ABSTRACT AND REFERENCES

ECOLOGY

ANALYSIS OF THE EFFICIENCY OF PURIFICATION OF GAS FLOWS IN A CENTRIFUGAL FILTER (p. 4-9)

Tatyana Boyko, Denis Skladanyy, Alla Abramova, Sergiy Plashykhin, Nikolai Semenyuk

Insufficient efficiency of cleaning of gas flows from particulates in existing filters necessitates research in this area. To eliminate these shortcomings, the centrifugal filter of a new design was developed.

Based on the experimental data obtained in a laboratory setup, the overall collection efficiency of particulates of different types of materials was computed.

To investigate the influence of various parameters of particulates collected on the overall collection efficiency of particulates of different types of materials, approximation as the mathematical approach was used. Based on this approach, the mathematical relationships between the evaluation of the overall collection efficiency of particulates of different materials and the diameter of particulates are developed in the form of a hyperbolic function. Such relationships are appropriate in the design and operation forecasting of filters with similar parameters, as well as in the process automation.

Evaluation of the correlation of parameters of particulates collected and relationship factors was performed. It was found that the overall collection efficiency of material particulates is affected primarily by the particulate diameter, and the material density, as reflected in the values of the factors.

Keywords: efficiency, centrifugal filter, approximation, particulate collection, dust-gas flow, separation chamber.

References

1. Biggs, S. (2006). Aggregate Structures and Solid-Liquid Separation Processes. Institute of Particle Science and Engineering. Japan.
2. Pandey, K. M., Ray, M. (2010). Experimental Studies on Hydrodynamics of a Cyclone Separator Employed in a Circulating Fluidized Bed. International Journal of Chemical Engineering and Applications, 1 (2), 123–131. doi: 10.7763/ijcea.2010.v1.21
3. Karagoz, I., Avci, A., Surmen, A., Sendogan, O. (2013). Design and performance evaluation of a new cyclone separator. Journal of Aerosol Science, 59, 57–64. doi: 10.1016/j.jaerosci.2013.01.010
4. Serebryanskyy, D. A. (2009). Purification of gases of dust in centrifugal filters. Industrial heating engineer, 2, 55–61.
5. Vaitikunas, P., Jakshtonene, I., Serebryanskyy, D. (2010). Analysis of numerical modeling the multichannel cyclone. Chemical and process engineering. 31, 635–645.
6. Shilyaev, M. I., Shilyaev, E. P. (2006) Methods of calculation of dust collector. State architectural and construction university, 385.
7. Muschelknautz, E. Trefz, M. (2006). Druckverlust and Absheidengrad in Cyclon. VDI. Warmenatlas, 6, 1–8.
8. Santana, J. D. A. M., Arnosti Jr., S., Coury, J. R. (2001). Performance of cylindrical-conical cyclones with different geometrical configurations. Brazilian Journal of Chemical Engineering, 18 (3), 1–14. doi: 10.1590/s0104-66322001000300003
9. Baltrenas, P., Vaitikunas, P., Sygal, D., Serebryanskyy, D., Jakshtonene, I. (2011). Paten LT2011041. Cylindrical multichannel cyclone. Republic of Lithuania.
10. Serebrianskyy, D. A., Semeniuk, H. V. (2013). Patent Ukrainy № 100913. Vidtsentrovyy klasyfikator. Stated from 22.03.2011 a2011 03390. Bul. № 3. Available: http://uapatents.com/4-100913-vidcentrovijj-klasifikator.html
11. Serebryanskyy, D. A., Semeniuk, M. V., Plashykhin, S. V. (2013). Research of distribution of concentration and disperse structure of firm particles in gas streams in system of channels with the closed contours. Industrial heating engineer, 35 (6), 83–92.
12. Bojko, T. V., Abramova, A. A., Serebryanskyy, D. O., Semeniuk, N. V. (2015). To a question of creation of mathematical model one-dimensional objects. Technological Audit and Production Reserves, 2/5 (22), 16–21. doi: 10.15587/2312-8372.2015.41072

JUSTIFICATION AND FORMALIZATION OF APPROACH TO REGIONAL ENVIRONMENTAL SAFETY EVALUATION (p. 9-18)

Yevhen Bezsonov, Viacheslav Andreev

The analysis of causation in the «man – nature» system is performed and their inextricable connection is proved. The approach to implementation of the concept of sustainable development with emphasis on environmental safety is proposed and justified. Human interests and needs are considered as having priority in the development process, but can be implemented only by ensuring the environmental safety of natural systems on which humanity depends entirely and an integral part of which it is. The potential and actual environmental and economic damage resulting from unsustainable use of natural resources is evaluated. Thus, beekeeping accounts for about 3 % of the gross regional product of Ukraine today, and the regression of fisheries in the Mykolaiv region is thousands of gigacalories.

The scheme for determining the potential mortality factor, which is the main indicator in the environmental safety index evaluation is proposed. The scheme describes the functional dependence of organisms on the pollutant concentration.

The study is based on the assumption that a person continues to be a central concern in the development process on the basis of tolerance towards other living beings, regardless of their value to human civilization. This approach to provision and control of environmental safety will allow more efficiently and systematically analyze the impact of the human economy on the functional stability of natural systems.

It is proved that the safety of human existence in the ecological system will be the greatest under safe living conditions for the most human impact sensitive living component of the environment. The system of regional environmental safety evaluation is based on the environmental characteristics of stenobionts and theoretical principles of the Shelford's law of tolerance and complication.

The methods for estimating the environmental safety index of abiotic and biotic components of ecosystems, the essence of which is to study the biological features of stenobionts, physical and chemical properties and parameters of the abiotic environment are proposed.

Keywords: environmental security, sustainable development, evaluation methods, formalization, ecosystem approach, environmental damage.

References

1. Budushchee, kotoroho myi khotym (2012). United Nation, Rio-de-Janeiro, 68. Available at: https://documents-dds-ny.un.org/doc/UNDOC/LTD/N12/436/90/PDF/N1243690.pdf?OpenElement
2. Preobrazovanye nasheho myra: Povestka dnia v oblasty ustoichyvoho razvytia na peryod do 2030 hoda (2015). United Nation, New York, 45. Available at: http://globalcompact.ru/files_manager/Povestka_dny_v_oblasti_ UR_do_2030.pdf
3. Pekynskaia deklaratsyia y Platforma deistvyi (1995). United Nation. Pekyn, 280. Available at: http://www.un.org

4. Alkamo, Dz. (2005). Ecosystems and human well-being: a framework for assessment. ISLAND PRESS: World Resources Institute, Washington, DC, 283. Available at: http://www.cifor.org/library/1866/ecosystems-and-human-well-being-a-framework-for-assessment/
5. Myi zhyvem ne po sredstvam: pryrodnyie bohatstva y blahosostoianye cheloveka (2005). Millennium Ecosystem Assessment, 24. Available at: http://www.millenniumassessment.org/documents/document.762.aspx.pdf
6. Millennium Ecosystem Assessment (2005). Ecosystems and Human Well_being: Desertifcation Synthesis. World Resources Institute, Washington, DC. Available at: http://www.millenniumassessment.org/documents/document.786.aspx.pdf
7. Anysymova, Y. M., Lavrovskyi, V. V. (1991). Ykhtyolohyia. 2nd edition. Moscow: Ahropromyzdat, 288.
8. Kulakov, V. V. (1997). Rybalstvo u Buzkomu Hardi ta reofilnyi ikhtiokompleks suchasnoho Pivdennoho Buhu. Veresen, 2.
9. Shcherbukha, A. Ya. (2004). Ikhtiofauna Ukrainy u retrospektyvi ta suchasni problemy zberezhennia yii riznomanittia. Visnyk zoolohii, 38 (3), 3–18.
10. Vasylev, Yu. S., Khrysanov, N. I. (1991) Ekolohyia yspolzovanyia vozobnovliaiushchykhsia enerhoystochnykov. Leningrad: Yzdatelstvo Lenynhradskoho unyversyteta, 343.
11. Human Development Report 2014: Sustaining Human Progress: Reducing Vulnerabilities and Building Resilience (2014). United Nation Development Programme, New York.
12. Millennium Ecosystem Assessment. Ecosystems and Human Well-being: Synthesis (2005). World Resources Institute, Island Press, Washington, DC, 154. Available at: http://www.millenniumassessment.org/documents/document.356.aspx.pdf
13. Dmytrenko, A. O. (2008). Derzhavne rehuliuvannia strukturnykh zrushen v ekonomitsi spriamovane na pidvyshchennia yakosti navkolyshnoho seredovyshcha. Ekolohichnyi menedzhment u zahalnii systemi upravlinnia. Tezy Vosmoi shchorichnoi Vseukrainskoi naukovoi konferentsii, 38–31.
14. Borovyk, O. N. (2012) Sutnist pravovoho zabezpechennia ekolohooriientovanoho hospodariuvannia. Naukovyi visnyk Natsionalnoho lisotekhnichnoho universytetu Ukrainy, 22.10, 72–78.
15. Povestka dnia na XXI vek (1992). United Nation, Rio-de-Janeiro. Available at: http://www.un.org/ru/documents/decl_conv/conventions/agenda21
16. Popov, V. F., Tolstykhyn, O. N. Vzaymosviaz sotsyalno-ekonomycheskykh uslovyi razvytyia obshchestva s pryorytetamy pryrodopolzovanyia. Available at: http://xreferat.com/112/779-1-vzaimosvyaz-social-no-ekonomicheskih-usloviiy-razvitiya-obshestva-s-prioritetami-prirodopol-zovaniya.html
17. Bezsonov, Ye. M. (2015). Neoantropotsentrychnyi pidkhid do zabezpechennia ekolohichnoi bezpeky ekosystemy. «Olviiskyi forum – 2015: stratehii krain Prychornomorskoho rehionu v heopolitychnomu prostori»: tezy, 2 (200), 165–167.
18. Bezsonov, Ye. M., Andrieiev, V. I. (2015). Ekolohichna skladova staloho rozvytku: obhruntuvannia priorytetnosti ta shliakhy zabezpechennia. Visnyk Vinnytskoho politekhnichnoho instytutu, 6 (123), 23–29.
19. Kharlamova, G., Nesterenko, V. (2014). Environmental security: integral assessment (case of Ukraine). Bulletin of Taras Shevchenko National University of Kyiv. Economics, 6 (159), 66–72.
20. Prokopenko, O. V., Shkola, V. Yu., Domashenko, M. D., Prokopenko, M. O. (2014). The theory and methods for investigation of the processes synchronized dealing with ecological safety within economic system. Marketing ì Menedžment Innovacìj, 5 (4), 182–191.
21. Zhu J., Tao X. (2011). Evaluation of Land Ecological Safety Based on Fuzzy Matter-Element Theory. Journal of Computers, 6 (12), 2639–2646. doi: 10.4304/jcp.6.12.2639-2646
22. Johnsa, G., Leeb, D. J., Leeworthyc, V. B., Boyerd, J., Nuttle, W. (2014). Developing economic indices to assess the human dimensions of the South Florida coastal marine ecosystem services. Ecological Indicators, 44, 69–80. doi: 10.1016/j.ecolind.2014.04.014
23. Bertolatti, D., Hannelly, T., Jansz, J. (2015). Environmental Health and Safety: Social Aspects. International Encyclopedia of the Social & Behavioral Sciences (Second Edition), 740–746. doi: 10.1016/b978-0-08-097086-8.14015-2
24. Glinskiy, V. V., Serga, L. K., Khvan, M. S. (2015). Environmental Safety of the Region: New Approach to Assessment. Procedia CIRP, 26, 30–34. doi: 10.1016/j.procir.2014.08.017
25. Gavrilidis, A. A., Ciocănea, C. M., Niţă, M. R., Onose, D. A., Năstase, I. I. (2016). Urban Landscape Quality Index – Planning Tool for Evaluating Urban Landscapes and Improving the Quality of Life. Procedia Environmental Sciences, 32, 155–167. doi: 10.1016/j.proenv.2016.03.020
26. Dobrovol's'kyj, V. V. (2005). Ekologichni znannja. Kyiv: VD «Profesional», 304.
27. Tejjar de Sharden, P. (2002). Fenomen cheloveka: Sb. ocherkov i jesse. Moscow: OOO «Izdatel'stvo ACT», 553.
28. Grabak, N. H. (2008). Energojemnist' g'runtu jak vazhlyvyj pokaznyk jogo rodjuchosti. Naukovi praci: Ekologija, 87 (74), 34–37.
29. Orlov, O. (2002). Energojemnist' gumusu jak kryterij gumusovogo stanu g'runtiv. Visnyk L'vivs'kogo universytetu. Serija biologichna, 31, 111–115.
30. Dobrovol's'kyj, V. V. (2010). Ekologichnyj ryzyk: ocinka i upravlinnja. Mykolai'v : Vydavnyctvo MDGU im. P. Mogyly, 216.
31. Pro zatverdzhennja Pravyl ljubytel's'kogo i sportyvnogo rybal'stva ta Instrukcii' pro porjadok obchyslennja ta vnesennja platezhiv za special'ne vykorystannja vodnyh zhyvyh resursiv pry zdijsnenni ljubytel's'kogo i sportyvnogo rybal'stva (1999). Nakaz Derzhavnogo komitetu rybnogo gospodarstva Ukrai'ny № 19 vid 15.02.1999. Available at: http://zakon4.rada.gov.ua/laws/show/z0269-99
32. Ob utverzhdenii pravil rybolovstva v bassejne Chernogo morja (1969). Prikaz Ministerstva rybnogo hozjajstva SSSR №402 ot 1 dekabrja 1969 goda. Available at: http://uristu.com/library/sssr/usr_7203
33. Pro zatverdzhennja limitiv ta prognoziv dopustymogo special'nogo vykorystannja vodnyh bioresursiv zagal'noderzhavnogo znachennja na 2015 rik (2014). Nakaz Ministerstva agrarnoi' polityky ta prodovol'stva Ukrai'ny № 428 vid 27.10.2014. Available at: http://zakon3.rada.gov.ua/laws/show/z1432-14
34. Ryba i moreprodukty. Tablica kalorijnosti produktov pitanija. Available at: http://health-diet.ru/base_of_food/food_1515
35. Kalorijnost' ryby i moreproduktov. Available at: http://gotovimka.ru/kalorijnost/ryba-i-moreprodukty.html
36. Zabolotnyj, V. Z., Lisec'kyj, M. F., Molodec'kyj, A. Je. (1997). Mykolai'vs'ka oblast'. Geografichnyj slovnyk-dovidnyk.
37. Regional'na dopovid' pro stan navkolyshn'ogo pryrodnogo seredovyshha u Mykolai'vs'kij oblasti za 2012 rik. Derzhavne upravlinnja ekologii' ta pryrodnyh resursiv u Mykolai'vs'kij oblasti. Available at: http://www.duecomk.gov.ua/data/nac_dop/19.pdf
38. Pronina, G. I., Korjagina, N. Ju. Jekologija i fiziologija rechnyh rakov. Moskovskoe Obshhestvo Ispytatelej Prirody. Available at: http://earthpapers.net/fiziologo-biohimicheskaya-harakteristika-rechnyh-rakov-pri-vyraschivanii-v-iskusstvennyh-usloviyah
39. Rahmanov, A. I. (2007). Rechnye raki. Soderzhanie i razvedenie. Moscow: OOO «Akvarium-Print», 48.

DEVELOPMENT OF UNIVERSAL MODEL OF KINETICS OF BIOREMEDIATION STATIONARY PROCESS WITH SUBSTRATE INHIBITION (p. 19-26)

Anna Bakhareva, Oleksii Shestopalov, Olesya Filenko, Boris Kobilyansky

The results of stationary laboratory experiments are analyzed on the basis of the specific (per unit biomass) degradation rate of environmental pollutants. The presence of substrate inhibition

for both gaseous, and water-dissolved pollutants is revealed. The phenomenological approach, which takes into account two obvious phenomena in a simple form: the contact of a microorganism with the substrate molecule and the inhibitory effect of the environment on it is applied to the analytical description of the relationship between the bio-oxidation rate and the pollution concentration. Numerical values of empirical coefficients of relationships for the investigated processes are calculated.

The differential equation, describing the kinetics of biochemical degradation at the macro-level is proposed. The macrokinetic mathematical model of bioremediation is defined as a system of two functions, quantitatively reflecting the pollutant specific oxidation rate-concentration relationship and the concentration-time relationship, and satisfying the relationship of these parameters in a differential form. The concentration-time relationship is determined in the form of both the numerical integration algorithm and the approximate formula. The relevance and versatility of the proposed model for the investigated processes are proved. The resulting model is the basis for the quantitative description of non-stationary processes in bioreactors.

Keywords: biochemical degradation, specific oxidation rate, macrokinetic model, pollution concentration, phenomenological approach, substrate inhibition.

References

1. Shareefdeen, Z., Herner, B., Webb, D., Wilson, S. (2003). Hydrogen sulfide (H2S) removal in synthetic media biofilters. Environmental Progress, 22 (3), 207–213. doi: 10.1002/ep.670220319
2. Shareefdeen, Z., Singh, A. (2005). Biotechnology for Odor and Air Pollution Control. Springer, Berlin. doi: 10.1007/b138434
3. Ménard, C., Ramirez, A. A., Heitz, M. (2013). Kinetics of simultaneous methane and toluene biofiltration in an inert packed bed. Journal of Chemical Technology & Biotechnology, 89 (4), 597–602. doi: 10.1002/jctb.4162
4. Park, S. Y., Brown, K. W., Thomas, J. C. (2004). The Use of Biofilters to Reduce Atmospheric Methane Emissions from Landfills: Part I. Biofilter Design. Water, Air, & Soil Pollution, 155 (1-4), 63–85. doi: 10.1023/b:wate.0000026522.36984.42
5. Nelson, M., Bohn, H. L. (2011). Soil-Based Biofiltration for Air Purification:Potentials for Environmental and Space LifeSupport Application. JEP, 2 (8), 1084–1094. doi: 10.4236/jep.2011.28125
6. Rojo, N., Muñoz, R., Gallastegui, G., Barona, A., Gurtubay, L., Prenafeta-Boldú, F. X., Elías, A. (2012). Carbon disulfide biofiltration: Influence of the accumulation of biodegradation products on biomass development. Journal of Chemical Technology & Biotechnology, 87 (6), 764–771. doi: 10.1002/jctb.3743
7. Rondeau, A., Mandon, A., Malhautier, L., Poly, F., Richaume, A. (2012). Biopurification of air containing a low concentration of TEX: comparison of removal efficiency using planted and non-planted biofilters. Journal of Chemical Technology & Biotechnology, 87 (6), 746–750. doi: 10.1002/jctb.3730
8. Andreasen, R. R., Nicolai, R. E., Poulsen, T. G. (2013). Pressure drop in biofilters as related to dust and biomass accumulation. Journal of Chemical Technology & Biotechnology, 88 (4), 733–733. doi: 10.1002/jctb.4049
9. Papirio, S., Villa-Gomez, D. K., Esposito, G., Pirozzi, F., Lens, P. N. L. (2013). Acid Mine Drainage Treatment in Fluidized-Bed Bioreactors by Sulfate-Reducing Bacteria: A Critical Review. Critical Reviews in Environmental Science and Technology, 43 (23), 2545–2580. doi: 10.1080/10643389.2012.694328
10. Oturan, M. A., Aaron, J.-J. (2014). Advanced Oxidation Processes in Water/Wastewater Treatment: Principles and Applications. A Review. Critical Reviews in Environmental Science and Technology, 44 (23), 2577–2641. doi: 10.1080/10643389.2013.829765
11. Zagorskis, A., Vaiškūnaitė, R. (2014). An Investigation on the Efficiency of Air Purification Using a Biofilter with Activated Bed of Different Origin. Chemical and Process Engineering, 35 (4), 435–445. doi: 10.2478/cpe-2014-0033
12. González-Sánchez, A., Arellano-García, L., Bonilla-Blancas, W., Baquerizo, G., Hernández, S., Gabriel, D., Revah, S. (2014). Kinetic Characterization by Respirometry of Volatile Organic Compound-Degrading Biofilms from Gas-Phase Biological Filters. Industrial & Engineering Chemistry Research, 53 (50), 19405–19415. doi: 10.1021/ie503327f
13. Shareefdeen, Z., Aidan, A., Ahmed, W., Khatri, M. B., Islam, M., Lecheheb, R., Shams, F. (2010). Hydrogen Sulphide Removal Using a Novel Biofilter Media. World Academy of Science, Engineering and Technology, 62, 13–16.
14. Shareefdeen, Z. M., Ahmed, W. Aidan, A. (2011). Kinetics and Modeling of H2S Removal in a Novel Biofilter. Advances in Chemical Engineering and Science, 1 (2), 72–76. doi: 10.4236/aces.2011.12012
15. Bonilla-Blancas, W., Mora, M., Revah, S., Baeza, J. A., Lafuente, J., Gamisans, X. et. al. (2015). Application of a novel respirometric methodology to characterize mass transfer and activity of H_2S-oxidizing biofilms in biotrickling filter beds. Biochemical Engineering Journal, 99, 24–34. doi: 10.1016/j.bej.2015.02.030
16. Romanovskij, Ju. M., Stepanova, N. V., Chernavskij, D. S. (2003). Matematicheskoe modelirovanie v biofizike. Moscow Izhevsk: Institut komp'juternih issledovanij, 402.
17. Veillette, M., Ramirez, A. A., Heitz, M. (2012). Biofiltration of air polluted with methane at concentration levels similar to swine slurry emissions: Influence of ammonium concentration. Journal of Environmental Science and Health, Part A, 47 (7), 1053–1064. doi: 10.1080/10934529.2012.667327
18. Surerus, V., Giordano, G., Teixeira, L. A. C. (2014). Activated sludge inhibition capacity index. Brazilian Journal of Chemical Engineering, 31 (2), 385–392. doi: 10.1590/0104-6632.20140312s00002516
19. Krichkovska, L. V., Vaskovez, L. A., Gurenko, I. V. et. al. (2014). Proektni rishennya u rozrobzi aparativ biologichnoy ochistki gazopovitryanih vikidiv. Kharkiv: NTU «KhPI», 208.
20. Bahareva, A. Yu., Shestopalov, O. V., Semenov, E. O., Bukatenko, N. O. (2015). Macrokinetic mathematical model development of biological treatment process of gasiform emissions. ScienceRise, 2/2 (7), 12–15. doi: 10.15587/2313-8416.2015.37057

IMPACT OF SOUND IRRADIATION ON CHLORELLA VULGARIS CELL METABOLISM (p. 27-31)

Natalia Golub, Igor Levtun

The urgency of the problem is to determine the parameters of the external factor, the effect of which on Chlorella vulgaris cells increases the biosynthesis of triacylglycerols – feedstock for biodiesel production without reducing the biomass growth rate. The purpose of the paper is to determine the impact of sound irradiation on Chlorella vulgaris metabolism and biomass growth. Cultivation was carried out in the Gromov 6 medium at a temperature of 18±2 °C. The effect of sound irradiation with frequencies of 5, 10, 15 and 20 kHz, power of 5 W/cm^2 on the yield of lipids and biomass is investigated. It is shown that ultrasound irradiation with a frequency of 20 kHz increases the growth of biomass by 10 % and lipids by 3 times compared to non-irradiated cells. This irradiation frequency is optimum among the studied frequencies to be used as a factor of influence for biodiesel production from Chlorella vulgaris microalgae. Irradiation with sound spectrum frequencies affects the cell metabolism towards increased biosynthesis of lipids. The specific content of the lipid fraction exceeds its content in non-irradiated cells by 1.5, 2.1 and 2 times for frequencies of 15, 10 and 5 kHz, respectively. At the same time, irradiation of microalgae cells

with frequencies of 10 and 15 kHz reduces the biomass growth by 10±1 % compared to the control sample.

Keywords: cultivation, microalgae, sound irradiation, lipids, ultrasound.

References

1. Becker, E. W. (1994) Microalgae: biotechnology and microbiology. Cambridge University Press, 301.
2. Jel'piner, I. E. (1963) Ultrazvuk. Fiziko–himicheskoe i biologicheskoe dejstvie. Moscow: Fizmatgiz, 490.
3. Malishevskij, A. O., Sanina, T. V., Alehina, N. N., Skrynnikova, Ju. V., Cheremushkina, I. V., Varnakov, A. E. (2008). Patent № 2328119 (RU), C12N13, C12N1/18, A21D8/02. Sposob aktivacii drozhzhej. № 2000124844/13, 15.01.2007; published: 10.07.2008.
4. Klomklieng, W., Prateepasen, A. (2012). Molasses fermentation to ethanol by Saccharomyces cerevisiae M30 using low ultrasonic frequency stimulation. KKU Research J.,17 (6), 950–957.
5. Al-Taee, N. E., Abood, S. A., Al-Mallah, M. K. (2013) Ultrasonic Waves Stimulate the Activity of Thymine Nucleotide Biosynthetic Enzymes, Nucleic Acids and Proteins Content of Sesamum Indicum L. Stem Calli. Pure Sciences, 39 (1), 91–97.
6. Aladjadjiyan, A. (2012) Physical Factors for Plant Growth Stimulation Improve Food Quality. Food Production – Approaches, Challenges and Tasks, 145–168. doi: 10.5772/32039
7. Hassanien, R. H., Hou, T., Li, Y., Li, B. (2014). Advances in Effects of Sound Waves on Plants. Journal of Integrative Agriculture, 13 (2), 335–348. doi: 10.1016/s2095-3119(13)60492-x
8. Chowdhury, E. K., Lim, H.-S., Bae, H. (2014) Update on the Effects of Sound Wave on Plants. The Korean Society of Plant Pathology, 20 (1), 1–5.
9. Qi, L., Teng, G., Hou, T., Zhu, B., Liu, X. (2010). Influence of Sound Wave Stimulation on the Growth of Strawberry in Sunlight Greenhouse. Computer and Computing Technologies in Agriculture III, 317, 449–454. doi: 10.1007/978-3-642-12220-0_65
10. Xiaocheng, Y., Bochu, W., Chuanren, D. (2003). Effects of sound stimulation on energy metabolism of Actinidia chinensis callus. Colloids and Surfaces B: Biointerfaces, 30 (1-2), 67–72. doi: 10.1016/s0927-7765(03)00027-4
11. Joyce, E. M., Wu, X., Mason, T. J. (2010). Effect of ultrasonic frequency and power on algae suspensions. Journal of Environmental Science and Health, Part A, 45 (7), 863–866. doi: 10.1080/10934521003709065
12. Lee, T. J., Nakano, K., Matsumara, M. (2001). Ultrasonic Irradiation for Blue-Green Algae Bloom Control. Environmental Technology, 22 (4), 383–390. doi: 10.1080/09593332208618270
13. Krehbiel, J. D., Schideman, L. C., King, D. A., Freund, J. B. (2014). Algal cell disruption using microbubbles to localize ultrasonic energy. Bioresource Technology, 173, 448–451. doi: 10.1016/j.biortech.2014.09.072
14. Ahn, C.-Y., Park, M.-H., Joung, S.-H., Kim, H.-S., Jang, K.-Y., Oh, H.-M. (2003). Growth Inhibition of Cyanobacteria by Ultrasonic Radiation: Laboratory and Enclosure Studies. Environmental Science & Technology, 37 (13), 3031–3037. doi: 10.1021/es034048z
15. Yuan, Z. (2001) Biologic Effect of Ultrasonic Radioaitom on Marine Chlorella Journal of Xiamen University. Natur. Sci., 40 (3), 653–657.
16. Choi, B., Lim, J.-H., Lee, J., Lee, T. (2013). Optimum conditions for cultivation of Chlorella sp. FC-21 using light emitting diodes. Korean Journal of Chemical Engineering, 30 (8), 1614–1619. doi: 10.1007/s11814-013-0081-0
17. Upitis, V. V. (1983). Makro– i mikrojelementy v optimizacii mineral'nogo pitanija mikrovodoroslej. Riga: Znanie, 239.
18. Men'shikov, V. V. (1987). Laboratornye metody issledovanija v klinike. Moscow: Medicina, 368.
19. Rejnhol'd, V. (1987) Dvizhenie u rastenij. Moscow: Znanie, 176.
20. GOST 13496.15–97 "Korma, Kombikorma, Kombikormova sirovina. Metodi viznachennja vmistu vil'nih zhiriv" (1997). Derzhavnyi standart Ukrainy.
21. Golub, N. B., Levtun, I. I. (2015). Pidvishhennja vmistu lipidiv u klitinah Chlorella vulgaris. Vidnovljuvana energetika, 1 (40), 86–91.

AN ENERGY-EFFICIENT AND ENVIRONMENT-FRIENDLY METHOD FOR NORMALIZING THE MICROCLIMATE IN HEATED MINESHAFT COMPARTMENTS (p. 32-39)

Daria Lapshyna

Underground mineshaft compartments with non-effective ventilation and heat output from mining facilities form an unfavourable microclimate that negatively affects the efficiency of work and the health of miners. Studies of the actual state of the microclimate conditions in the drainage units of the Kryvbas mines show that when two or three pumping units operate simultaneously, the air temperature in them reaches 36–38 °C and the air velocity fluctuates within 0.2–0.3 m/s. Removal of warm air from the pumping unit is aggravated by lack of special ventilation openings and drop of pressure at the inlet and outlet of the unit.

To solve the problem of normalizing the microclimate in underground mine compartments with operating facilities, we modelled mathematically the process of cooling with the help of a pneumatically-vortex device (PVD). The mathematical model describes changes in thermal and physical properties of the cooled air stream formed by the PVD as well as allows determining its basic parameters – long range x_{max}=34.9 m and diameter $2r_{max}$=12.58 m – and studying the temperature field of the stream. We have used the mathematical modelling to develop a program of regulating the microclimate in underground mine compartments that are provided with heat sources. The model is coded in the programming language Visual Basic for Applications Microsoft Excel and has a simple interface. The use of this program allows adjusting the parameters of the microclimate in mineshaft compartments in two modes – Airing and Cooling – with an optimal use of the compressed air and ventilation air.

The research findings presented in the article have been introduced in industrial conditions – in the pumping units of the Lenin Mine PJSC Kryvbaszalizrudkom and the Artem Mine PJSC Arselor-Mittal Kryvyi Rih (Ukraine).

Keywords: ventilation, microclimate, mathematical model of heat exchange, turbulent jet, vortex effect, cooling, compressed air.

References

1. Stupnik, M. I., Pysmennyi, S. V. (2012). Combined methods of further development of Krivbass iron ore deposits. Journal of Kryvyi Rih National University, 95 (1), 3–7.
2. Unified Rules of safety at underground mining method (1977). Moscow, USSR: Nedra, 225.
3. Lapshyn, A. E., Nemchenko, A. A., Konovalyuk, V. A., Lapshina, D. A. (2012). The heat exchange between the water of mine collectors and air. Journal of Kryvyi Rih National University, 33, 94–96.
4. Lapshyn, A. E., Nemchenko, A. A., Konovalyuk, V. A., Lapshina, D. A. (2013). Studies of air exchange in the chambers with heat sources. Journal of Kryvyi Rih National University, 34, 235–238.
5. Nemchenko, A. A., Lapshina, D. A. (2012). Microclimate normalization in the underground chambers of mines. Sustainable development of industry and society, International Conference, 252–253. doi: 10.1201/9781439833391.ch36
6. Johnson, O. S. (2006). Thermo- and psychrometric properties of intake air passing through fragmented strata. 11-th U.S./North American Mine Ventilation Symposium, 251–259.

7. Boyko, V. A., Boyko, A. V. To the question about the choice of method and means for normalizing the thermal conditions in preparatory mine workings of deep mines of Donbass in the period of their excavation. Scientific Bulletin of National mining university, 23–26.
8. Lapshyn, A. A. (2014). Industrial studies of the microclimate and the condition of mine ventilation in deep ore mines. Metallurgical and mining industry, 1, 76–79.
9. Alekseenko, S. A., Shaihlislamova, I. A. (2012). Classification of methods and means of regulation of a thermal mode in mines Sustainable development and artificial cold, 501–505.
10. Bluhm, S., von Glehn, F. (2004). Important basics of mine ventilation and cooling planning. Journal Mine Ventilation Society South Africa, 57 (1), 15–24.
11. Akande, J. M., Moshood, O. (2013). Modelling of Okaba Underground Coal Mine Ventilation System. International Journal of Engineering and Technology, 3 (7), 766–772.
12. Marx, W, von Glehn, F., Wilson, R. W. (2006). Design of energy efficient mine ventilation and cooling systems. 8th U.S./North American Mine ventilation Symposium, 641–648. doi: 10.1201/9781439833391.ch39
13. Belle, B. K. (2008). Energy savings on mine ventilation fans using 'Quick-Win' Hermit Crab Technology-A perspective. 12th U.S./North American Mine ventilation Symposium, 427–433.
14. Ratner, G., Viviers, S. (2013). Underground auxiliary ventilation monitoring and diagnostic system. The Australian Mine Ventilation Conference, 57–62.
15. Rawlins, C. (2004) Underground mine heat loads and associated reduction methodologies. Journal Mine Ventilation Society South Africa, 57 (1), 25–30.
16. Lapshyn, O. E., Lapshyn, O. O., Dengub, V. I. (2012). Patent for useful model № 71139. Lapshyn's cooling ejector. Applicant and the patentee Kryvyi Rih National University. № u201200123. applicant 04.01.2012; published 25.07.2012, 14.
17. Lapshyn, O. E., Lapshyn, O. O., Galinskyi, V. S. (2012). Patent for useful model № 71727. Lapshyn's hydraulic nozzle. Applicant and the patentee Kryvyi Rih National University. № u20111391. applicant 07.11.2011; published 10.07.2012, 13.
18. Lapshyn, O. O. Lyashenko, V. I. (2014). Improvement of efficiency of mine air cooling with use of nozzle irrigation. Non-ferrous metallurgy, 1, 8–14.
19. Lapshyn, O. O. (2014). Air cooling with use of mine water. Mining journal, 5, 13–17.
20. Alabiev, V. R. (2004). Formation of refrigerant dangerous concentrations in mines during exploitation of mine refrigeration. The ways and means of establishing a safe and healthy working conditions in coal mines, 1, 184–190.
21. Tinina, S. V. (2009). About increase of efficiency of local systems of conditioning deadlock development workings of deep mines. Geotechnical mechanics, 82, 211–219.
22. Gerasimenko, G. P. (1971) Integrated use of pneumatic energy during the mining of deep deposits. Moscow: Nedra, 7–16.
23. Ranque, G. J. (1933). Experiments on expansion in a vortex with simultaneous exhaust of hot air and cold air. J Phys Radium (Paris), 4, 112–114.
24. Perepelitsa, V. G., Tinina, S. V. (2008). To the question about the possibility of using vortex coolers in the creation of air conditioning systems deadlock deep mine workings. Geotechnical mechanics, 77, 154–159.
25. Chang, K., Li, Q., Zhou, G., Li, Q. (2011). Experimental investigation of vortex tube refrigerator with a divergent hot tube. International Journal of Refrigeration, 34 (1), 322–327. doi: 10.1016/j.ijrefrig.2010.09.001
26. Nian, L., Zheng, W., Xiaohong, H., Guangming, C. (2014) Experimental study of the Couple Characteristics of the Refrigerants and Vortex Tube. International Refrigeration and Air Conditioning Conference, 15–18.
27. Volkov, K. N., Emelyanov, V. N., Zazimko, V. A. (2013). Turbulent jet – statistical models and large vortices simulation. Moscow: Fizmatlit, 360.
28. Abramovich, G. N. (1960). The theory of turbulent jets. Moscow: Fizmatgiz, 652.

COMPARATIVE ANALYSIS OF METHODS TO MINIMIZE DUST FROM GRANITE MINE DUMPS (p. 40-46)

Oksana Tverda, Kostyantyn Tkachuk, Yuliia Davydenko

The measures to reduce the concentration of dust from the mine dump are selected. The criteria for their evaluation and factors of significance are identified to compare them and determine the method that will allow gaining the most ecological and economic effect of its implementation. The solution to this problem is possible using the method of the "best alternative in multicriteria problems". The advantage of this method is accounting of assessment criteria of dust reduction methods and their factors of significance. The research allows determining the most appropriate method to minimize dust from the mine dumps by the main criteria: economic costs, the specific consumption of the substance used, the possibility of dust collection in the air, dust emission reduction level, the maximum distance from the dump, the emergence of new harmful compounds, the possibility of use in different seasons. It is proved that the dust reduction method, which corresponds to the application of the polymer solution, and is 0.95 has the highest rate of the membership function among others.

Keywords: dust, dust control, dump, concentration, best alternative search method.

References

1. Shuvalov, Y., Il'chenkova, S., Gaspar'jan, N., Bul'bashev, A. (2004). Snizhenie pyleobrazovanija i perenosa pyli pri razrushenii gornyh porod. Gornyj informacionno-analiticheskij bjulleten', 10, 75–78.
2. Tverda, O., Vorobiov, V., Davydenko, Y. (2015). Doslidzhennia protsesu rozsiiuvannia pylu z vidvalu kar'ieru v robochii zoni ta na prylehlykh terytoriiakh. Visnyk NTUU "KPI". Seriia "Hirnytstvo", 29, 96–103.
3. Ivanov, A. (2015). Snizhenie ajerozol'nogo zagrjaznenija atmosfernogo vozduha ot proizvodstvennyh ob'ektov OAO "Kovdorskij GOK". Sankt-Peterburg, 206.
4. Domnichev, M., Nesterenko, O., Nazarenko, V., Lapshin, O. (2011). Borotba z pylinniam vidvaliv hirnychozbahachuvalnykh kombinativ. Vesnik KTU, 29, 118–121.
5. Salii, I. (2010). Pryhnichennia pyloutvorennia na shlakovykh vidvalakh hirnycho-metalurhiinykh vyrobnytstv. Vesnik KTU, 25, 136–141.
6. Salii, I. (2012). Rozrobka zasobu pryhnichennia pyloutvorennia na shlakovykh vidvalakh hirnycho-metalurhiinykh vyrobnytstv. Kyiv, 168.
7. Protsessyi obespecheniya otkryityih gornyih rabot. Available at: http://studopedia.su/9_75535_osushenie-karernih-poley-i-karerov.html (Last accessed: 29.02.2016).
8. Lesueur, D. (2011). 2 – Polymer modified bitumen emulsions (PMBEs). Woodhead. Series "Civil and Structural Engineering", 25–42.
9. Zhu, J., Birgisson, B., Kringos, N. (2014). Polymer modification of bitumen: Advances and challenges. European Polymer Journal, 54, 18–38. doi: 10.1016/j.eurpolymj.2014.02.005
10. Kovshov, V., Kovshova, O., Nikolaeva, N. Geoekologicheskiy analiz protsessa rekultivatsii narushennyih zemel i pyilepodavleniya na

karerah (na primere OAO «Mordovtsement» v Mordovii). Available at: http://www.sworld.com.ua/index.php/biology/ecology-and-biotechnology/1261-kovshov-vp-kovshova-os-nikolaeva-nv?lang=uk (Last accessed: 29.02.2016).
11. Mesyats, S., Volkova, E. (2009). Obosnovanie sposobov sohraneniya tehnogennogo mineralnogo syirya, skladirovannogo v otvalyi othodov rudoobogascheniya. Vestnik MGTU, 12 (4), 735–741.
12. Slastunov, S., Koroleva, V., Kolikov, K. (2001). Gornoe delo i okruzhayushhaya sreda. Moscow: Logos, 272.
13. Savelieva, E. (2014). Study of waste dumps impact on the adjacent areas. Teka. Commission of motorization and energetics in agriculture, 14 (2), 138–145.
14. Serbinova, L. (2013). Method for justification of measures for reducing dustiness of working areas in open cast mining works. Eastern-European Journal of Enterprise Technologies, 4/10 (64), 15–18. Available at: http://journals.uran.ua/eejet/article/view/16306/13829
15. Zajchenko, Y. (1975). Issledovanie operacij. Kyiv: the Graduate School, 320.
16. Zajchenko, O. (2014). Konspekt lekcij. Available at: http://campus.kpi.ua/tutor/index.php?mode=mob&show&file=ytsycxcldhxvhbcrwgbd (Last accessed: 12.02.2016).
17. Triantaphyllou, E. (2000). Multi-criteria Decision Making Methods: A Comparative Study (Applied Optimization). Springer, 290. doi: 10.1007/978-1-4757-3157-6
18. Tverda, O., Vorobiov, V., Davydenko, Y. (2015). Estimate the concentration of dust during excavation of the rock mass and the formation of dumps on pits. ISJ Theoretical & Applied Science, 11 (31), 1–7. doi: 10.15863/tas.2015.11.31.1
19. Spraying Systems Co (2008). A Guide to Spray Technology for Dust Control. Bulletin No. 652, 20.

RESEARCH OF EFFICIENCY OF WATER PURIFICATION-EXCHANGE RESIN FROM IRON COMPOUNDS USING MODIFIED FILTER MEDIA (p. 47-52)

Nikolai Gomelya, Mariia Tverdokhlib

Recently, the modified media have become widely used in the processes of iron removal from water. These media are based on the natural granular material with a catalytically-active surface layer, which promotes a more efficient oxidation of iron ions. However, their application raises some problems associated with restoring their oxidative capacity, reliability and duration of use.

The paper presents the results of removal of iron ions from water by catalytic oxidation. The method of modifying the filter medium for iron removal from water is developed. The efficiency of iron oxidation with the zeolite and cation-exchange resins modified with iron and manganese compounds is evaluated.

It is shown that the modified zeolite is ineffective compared to the modified cation-exchange resin Dowex Mac-3. The manganese-modified cation-exchange resin provides efficient removal of iron ions from water. The iron removal degree was initially 97 % and then gradually decreased to 86 %. The iron concentration in the treated water did not exceed 0.3 mg/dm^3. When using the iron-modified cation-exchange resin, the iron concentration decreased from 15 to 0.1–0.2 mg/dm^3. The iron removal degree was more than 99 % over a long time.

It is found that efficient iron oxidation in water occurs in the presence of sufficient oxygen, that is pre-aeration is required.

The drawback of the proposed modified media is a slight loss of oxidative capacity after filter washing.

Keywords: iron removal, oxidation, filtration, iron, cation-exchange resin, zeolite, catalyst, aeration, hydrolysis, precipitation.

References

1. Kulakov, V. V., Soshnikov, E. V., Chaikovskyi, H. P. (1998). The deironing and demanganization of ground water. Khabarovsk, 100.
2. Sogaard, E. G., Madsen, H. T. (2013). Groundwater Chemistry and Treatment: Application to Danish Waterworks. Water Treatment, InTech. Available at: http://www.intechopen.com/books/water-treatment/groundwater-chemistry-and-treatment-application-to-danish-waterworks
3. Vaaramaa, K., Lehto, J. (2003). Removal of metals and anions from drinking water by ion exchange. Desalination, 155 (2), 157–170. doi: 10.1016/s0011-9164(03)00293-5
4. Bozhenko A. M., Homelia Y. N., Omel'chuk Yu. A. (2007). The choic a mixture of ion exchangers for effective softening and iron removal of water. Collection of scientific works of the Sevastopol national University of nuclear energy and industry, 24/4, 144–149.
5. Aziz, H. A., Yusoff, M. S., Adlan, M. N., Adnan, N. H., Alias, S. (2004). Physico-chemical removal of iron from semi-aerobic landfill leachate by limestone filter. Waste Management, 24 (4), 353–358. doi: 10.1016/j.wasman.2003.10.006
6. Stepanenko, T. I. (2013). Treatment of wastewater from heavy metal ions using the reagent method with the use of the reagent lime. Automobile and road Institute: research and production collection, 1 (16), 165 –171.
7. Korchef, A., Kerkeni, I., Amor, M. B., Galland, S., Persin, F. (2009). Iron removal from aqueous solution by oxidation, precipitation and ultrafi ltration. Desalination and Water Treatment, 9 (1-3), 1–8. doi: 10.5004/dwt.2009.745
8. Honcharuk, V. V., Kavytskaia, A. A., Skyl'skaia, M. D. (2011). Nanofiltration in drinking water supply. Water Chemistry and Technology, 33, 63–94.
9. Ghosh, D., Solanki, H., Purkait, M. K. (2008). Removal of Fe(II) from tap water by electrocoagulation technique. Journal of Hazardous Materials, 155 (1-2), 135–143. doi: 10.1016/j.jhazmat.2007.11.042
10. Yurkov, S. V., Sadchykov, O. O. (2009). Iron removal water by electrocoagulation . Problems of water supply, wastewater and hydraulics: Scientific-technical collection, 12, 20–24.
11. Kulskiy, L. A. (1971). Theoretical basis and technology of water conditioning. Kyiv: Naukova Dumka, 151.
12. Zolotova, E. F., Ass, H. Yu. (1975). Water purification from iron, manganese, fluorine, and hydrogen sulfide. Moscow: Stroyizdat, 176.
13. Barloková, D., Ilavský, J. (2010). Removal of Iron and Manganese from Water Using Filtration by Natural Material. Polish J. of Environ. Stud., 19/6, 1117–1122.
14. Kalashnykova, E. H., Arutiunova, Y. Yu., Smyrnov, A. D. (2007). A study of various methods of deodorizing water with water treatment. Water supply and sanitary technique, 1, 17–24.
15. Staroverov, S. V., Yudin, R. I. (2013). Sorbents for iron removal artesian water. Scientific World. Available at: http://www.sworld.com.ua/index.php/ru/arts-architecture-and-construction-413/heat-vent-water-supply-and-sewerage-413/19723-413-1033
16. Ivanets, A. I., Kuznetsova, T. F., Woronets, E. A. (2012). Oxidation bivalent iron in water for manganese and copper oxide catalyst. Sviridovskie reading, 8, 30–36.
17. Tarasevich, Yu. I., Kulishenko, O. Yu., Ostapenko, R. V., Kravchenko, T. B. (2014). De-ironing and demanganation of artesian water at industrial water intakes in Mukacheve (Zakarpats'karegion). Reports of the National Academy of Sciences of Ukraine, 10, 136–143.
18. Sukharev, Y. I., Kuvykin, E. A. (2002). The use of glauconite deposits of the Urals in the processes of water purification from iron(II, III). Herald of the Chelyabinsk scientific center, 1, 62–66.
19. Lurie, Y. Y., Rybnikov, A. I. (1974). Chemical analysis of industrial wastewater. Moscow: Chemistry, 280.
20. Tuhaj, A. M., Sadchykov, O. O. (2013). Experimental study of iron removal from underground water on dual-bed filters. Scientific Bulletin of construction, 72, 363–369.