), 237–242. doi: 10.1016/j.aasci.2016.08.009
13. Fu, F., Wang, Q. (2011). Removal of heavy metal ions from wastewaters: A review. Journal of Environmental Management, 92 (3), 407–418. doi: 10.1016/j.jenvman.2010.11.011
14. Angelakis, A. N., Durham, B. (2008). Water recycling and reuse in EUREAU countries: Trends and challenges. Desalination, 218 (1-3), 3–12. doi: 10.1016/j.desal.2006.07.015
15. Klemes, J. J. (2012). Industrial water recycle/reuse. Current Opinion in Chemical Engineering, 1 (3), 238–245. doi: 10.1016/j.coche.2012.03.010
16. Bratina, B., Sorgo, A., Kramberger, J., Ajdnik, U., Zemljic, L. F., Ekart, J., Safaric, R. (2016). From municipal/industrial wastewater sludge and FOG to fertilizer: A proposal for economic sustainable sludge management. Journal of Environmental Management, 183, 1009–1025. doi: 10.1016/j.jenvman.2016.09.063
17. Kasimov, A. M., Gurenko, I. V., Macevitaya, I. N. (2013). Ekologicheskie i ehkonomicheskie instrumenty sokrashcheniya ushcherba okruzhayushchei prirodnoi srede so storony nakopitelei promyshlennyh othodov. Ekologiya i promyshlennost', 1, 79–83.

DOI: 10.15587/1729-4061.2017.102393

ESTABLISHMENT OF THE MECHANISM AND FIREPROOF EFFICIENCY OF WOOD TREATED WITH AN IMPREGNATING SOLUTION AND COATINGS (p. 50-55)

Yuriy Tsapko
National University of Life and Environmental Sciences of Ukraine, Kyiv, Ukraine
V. D. Glukhovsky Scientific Research Institute for Binders and Materials
Kyiv National University of Construction and Architecture, Kyiv, Ukraine
ORCID: http://orcid.org/0000-0001-9118-6872

Aleksii Tsapko
National University of Life and Environmental Sciences of Ukraine, Kyiv, Ukraine
ORCID: http://orcid.org/0000-0003-2298-068X

Description of the behavior of fireproof means and coatings, including those swelling, in the moment of the formation of a thermal insulating structure is a special and complex task. In general, it covers both stages of the process of thermal protection: both heat transfer and subsequent swelling of the coating, which is formed during fire protection. In necessitates studying conditions for the formation of barrier to thermal conductivity and the establishment of a mechanism of fire protection from layer to a layer of coke. Given this, we examined the process of fire protection with work of an impregnating solution and at swelling of a fireproof coating. Data that we obtained revealed that the formation of volatile products under the effect of coating at high temperature occurs with the formation of noncombustible substances. We established experimentally that under the action of heat flow on the fireproof samples, intense release of inert gases occurs, as well as a reduction in the combustible, which leads to the effectiveness of fire protection in reverse order. It was found in the course of conducted tests that the intensity of the formation of noncombustible gases shifts toward elevated temperature with the formation of coked cellular material. Results of determining a swelling capacity of coating for the intumescent system demonstrated that under the influence of high-temperature flow, material combustion and weight loss of the coating is reduced by more than twice due to the formation of high-temperature compounds; in this case, the time to reach a limit temperature grows as well. A coating under the influence of high temperature forms a significant coefficient of swelling, contributes to the formation of a thermal insulating layer of coke, which prevents wood from burning, as well as the passage of high temperature to the material. In general, the efficiency of wood fire protection revealed that the goods belong to the materials that are difficult to combust, which spread the flame over surface slowly and with low smoke-generating capacity.

Keywords: protection means, fire resistance, volatile products, loss of weight, surface treatment, efficiency of protection.

Refrences

1. Tsapko, Y., Guzii, S., Remenets, M., Kravchenko, A., Tsapko, O. (2016). Evaluation of effectiveness of wood fire protection upon exposure to flame of magnesium. Eastern-European Journal of Enterprise Technologies, 4 (10 (82)), 31–36. doi: 10.15587/1729-4061.2016.73543
2. Kryvenko, P., Tsapko, Y., Guzii, S., Kravchenko, A. (2016). Determination of the effect of fillers on the intumescent ability of the organic-inorganic coatings of building constructions. Eastern-European Journal of Enterprise Technologies, 5 (10 (83)), 26–31. doi: 10.15587/1729-4061.2016.79869
3. Tsapko, J., Tsapko, A. (2017). Simulation of the phase transformation front advancement during the swelling of fire retardant coatings. Eastern-European Journal of Enterprise Technologies, 2 (11 (86)), 50–55. doi: 10.15587/1729-4061.2017.73542
4. Leonovich, A. A., Sheloumov, A. V. (2013). Sravnitel'nyy analiz ehffektivnosti ognezashchitnyh sredstv na primere drevesnyh materialov. Izv. SPbGLTU, 204, 161–171.
5. Fan, F., Xia, Z., Li, Q., Li, Z. (2013). Effects of inorganic fillers on the shear viscosity and fire retardant performance of waterborne intumescent coatings. Progress in Organic Coatings, 76 (5), 844–851. doi: 10.1016/j.porgcoat.2013.02.002
6. Timofeeva, S. V., Malyasova, A. S., Helevina, O. G. (2011). Materialy ponizhenoy pozharnoy opasnosti s pokrytiem na osnove zhidkih si-

loksanovyh kauchukov, otverzhdennyh metodom poliprisoedineniya. Pozharovzryvobezopasnost, 20 (9), 22–25.
7. Xiao, N., Zheng, X., Song, S., Pu, J. (2014). Effects of Complex Flame Retardant on the Thermal Decomposition of Natural Fiber. BioResources, 9 (3), 4924–4933. doi: 10.15376/biores.9.3.4924-4933
8. Nine, M. J., Tran, D. N. H., Tung, T. T., Kabiri, S., Losic, D. (2017). Graphene-Borate as an Efficient Fire Retardant for Cellulosic Materials with Multiple and Synergetic Modes of Action. ACS Applied Materials & Interfaces, 9 (11), 10160–10168. doi: 10.1021/acsami.7b00572
9. Antsupov, E. V., Rodivilov, S. M. (2011). Antipireny dlya poristyh materialov. Pozharovzryvobezopasnost, 20 (5), 25–32.
10. Carosio, F., Kochumalayil, J., Cuttica, F., Camino, G., Berglund, L. (2015). Oriented Clay Nanopaper from Biobased Components – Mechanisms for Superior Fire Protection Properties. ACS Applied Materials & Interfaces, 7 (10), 5847–5856. doi: 10.1021/am509058h
11. Kruger, S., Gluth, G. J. G., Watolla, M.-B., Morys, M., Haßler, D., Schartel, B. (2016). Neue Wege: Reaktive Brandschutzbeschichtungen fur Extrembedingungen. Bautechnik, 93 (8), 531–542. doi: 10.1002/bate.201600032
12. Cirpici, B. K., Wang, Y. C., Rogers, B. (2016). Assessment of the thermal conductivity of intumescent coatings in fire. Fire Safety Journal, 81, 74–84. doi: 10.1016/j.firesaf.2016.01.011

DOI: 10.15587/1729-4061.2017.101708

RESEARCH OF THE EFFECTS OF VARIOUS GASES ON CAVITATION-BASED REMOVAL OF ORGANIC POLLUTANTS FROM DISTILLERY WASTEWATER (p. 56-62)

Taras Falyk
Lviv Polytechnic National University, Lviv, Ukraine
ORCID: http://orcid.org/0000-0003-3556-8627

Liliya Shevchuk
Lviv Polytechnic National University, Lviv, Ukraine
ORCID: http://orcid.org/0000-0001-6274-0256

Irena Nykulyshyn
Lviv Polytechnic National University, Lviv, Ukraine
ORCID: http://orcid.org/0000-0002-3394-0395

Stepan Melnyk
Lviv Polytechnic National University, Lviv, Ukraine
ORCID: http://orcid.org/0000-0002-0629-9723

The tendency to preserve water resources and rationally use natural waters promotes finding new methods and improving the existing methods of wastewater treatment. Using the phenomenon of cavitation to intensify the treatment processes we have proposed saturating the cavitation zone with various gases such as nitrogen, oxygen, and the mixture of nitrogen and oxygen in the ratio of 1:1.

The study focuses on the impact of the nature of bubbled gases, both with ultrasonic treatment and without it, on the changes in the chemical oxygen demand (COD). The calculated effective rate constants for the destruction of organic compounds in distillery wastewater have proved that the highest value of 1.2 10^{-4} sec^{-1} is achieved through bubbling nitrogen in the cavitation zone. The use of nitrogen alone allows reaching the effective rate constant value of 0.7 10^{-4} sec^{-1} vs. 0.2 10^{-4} sec^{-1} in case when ultrasound is used alone. The highest degree of water treatment in cavitation conditions (63 %) is achieved in the presence of nitrogen, and the lowest (38.8 %) – of the mixture of nitrogen and oxygen in the ratio of 1:1.

The differences in the effects of various bubbled gases on distillery wastewater are revealed depending on the electronic excitation energy of water molecules and the formation rates of radicals H and HO that are strong oxidants of the process.

It is determined that the destruction of organic impurities in distillery wastewater can be described with the use of the first-order kinetic equation. The research has confirmed the synergistic effect of the joint action of cavitation and nitrogen in the distillery wastewater treatment. The study has determined the relative series of the effects of the nature of certain gases on the cavitation treatment of distillery wastewater and proved that the most effective nitrogen dioxide can increase the degree of the wastewater treatment by 46 % compared to the effect of ultrasound alone. Given the growing problem of inadequate industrial and domestic wastewater treatment, the development of innovative technologies is particularly important. The use of the proposed cavitation technology for the treatment of wastewater from distillery plants can reduce or even completely eliminate the negative impact of contaminants on the environment.

Keywords: cavitation treatment, wastewater, gas nature, chemical oxygen demand (COD), the degree of destruction of organic compounds.

Refrences

1. Dolinskyy, A. A., Avdeeva, L. Y., Zhukotskyy, E. K., Makarenko, A. A. (2014). Vykorystannya kavitaziynyh tehnologiy pry obrobzi ridkyh geterogennyh system. Naukovi prazi. Odeska nazionalna academiya harchovyh technologiy, 3 (45), 9–13.
2. Ashokkumar, M. (Ed.) (2011). Theoretical and experimental sonochemistry involving inorganic systems. Springer Science+Business Media B. V., 404. doi: 10.1007/978-90-481-3887-6
3. Oller, I., Malato, S., Sanchez-Perez, J. A. (2011). Combination of Advanced Oxidation Processes and biological treatments for wastewater decontamination—A review. Science of The Total Environment, 409 (20), 4141–4166. doi: 10.1016/j.scitotenv.2010.08.061
4. Vitenko,T. N., Gumnitskii, Ya. M. (2007). A Mechanism of the Activating Effect of Hydrodynamic Cavitation on Water. Journal of water chemistry and technology, 29 (5), 231–237.
5. Znak, Z. O., Suhatskyy, Yu. V., Mnich, R. V. (2014). Rozroblennya kavitaziyno-flotaziynogo prozesu ochyschennya stichnuh vod v aspekti realizazii suchasnyh konzepziysuntezu himiko-tehnologichnyh system. Visnyk nazionalnogo universytetu "Lvivska Politechnika", 787, 75–79.
6. Savka, I. M., Shevchuk, L. I., Nykulyshyn, I. Ye., Pikh, Z. H. (2008). Zastosuvannya ultrazvuku dlya ochyshchennya stichnykh vod z riznymy typamy zabrudnen. Visnyk natsionalnoho universytetu «Lvivska politekhnika», 609, 197–200.
7. Gultekin, I., Ince, N. H. (2008). Ultrasonic destruction of bisphenol-A: The operating parameters. Ultrasonics Sonochemistry, 15 (4), 524–529. doi: 10.1016/j.ultsonch.2007.05.005
8. Jung, Y. J., Oh, B. S., Kang, J.-W. (2008). Synergistic effect of sequential or combined use of ozone and UV radiation for the disinfection of Bacillus subtilis spores. Water Research, 42 (6-7), 1613–1621. doi: 10.1016/j.watres.2007.10.008
9. Sangave, P. C., Pandit, A. B. (2006). Ultrasound and enzyme assisted biodegradation of distillery wastewater. Journal of Environmental Management, 80 (1), 36–46. doi: 10.1016/j.jenvman.2005.08.010
10. Guo, Z., Feng, R. (2009). Ultrasonic irradiation-induced degradation of low-concentration bisphenol A in aqueous solution. Journal of Hazardous Materials, 163 (2-3), 855–860. doi: 10.1016/j.jhazmat.2008.07.038
11. Vitenko, T. M. (2009). Hidrodynamichna kavitatsiya u masoobminnykh, khimichnykh i biolohichnykh protsesakh. Ternopil: TDTU im. I. Pulyuya, 224.

12. Adhikari, U., Goliaei, A., Berkowitz, M. L. (2015). Mechanism of Membrane Poration by Shock Wave Induced Nanobubble Collapse: A Molecular Dynamics Study. The Journal of Physical Chemistry B, 119 (20), 6225–6234. doi: 10.1021/acs.jpcb.5b02218
13. Nasseri, S., Vaezi, F., Mahvi, A. H., Nabizadeh, R., Haddadi, S. (2006). Determination of the ultrasonic effectiveness in advanced waste water treatment. Iran. Journal of Environmental Health Science and Engineering, 3 (2), 109–116.
14. Deming, D., Zhen, C., Zhengchu, Y., Xiuyi, H., Lei, Z., Yang, X., Zhiyong, G., Dapeng, L. (2016). Treatment Research of Polyvinyl Alcohol Waste water by Ozone/Ultrasound Oxidation Process. Journal of Jilin University (Earth Science Edition), 46 (4), 1191–1198.
15. Mendez-Arriaga, F., Torres-Palma, R. A., Pétrier, C., Esplugas, S., Gimenez, J., Pulgarin, C. (2008). Ultrasonic treatment of water contaminated with ibuprofen. Water Research, 42 (16), 4243–4248. doi: 10.1016/j.watres.2008.05.033
16. Koval, I., Kislenko, V., Shevchuk, L., Starchevskyy, V. (2015). Kinetic regularities of the processes of accumulation and destruction of microorganisms in water at bubbling of the different gases. Chemistry & Chemical Technology, 5 (4), 463–467.
17. Predzymirska, L., Shevchuk, L. (2013). Disinfection of water with ultrasound in the atmosphere of different gases. Chemistry and Chemical Technology: Proceedings of the 3rd International Conference of Young Scientists CCT-2013, 36–37.
18. Heponiemi, A., Lassi, U. (2012). Advanced Oxidation Processes in Food Industry Wastewater Treatment – A Review. Chap. 17. Food Industrial Processes – Methods and Equipment. doi: 10.5772/33341
19. Shevchuk, L. I., Starchevskyy, V. L. (2014). Kavitatsiya. Fizychni, khimichni, biolohichni ta tekhnolohichni aspekty. Lviv: Vydavnytstvo Lvivskoyi politekhniky, 376.
20. Shevchuk, L. I., Aftanaziv, I. S., Strohan, O. I., Starchevskyy, V. L. (2013). Nyzkochastotni vibrorezonansni kavitatory. Lviv: Vydavnytstvo Lvivskoyi politekhniky, 176.

DOI: 10.15587/1729-4061.2017.102314

ASSESSMENT OF IMPROVEMENT OF ECOLOGICAL SAFETY OF POWER PLANTS BY ARRANGING THE SYSTEM OF POLLUTANT NEUTRALIZATION (p. 63-73)

Sergij Vambol
National University of Civil Protection of Ukraine, Kharkiv, Ukraine
ORCID: http://orcid.org/0000-0002-8376-9020

Viola Vambol
National University of Civil Protection of Ukraine, Kharkiv, Ukraine
ORCID: http://orcid.org/0000-0002-8229-3956

Olexandr Kondratenko
National University of Civil Protection of Ukraine, Kharkiv, Ukraine
ORCID: http://orcid.org/0000-0001-9687-0454

Yana Suchikova
Berdyansk State Pedagogical University, Berdyansk, Ukraine
ORCID: http://orcid.org/0000-0003-4537-966X

Olga Hurenko
Berdyansk State Pedagogical University, Berdyansk, Ukraine
ORCID: http://orcid.org/0000-0003-3562-7818

The purpose of the study is to determine the physical essence of numeric values of a layout factor of the particulate matter filter in the exhaust system of the diesel plant for the mathematical model of its operational efficiency. Physical essence of this factor is that it makes it possible to take into account the influence of temperature of exhaust gases of the diesel engine at the inlet to the housing of the filter, which affects the course of processes of condensation of products of incomplete combustion of fuel on particulate matters and coagulation of particulate matters themselves in the flow of exhaust gases and, as a consequence, dimensions of particulate matters. The temperature of exhaust gases in such statement varies depending on location of the filter along the exhaust tract of the diesel engine (due to processes of extension of exhaust gases flow and heat exchange with the environment), as well as by the modes of external velocity characteristic of the diesel engine. Such influence was explored experimentally at the engine test bench with the autotractor diesel engine 2Ch10.5/12. The methods of obtaining the source data for the construction of the coefficient were described. Ecological parameters of exhaust gases of the diesel engine for different locations of the filter, received by direct and indirect measurements, were approximated by the linear regression method and formed the basis for the definition of numeric values and the formula to determine layout factor of the exhaust system. We established and mathematically described quantitative and qualitative relationships between indicators of operational efficiency of the particulate matter filter and the temperature of exhaust gases of the diesel engine 2Ч10.5/12 at the inlet to the filter.

Keywords: technogenic ecological safety, diesel engine, particulate matter filter, efficiency of cleaning, nanomaterials.

Refrences

1. Mollenhauer, K., Tschoke, H. (Eds.) (2010). Handbook of Diesel Engines. Berlin: Springer-Verlag Berlin Heidelberg, 636. doi: 10.1007/978-3-540-89083-6
2. Eastwood, P. (2008). Particulate emissions from vehicles. Chichester: John Wiley & Sons Ltd., 513. doi: 10.1002/9780470986516
3. Merkisz, J., Pielecha, J., Radzimirsky, S. (2014). New trends in emission control in the European Union. Springer tracts on transportation and traffic. Vol. 4. London: Springer Int. Publ. Switzerland, 175. doi: 10.1007/978-3-319-02705-0
4. Bugarsky, A. D., Janisko, S. J., Cauda, E. G., Mischler, S. E., Noll, J. D. (2012). Controlling exposure to diesel emissions in undergroung mines. Englewood: Society for Mining, Metallurgy and Exploration Inc., 503.
5. Blanco-Rodriguez, D. (2014). Modelling and observation of exhaust gas concentration for diesel engine control. London: Springer Int. Publ, 197. doi: 10.1007/978-3-319-06737-7
6. Bari, S. (Ed.) (2013). Diesel engine – combustion, emissions and condition monitoring. Rijeka: InTech, 278. doi: 10.5772/2782
7. Resitoglu, I. A., Altinisik, K., Keskin, A. (2014). The pollutant emissions from diesel-engine vehicles and exhaust aftertreatment systems. Clean Technologies and Environmental Policy, 17 (1), 15–27. doi: 10.1007/s10098-014-0793-9
8. Johnson, T. V. (2012). SAE 2011 World Congress. Platinum Metals Review, 56 (2), 75–82. doi: 10.1595/147106712x630615
9. Johnson, T. V. (2013). SAE 2012 World Congress. Platinum Metals Review, 57 (2), 117–122. doi: 10.1595/147106713x663933
10. Gorsmann, C. (2015). SAE 2014 Heavy-Duty Diesel Emissions Control Symposium. Johnson Matthey Technology Review, 59 (2), 139–151. doi: 10.1595/205651315x687524
11. Khrypunov, G., Vambol, S., Deyneko, N., Sychikova, Y. (2016). Increasing the efficiency of film solar cells based on cadmium telluride. Eastern-European Journal of Enterprise Technologies, 6 (5 (84)), 12–18. doi: 10.15587/1729-4061.2016.85617
12. Vambol, S., Vambol, V., Sychikova, Y., Deyneko, N. (2017). Analysis of the ways to provide ecological safety for the products of nano-

technologies throughout their life cycle. Eastern-European Journal of Enterprise Technologies, 1 (10 (85)), 27–36. doi: 10.15587/1729-4061.2017.85847

13. Suchikova, Y., Kidalov, V., Sukach, G. (2010). Blue shift of photoluminescence spectrum of porous InP. ECS Transactions, 25 (24), 59–64. doi: 10.1149/1.3316113
14. Regulation No. 49. Revision 5. Uniform provision concerning the approval of compression ignition (C.I.) and natural gas (NG) engines as well as positive-ignition (P.I.) engines fuelled with liquefied petroleum gas (LPG) and vehicles equipped with C. I. and NG engines and P. I. engines fuelled with LPG, with regard to the emissions of pollutants by the engine (2011). United Nations Economic and Social Council Economics Commission for Europe Inland Transport Committee Working Party on the Construction of Vehicles. E/ECE/TRANS/505, 194.
15. Regulation No. 96. Uniform provision concerning the approval of compression ignition (C.I.) engines to be installed in agricultural and forestry tractors with the regard to the emissions of pollutants by the engine (1995). Geneva, 109.
16. Vambol, S., Strokov, O., Vambol, V., Kondratenko, O. (2015). Methodological approach to the construction of a system for managing the environmental safety of operation of power plants. Internal combustion engines, 1, 48–52.
17. Kondratenko, O., Strokov, O., Vambol', S., Avramenko, A. (2015). Mathematical model of efficiency of diesel particulate matter filter. Scientific Bulletin of National Mining University, 6, 55–61.
18. On Amendments to the Law of Ukraine "On some issues of import to the customs territory of Ukraine and registration of vehicles' relatively wheeled vehicles. The Law of Ukraine of 08.08.2012 No. 5177 (2012). Supreme Council of Ukraine, No. 36-37.
19. Juric, V., Zupanovic, D. (2012). Ecological Impacts of Diesel Engine Emissions. PROMET – Traffic&Transportation, 24 (2). doi: 10.7307/ptt.v24i2.287
20. On Approval of Regulation on ecological organization of providing SES of Ukraine (2013). Order of the SES of Ukraine. Kyiv, No. 618. Available at: http://www.dsns.gov.ua/files/2013/10/8/618.pdf
21. Samusja, V. (2007). Mobile lifting device for emergency rescue operations. Possibilities of using methods of mechanics to solve safety issues in emergency situations. Kharkiv: UCDU, 3–4.
22. Shmandij, V. M., Vambol', V. V., Kondratenko, O. M. (2016). Conceptual basis and creation of ecological safety management system of harmful aerosol suppression, which uses multiphase dispersed structures. Bulletin of the Kokshetau Technical Institute of the Ministry of Emergency Situations of the Republic of Kazakhstan, 1 (21), 55–61.
23. Vambol, V., Shmandij, V., Vambol, S., Kondratenko, O. (2015). The systematic approach to solving the problem of management of ecological safety during process of biowaste products utilization. Ecological Safety, 1 (19), 7–11. Available at: http://www.kdu.edu.ua/EKB_jurnal/2015_1(19)/PDF/7-11.pdf
24. Takasaki, M., Kurita, H., Kubota, T., Takashima, K., Hayashi, M., Mizuno, A. (2015). Electrostatic precipitation of diesel PM at reduced gas temperature. 2015 IEEE Industry Applications Society Annual Meeting. doi: 10.1109/ias.2015.7356755
25. Hebbar, G. S., Bhat, A. K. (2013). Control of NOx from a DI diesel engine with hot EGR and ethanol fumigation: An experimental investigation. International Journal of Automotive Technology, 14 (3), 333–341. doi: 10.1007/s12239-013-0037-8
26. O'Connor, J., Musculus, M. (2013). Effects of exhaust gas recirculation and load on soot in a heavy-duty optical diesel engine with close-coupled post injections for high-efficiency combustion phasing. International Journal of Engine Research, 15 (4), 421–443. doi: 10.1177/1468087413488767
27. Steiner, S., Czerwinski, J., Comte, P., Heeb, N. V., Mayer, A., Petri-Fink, A., Rothen-Rutishauser, B. (2014). Effects of an iron-based fuel-borne catalyst and a diesel particle filter on exhaust toxicity in lung cells in vitro. Analytical and Bioanalytical Chemistry, 407 (20), 5977–5986. doi: 10.1007/s00216-014-7878-5
28. Mahadevan, B. S., Johnson, J. H., Shahbakhti, M. (2017). Predicting Pressure Drop, Temperature, and Particulate Matter Distribution of a Catalyzed Diesel Particulate Filter Using a Multi-Zone Model Including Cake Permeability. Emission Control Science and Technology, 3 (2), 171–201. doi: 10.1007/s40825-017-0062-6
29. Lapuerta, M., Hernandez, J. J., Oliva, F. (2012). Strategies for active diesel particulate filter regeneration based on late injection and exhaust recirculation with different fuels. International Journal of Engine Research, 15 (2), 209–221. doi: 10.1177/1468087412468584
30. Mertzis, D., Koufodimos, G., Kavvadas, I., Samaras, Z. (2017). Applying modern automotive technology on small scale gasification systems for CHP production: A compact hot gas filtration system. Biomass and Bioenergy, 101, 9–20. doi: 10.1016/j.biombioe.2017.03.021
31. Lamotte, D., Neumann, P., Schrewe, K. (2017). Additive Based Regeneration Adjusted for Indian Low Load Driving Profiles. SAE Technical Paper Series. doi: 10.4271/2017-26-0144
32. Iwata, H., Konstandopoulos, A., Nakamura, K., Ogiso, A., Ogyu, K., Shibata, T., Ohno, K. (2015). Further Experimental Study of Asymmetric Plugging Layout on DPFs: Effect of Wall Thickness on Pressure Drop and Soot Oxidation. SAE Technical Paper Series. doi: 10.4271/2015-01-1016
33. Tronconi, E., Nova, I., Marchitti, F., Koltsakis, G., Karamitros, D., Maletic, B. et. al. (2015). Interaction of NO x Reduction and Soot Oxidation in a DPF with Cu-Zeolite SCR Coating. Emission Control Science and Technology, 1 (2), 134–151. doi: 10.1007/s40825-015-0014-y
34. Sandra, F., Ballestero, A., NGuyen, V. L., Tsampas, M. N., Vernoux, P., Balan, C. et. al. (2016). Silicon carbide-based membranes with high soot particle filtration efficiency, durability and catalytic activity for CO/HC oxidation and soot combustion. Journal of Membrane Science, 501, 79–92. doi: 10.1016/j.memsci.2015.12.015
35. Sadiktsis, I., Koegler, J. H., Benham, T., Bergvall, C., Westerholm, R. (2014). Particulate associated polycyclic aromatic hydrocarbon exhaust emissions from a portable power generator fueled with three different fuels – A comparison between petroleum diesel and two biodiesels. Fuel, 115, 573–580. doi: 10.1016/j.fuel.2013.07.062
36. Han, C. B., Jiang, T., Zhang, C., Li, X., Zhang, C., Cao, X., Wang, Z. L. (2015). Removal of Particulate Matter Emissions from a Vehicle Using a Self-Powered Triboelectric Filter. ACS Nano, 9 (12), 12552–12561. doi: 10.1021/acsnano.5b06327
37. Fino, D., Bensaid, S., Piumetti, M., Russo, N. (2016). A review on the catalytic combustion of soot in Diesel particulate filters for automotive applications: From powder catalysts to structured reactors. Applied Catalysis A: General, 509, 75–96. doi: 10.1016/j.apcata.2015.10.016
38. Nanjundaswamy, H., Nagaraju, V., Wu, Y., Koehler, E., Sappok, A., Ragaller, P., Bromberg, L. (2015). Advanced RF Particulate Filter Sensing and Controls for Efficient Aftertreatment Management and Reduced Fuel Consumption. SAE Technical Paper Series. doi: 10.4271/2015-01-0996
39. Bogarra, M., Herreros, J. M., Tsolakis, A., York, A. P. E., Millington, P. J. (2016). Study of particulate matter and gaseous emissions in gasoline direct injection engine using on-board exhaust gas fuel reforming. Applied Energy, 180, 245–255. doi: 10.1016/j.apenergy.2016.07.100
40. Millo, F., Andreata, M., Rafigh, M., Mercuri, D., Pozzi, C. (2015). Impact on vehicle fuel economy of the soot loading on diesel particu-

late filters made of different substrate materials. Energy, 86, 19–30. doi: 10.1016/j.energy.2015.03.076

41. Johansen, K., Bentzer, H., Kustov, A., Larsen, K., Janssens, T. V. W., Barfod, R. G. (2014). Integration of Vanadium and Zeolite Type SCR Functionality into DPF in Exhaust Aftertreatment Systems – Advantages and Challenges. SAE Technical Paper Series. doi: 10.4271/2014-01-1523
42. Gordon, T. D., Presto, A. A., Nguyen, N. T., Robertson, W. H., Na, K., Sahay, K. N. et. al. (2014). Secondary organic aerosol production from diesel vehicle exhaust: impact of aftertreatment, fuel chemistry and driving cycle. Atmospheric Chemistry and Physics, 14 (9), 4643–4659. doi: 10.5194/acp-14-4643-2014
43. Zvonov, V., Kornilov, G., Kozlov, A., Simonova, E. (2005). Assessment and control of dispersed particles emission with diesel exhaust gas. Moscow: Prima-Press-M, 312.
44. Vambol, S. O., Strokov, O. P., Vambol, V. V., Kondratenko, O. M. (2015). Modern methods for improving the ecological safety of power plants exploitation. Kharkiv: Styl-Izdat, 212.
45. Kondratenko, O. (2015). Mathematical model of the hydraulic resistance of the diesel particulate matter filter. Part 3: arrangement coefficient. Bulliten of the National Technical University "KhPI". Series: Mathematical Modelling in technique and Technology, 6 (1115), 29–40.
46. Parsadanov, I. (2003). Increasing of quality and competitiveness of diesel engines based on complex fuel and ecological criteria. Kharkiv: NTU "KhPI", 244.
47. Aleksandrov, A., Irharov, I., Bagrov, V. et. al. (2012). Alternative fuels for internal combustion engines. Moscow: OOO "Oniko-M", 791.

DOI: 10.15587/1729-4061.2017.102374

INVESTIGATION OF SURFACE WATER QUALITY IN MAGNITOGORSK INDUSTRIAL AREA FOR THE ENVIRONMENTAL ESTIMATION OF TECHNOGENIC WATERCOURSE STATE (p. 74-81)

Yuliya Somova
Nosov Magnitogorsk State Technical University, Magnitogorsk, Russia
ORCID: http://orcid.org/0000-0003-0856-4612

Elena Degodia
Nosov Magnitogorsk State Technical University, Magnitogorsk, Russia
ORCID: http://orcid.org/0000-0002-4220-7371

Yelena Kasatkina
Nosov Magnitogorsk State Technical University, Magnitogorsk, Russia
ORCID: http://orcid.org/0000-0003-4563-8588

Aleksey Periatinsky
Nosov Magnitogorsk State Technical University, Magnitogorsk, Russia
ORCID: http://orcid.org/0000-0003-0393-8128

Aleksandr Kudriashov
Nosov Magnitogorsk State Technical University, Magnitogorsk, Russia
ORCID: http://orcid.org/0000-0002-3614-8838

It was established that the average chemical indicators of water (ml/l) were as follows: 760 for mineralization, 73 for chlorides, 54 for sulfates, and water pH was not more than 8. Taking into account the indicators of the groundwater quality in this area, it can be said that the general pollution resistance of natural waters is low.

The main indicators characterizing quality and use of water from this source were considered. Coming of industrial effluents from ore mining and processing facilities and metallurgical production of the integrated metallurgical plant has led to a significant change in the physicochemical parameters of the aquatic environment, which limits this water use.

In general, the irrigation indices calculated in this work comply with the norms. However within the city limits (pond-cooler), water is characterized by an elevated pH (>8), which is already a limitation for the use of pond water for irrigation. It should be noted that water containing CO_2>1.5 mg-equ./l and pH>8.4 has limitations for irrigation of crops.

The obtained data are important for the use of water for the needs of population and the city-forming Magnitogorsk Metallurgical Works PJSC.

Keywords: geological structure, industrial effluents, hydrotechnical test; pH value, heavy metals, mineralization, irrigation indicators.

Refrences

1. Bobrova, Z., Ilina, O. (2010). Evaluation of the state of water in the Ural River. Theory and Technology of Metallurgical Production, 1, 165–170.
2. Khokryakov, A. V., Fadeichev, A. F., Tseytlin, E. M. (2014). Description of environmental issues of mining enterprises basing on environmental hazard index. Inzynieria Mineralna, XY (1 (33)), 283–287.
3. The Federal Law from January 10, 2002 of No. 7-Federal Law "About Environmental Protection" with changes from 25.06.2012. The State Duma. Available at: http://www.prirodnadzor.admhmao.ru/dokumenty/rf/228778/
4. Antoninova, N., Rybnikova, L., Slavikovskaya, Y., Rybnikov, P., Shubina, L. (2012). Geo-ecological assessment of land and water management in the areas of development of the natural and man-made materials Urals. Journal of Mining Science, 2, 194–200.
5. Astakhov, A., Dikolenko, E., Harchenko, V. (2006). Environmental safety and efficiency of environmental management. Moscow: MGGU publishing house, 323.
6. Tseytlin, E. (2012). Features of environmental hazard assessment of mining enterprises. Theses of the report of VII Krakow conference of young scientists. Krakow, 809–819.
7. Hohryakov, A. V., Fadeichev, A. F., Ceytlin, E. M. (2011). Dinamika izmeneniya vliyaniya vedushchih predpriyatiy Urala na okruzhayushchuyu sredu. Izvestiya vysshih uchebnyh zavedeniy. Gornyy zhurnal, 8, 44–52.
8. Bobrova, Z., Ilina, O., Studenok, G., Tseitlin, E. (2016). Impact of the enterprises of the mineral and raw materials complex of the Urals on water resources. Journal of the Ural state mining university, 1 (41), 62–66.
9. Liang, Q., Gao, R., Xi, B., Zhang, Y., Zhang, H. (2014). Long-term effects of irrigation using water from the river receiving treated industrial wastewater on soil organic carbon fractions and enzyme activities. Agricultural Water Management, 135, 100–108. doi: 10.1016/j.agwat.2014.01.003
10. Michael-Kordatou, I., Michael, C., Duan, X., He, X., Dionysiou, D. D., Mills, M. A., Fatta-Kassinos, D. (2015). Dissolved effluent organic matter: Characteristics and potential implications in wastewater treatment and reuse applications. Water Research, 77, 213–248. doi: 10.1016/j.watres.2015.03.011
11. Khandare, R. V., Govindwar, S. P. (2015). Phytoremediation of textile dyes and effluents: Current scenario and future prospects.

Biotechnology Advances, 33 (8), 1697–1714. doi: 10.1016/j.biotechadv.2015.09.003

12. Sheets, J. P., Yang, L., Ge, X., Wang, Z., Li, Y. (2015). Beyond land application: Emerging technologies for the treatment and reuse of anaerobically digested agricultural and food waste. Waste Management, 44, 94–115. doi: 10.1016/j.wasman.2015.07.037
13. Gaev, A. (1968). Hydrogeochemistry of the Urals and issues of protection of groundwater. Sverdlovsk: Ural.-in. Publishing house, 368.
14. Degody, E., Maltseva, E.; Chigisheva, O. P. (Ed.) (2013). A comprehensive assessment of the current state of the Lake Yakty-Kul region. Vol. 2. Science Today: Theory, Practice, Innovation. Rostov-on-Don: Publishing house of the International Research Center "Scientific Cooperation", 208–230.
15. Pankova, E., Aivarov, I. (1995). Environmental requirements for the quality of irrigation water. Pochvovedenie, 7, 870–878.
16. Valeev, V., Somova, Yu., Zueva, T. (2012). Research of technogenic watercourses of the Magnitogorsk industrial region. Vol. 2. Safety of vital activity in the third millennium. Chelyabinsk: ed. Tsentu-SUURU, 112–116.
17. Cherchintsev, V., Valeev, V., Somova, Yu. (2011). The study of oily sludge bottom sediments of metallurgical production. Vestnik Magnitogorskogo Gosudarstvennogo Tekhnicheskogo Universiteta im. G. I. Nosova, 2, 80–83.