**Model calculations and monitoring of the stabilizer column at the industrial diesel fuel hydrodewaxing unit**

**Belinskaya Nataliya Sergeevna**

National Research Tomsk Polytechnic University

Assistant teacher at the Department of Fuel Engineering and Chemical Cybernetics

Address: 634050, Tomsk, Lenin Avenue, 30

Tel.: 8 913 116 4223; e-mail: belinskaya@tpu.ru

**Frantsina Evgeniya Vladimirovna**

National Research Tomsk Polytechnic University

Junior research associate at the Department of Fuel Engineering and Chemical Cybernetics

Address: 634050, Tomsk, Lenin Avenue, 30

Tel.: 8 (3822) 60 62 47; e-mail: evf@tpu.ru

**Zyryanova Irina Vladimirovna**

National Research Tomsk Polytechnic University

Master student at the Department of Fuel Engineering and Chemical Cybernetics

Address: 634050, г. Томск, проспект Ленина, 30

e-mail: 0909ziv@mail.ru

***Keywords:*** *catalytic dewaxing, diesel fuel, optimization, mathematical model, stabilizer column, hydrogen sulphide, corrosion.*

The paper considers the influence of technological parameters for different schemes of flows directions into the stabilizer column on the separation of hydrogen sulphide. The monitoring of stabilizer column at the dewaxing unit was carried out in order to determine the influence of flow rates of reflux and stable naphtha (as additional vapourizing agent) into the column. It was found that achieving the absence of hydrogen sulphide in the stable hydrogenate is possible by increasing the flow rate of reflux and improving the scheme of flows directions into the column. By means of model calculations and processing of results of test run at the industrial dewaxing unit the optimal modes of stabilizer column operation were determined depending on the feedstock composition. As a result of the current research the optimal scheme of flows directions into column was established.

**References**

1. Roffey P., Davies E.H. The generation of corrosion under insulation and stress corrosion cracking due to sulphide stress cracking in an austenitic stainless steel hydrocarbon gas pipeline. Engineering Failure Analysis, 2014, Vol. 44, pp. 148-157.

2. Medvedeva M.L. Corrosion and protection of the equipment at petroleum and gas processing, М.: Oil and Gas I.M. Gubkin petroleum and gas university, 2005, 312 p.

3. Belinskaya N.S., Ivanchina E.D., Ivashkina E.N., Chuzlov V.A., Faleev S.A. Mathematical modeling of the process of catalytic hydrodewaxing of atmospheric gasoil considering the interconnection of the technological scheme devices. Procedia Engineering, 2015, Vol. 113, pp. 68-72.

4. Faleev S.A., Belinskaya N.S., Ivanchina E.D., Ivashkina E.N., Frantsina E.V., Silko G.Yu. Optimization of the hydrocarbon composition of raw material on reforming and hydro-deparaffinization units by mathematical simulation. Neftepererabotka i neftehimija. Nauchno-tehnicheskie dostizhenija i peredovoj opyt, 2013, no. 10, pp. 14-18 (in Russ.).

5. Belinskaya N.S., Ivanchina E.D., Ivashkina E.N., Silko G.Yu., Frantsina E.V. Optimization of the technological mode of diesel fuel hydrodewaxing unit by the method of mathematical modelling. Izvestija vuzov. Himija i himicheskaja tehnologija, 2014, Vol. 57, no 11, pp. 90-92 (in Russ.).

6. Ivanchina E.D., Belinskaya N.S., Frantsina E.V., Popova N.V., Koshutin S.N. Mathematical modelling and optimization of diesel cuts and atmospheric gasoil catalytic dewaxing. Mir nefteproduktov. Vestnik neftjanyh kompanij, 2016, no. 6, pp. 37-46 (in Russ.).

7. Belinskaya N.S., Frantsina E.V. Kinetic model of diesel fuel manufacture. Modeli, sistemy, seti v jekonomike, tehnike, prirode i obshhestve, 2013, no. 2(6), pp. 145-149 (in Russ.).

8. GOST 17323 – 71. Engine fuel. Method for the determination of mercaptan and hydrogen sulphide sulfur content by potentiometric titration.

**Effective choice of distillation columns sequences with internal partitions**

**Pankrushina Alla Vadimovna**

Dmitry Mendeleev University of Chemical Technology of Russia,

post-graduate student of the Department of Informatics and Computer Design,

Address: Miusskaya Sq. 9, Moscow, 125047, Russia

Num. 8 (499) 978-84-11

e-mail: avpankrushina@gmail.com

**Gartman Tamas Nikolaevich**
Dmitry Mendeleev University of Chemical Technology of Russia,

doctor of technical sciences, professor, head of the Department of Informatics and Computer Design

Address: Miusskaya Sq. 9, Moscow, 125047, Russia

Num. 8 (499) 978-84-11

e-mail: gartman@muctr.ru

**Pererva Oleg Valentinovich**

JSC GNIIHTEOS,

candidate of technical sciences, older scientific employee

Address: Moscow, Highway enthusiasts, 38,

Num. 8 (495) 673-71-62,

e-mail: opererva@mail.ru

**Novikova Dina Konstantinovna**

Dmitry Mendeleev University of Chemical Technology of Russia,

PhD in Chemistry, assistant professor of the Department of Informatics and Computer Design

Address: Miusskaya Sq. 9, Moscow, 125047, Russia

Num. 8 (499) 978-84-11

e-mail: novidin@yandex.ru

**Klushin Dmitry Vitalevich**

Dmitry Mendeleev University of Chemical Technology of Russia,

candidate of technical sciences, assistant professor of the Department of Informatics and Computer Design

Address: Miusskaya Sq. 9, Moscow, 125047, Russia

Num. 8 (499) 978-84-11

e-mail: dklushin@yahoo.com

***Keywords:*** *optimal synthesis, distillation columns, complex of distillation columns, energy efficiency, criterion method calculation.*

In this paper, we propose criterion equations that allow us to make a quick program choice between the different versions of the separation of a three-component mixture based on the calculation of two inequalities. The developed criterial equations and the method of choosing the optimal separation sequence are applicable for the subsequent optimization by rigorous calculation methods of complex complexes of rectifying columns and columns with internal partitions, and also for choosing the optimal separation sequence with initial approximations for each distillation column for the subsequent strict calculation of rectification. The applicability of the proposed criterial equations is confirmed by rigorous technological calculation using the example of column complexes with direct, indirect and symmetrical separation sequences, including columns with an inner wall.

**References**

1. Khalili-Garakani A., Ivakpour J., Kasiri1 N. Three-component Distillation Columns Sequencing: Including Configurations with Divided-Wall Columns // Iranian Journal of Oil & Gas Science and Technology, Vol. 5 (2016), No. 2, pp. 66-83

2. Komissarov Yu.A., Gordeev LS, Vent DP Scientific foundations of rectification processes: In 2 vol. T. 2. Textbook for high schools / Ed. LA Serafimova. -M .: Chemistry, 2004. - 416 p. (in Russ.)

3. Frolkova AK, Khakhin LA Entropy estimation of rectification of binary mixtures for various variants of process calculation // Vestnik MITHT [Messenger of MITHT]. 2008. T. 3. № 2. P. 53-61 (in Russ.)

4. Petlyuk FB, Serafimov LA Multicomponent rectification. Theory and calculation. - Moscow: Chemistry, 1983. 303 p. (in Russ.)

5. Petlyuk FB, Platonov VM, Avetyan VS Optimal schemes of rectification multicomponent mixtures // Chim. promyshlennost [Chem. Industry]. 1966. No. 11. P. 65-69. (in Russ.)

6. Dodge BF Chemical Thermodynamics. Trans. with English. M.L. Karapetyants. Under red.V. A. Kireeva. - Moscow, Izd - inostr. met., 1950, 786 p. (in Russ.)

7. Alcantara-Avila, J. R., Cabrera-Ruiz J., Segovia-Hernandez J.G., Hernandez S., Ben-GuangRong. Controllability analysis of thermodynamically equivalent thermally coupled arrangements for quaternary distillations // Chemical engineering research and design. 2008. P. 23-37.

8. Platonov, VM and Bergo, BG, "Separation of multicomponent mixtures," Moscow, Izd. V Khimiya, 1965, 368 p. (in Russ.)

**Composition and rheological properties of ammophosphate slurry based on ore-balanced from central Kyzylkum phosphorite**

**Ortikova Safie Saidmambievna**

Institute of General and Inorganic Chemistry, Academy of Sciences of Uzbekistan, senior researcher applicant of phosphate fertilizer laboratory of IGIC AS UzR

Address: 77-а Mirzo Ulugbek, 100170, Tashkent. Office phone (99871) 262-01-02

Email: ortikova.sofiya@mail.ru

**Аlimov Umar Kadirbergenovich**

Institute of General and Inorganic Chemistry, Academy of Sciences of Uzbekistan, PhD in technics, senior researcher of phosphate fertilizer laboratory of IGIC AS UzR

Address: 77-а Mirzo Ulugbek, 100170, Tashkent. Office phone (99871) 262-01-02

Email: igic@rambler.ru

**Namazov Shafoat Sattarovich**

Institute of General and Inorganic Chemistry, Academy of Sciences of Uzbekistan, Doctor of Science, Professor, head of phosphate fertilizer laboratory of IGIC AS UzR

Address: 77-а Mirzo Ulugbek, 100170, Tashkent. Office phone (99871) 262-01-02

Email: igic@rambler.ru

***Keywords:*** *wet process phosphoric acid, ore-balanced, composition, density and viscosity.*

There have been the composition and rheological properties (density and viscosity) both unevaporated and evaporated ammophosphate slurry obtained on a basis of the mineralized mass from Central Kyzylkum phosphorite by wet-process phosphoric acid subsequent separation of calcium-phosphate slurry into solid and liquid phases then ammonization the latte up to pH 4.0-4.5. The results of chemical analysis on composition determination of both type of ammoniated slurry show that total and acceptable form of Р2О5 on 2 % solution of citric acid in them are from 8.83 tо 13.84; from 8.83 to 13.65 and from 23.80 tо 28.00; from 23.48 tо 28.0 respectively. It was established that effect of wet-phosphoric acid rate, pH and temperature on debsity and viscosity of unevaporated and evaporated ammophosphate slurry. It was shown that data obtained on rheological properties evidence about possibility of the ammophosphate slurry pump from one apparatus to another without difficulty.

**References**

1. Syomkin V.I. Obtaining mineral fertilizers prolonged action of Karatau phosphorite. PhD thesis in techniques sciences, 1990. 19 p. (in Russ.).

2. Sattarov T.A. Development of ammophosphate fertilizers technology based on Central Kyzylkum phosphorites. PhD thesis in techniques sciences. Tashkent, 2008. 25 p. (in Russ.).

3. U.К.Аlimov, S.S.Ortikova, Sh.S.Namazov, A.M.Reymov, D.A.Kaymakova Rational approach for decision of processing ore-balanced from Central Kyzylkum phosphorites on ammophosphate fertilizers. Uzbekskiy himicheskiy zhurnal [ Uzbek Chemical Journal], 2015, no. 5, pp. 56-60 (in Russ.).

4. Ortikova S.S., Аlimov U.К., Namazov Sh.S., Seytnazarov А.R., Beglov B.М. Phosphoric and nitrogen-phosphate-calcium fertilizers obtained by phosphoric acid processing of ore-balanced from Central Kyzylkum phosphorite. Himicheskaya promishlennost segodnya [Chemical Industry today], 2016, no. 11, pp. 13-21 (in Russ.).

5.Vinnik M.M., Erbanova L.N., Zaytsev P.M. Methods of analysis of phosphate raw, phosphorus and complex fertilizers, feed phosphates.// M.: Chimiya, 1975. (in Russ.).

6. Evdokimova L.I., Novikov N.I., Trutnev N.V., Kononov А.V. Effect of impurities containing in wet-phosphoric acid on pH of ammonium phosphate. Himicheskaya promishlennost [Chemical Industry], 1983, no. 12, pp. 728-729 (in Russ.).

7. Kononov А.V., Trutneva N.V., Evdokimova L.I. Effect of mole ration of NH3: H3PO4 on viscosity of ammonium phosphate slurry. Himicheskaya promishlennost [Chemical Industry], 1982, no. 12, pp. 729-731 (in Russ.).

8. Kononov A.V., Sterlin V.N., Evdokimova L.I. Bases of technology of complex fertilizer.// М.: Chimya, 1988. 320 p. (in Russ.).

**Physicochemical and commodity property of complex nitrogen-phosphorus-calcium-sulphur containing fertilizer**

**Ortikova Safie Saidmambievna**

Institute of General and Inorganic Chemistry, Academy of Sciences of Uzbekistan, senior researcher applicant of phosphate fertilizer laboratory of IGIC AS UzR

Address: 77-а Mirzo Ulugbek, 100170, Tashkent. Office phone (99871) 262-01-02

Email: ortikova.sofiya@mail.ru

**Аlimov Umar Kadirbergenovich**

Institute of General and Inorganic Chemistry, Academy of Sciences of Uzbekistan, PhD in technics, senior researcher of phosphate fertilizer laboratory of IGIC AS UzR

Address: 77-а Mirzo Ulugbek, 100170, Tashkent. Office phone (99871) 262-01-02

Email: igic@rambler.ru

**Badalova Oydinа Abdukahharovna**

Institute of General and Inorganic Chemistry, Academy of Sciences of Uzbekistan, junior researcher of phosphate fertilizer laboratory of IGIC AS UzR

Address: 77-а Mirzo Ulugbek, 100170, Tashkent. Office phone (99871) 262-01-02

Email: igic@rambler.ru

**Namazov Shafаat Sattarovich**

Institute of General and Inorganic Chemistry, Academy of Sciences of Uzbekistan, Doctor of Science, Professor, head of phosphate fertilizer laboratory of IGIC AS UzR

Address: 77-а Mirzo Ulugbek, 100170, Tashkent. Office phone (99871) 262-01-02

Email: igic@rambler.ru

***Keywords:*** *NPSCa – fertilizer, hygroscopic point, sorption kinetics of water vapour, ore-balanced, wet-processing phosphoric acid and sulphuric acid.*

In this study scientific data on investigation of hygroscopic point, sorption kinetics of water vapour and sorption capacity of granular nitrogen-phosphorus-sulphur-calcium containing (NPSCa) fertilizer based on interaction ore-balanced from Central Kyzylkum phosphorite by partially ammoniated mixes of phosphoric and sulphuric acids have been formulated. Fertilizer with initial moisture from 1.12 to 1.92% and static strength in a range of 2.38-3.92 МPа is characterized rather friability. It was established that hygroscopic point of granular fertilizer is fluctuated in ranges of 68.61-75.26%. There has been shown the fertilizer having hygroscopic point on scale of Pestov N.E. is bibulous and weak bibulous substances. The value of sorption capacity of experimental models of complex fertilizer is varied in a range from 9.82 to 16.52% maintaining at that its shape and friability. The fertilizers with that figures rather quite suitable for bulk storage during the all year and handling for long way.

**References**

1. Beglov B.M., Namazov Sh.S. Phosphorite from Central Kyzylkum and their processing. Tashkent: AN RUz, 2013. 460 p. (in Russ.).

2. Pryanishnikov D.N. Agricultural chemistry. Selected works. V 1. М.: Selhozgiz, 1952. 692 p. (in Russ.).

3. Kopeykina A.N. Value of secondary elements for agriculture crops. Himicheskaya promyishlennost` za rubezhom [Chemical Industry the abroad] , 1984, no. 1, pp. 26-44 (in Russ.).

4. Magnickiy K.P. Calcium feeding plant. Agrohimiya [Agricultural chemistry ], 1969, no. 12, pp. 129 – 140 (in Russ.).

5. Badalova O.A., Ortikova S.S., Namazov SH.S., Seytnazarov A.R., Beglov B.M. NPSCa-fertilizers based on interaction of ore-balanced of Central Kyzylkum phosphorite by partially ammoniated mixes phosphoric and sulphuric acidsт. Uzbekskiy himicheskiy zhurnal [Uzbek Chemical Journal], 2016, no. 6, pp. 22-32 (in Russ.).

6. GOST 20851.4-75. Fertilizer mineral. Tests on water determination. М.: IPK izdatel`stvo standartov, 2000. 6 p. (in Russ.).

7. GOST 21560.2-82. Fertilizer mineral. Tests. М.: Gosstandart, 1982. 30 p. (in Russ.).

8. Pestov N.E. Physicochemical properties granular and powder chemical products. М.: AN SSSR, 1947. 239 p. (in Russ.).

9. Pozin M.E., Kopyilyov B.A., Tumarkina E.S., Bel`chenko G.V. Handbook for practical activity on inorganic chemistry technology. L.: Goshimizdat, 1963. 376 p. (in Russ.).

**Kinetics constant of phosphoric acid decomposition of phosphorite powder from central Kyzylkum**

**Аlimov Umarbek Kadirbergenovich**

Institute of General and Inorganic Chemistry, Academy of Sciences of Uzbekistan, PhD in technics, senior researcher of phosphate fertilizer laboratory of IGIC AS UzR

Address: 77-а Mirzo Ulugbek, 100170, Tashkent. Office phone (99871) 262-01-02

Email: igic@rambler.ru

**Tadjiev Sayfitdin Muhitdinovich**

Institute of General and Inorganic Chemistry, Academy of Sciences of Uzbekistan, PhD in chemistry, head of complex fertilizer laboratory of IGIC AS UzR

Address: 77-а Mirzo Ulugbek, 100170, Tashkent. Office phone (99871) 262-01-02

Email: sayf 48@rambler.ru

**Namazov Shafаat Sattarovich**

Institute of General and Inorganic Chemistry, Academy of Sciences of Uzbekistan, Doctor of Science, Professor, head of phosphate fertilizer laboratory of IGIC AS UzR

Address: 77-а Mirzo Ulugbek, 100170, Tashkent. Office phone (99871) 262-01-02

Email: igic@rambler.ru

***Keywords:*** *phosphorite powder, wet-process phosphoric acid, decomposition kinetics, reaction rate constant, activation energy.*

In this article there have been the results of laboratory researches on study of decomposition kinetics of Kyzylkum phosphorite powder by wet-process phosphoric acid containing various concentration (35,69; 41,20; 44,98% Р2О5) with high norm and at temperature in 5-120 minutes. It is shown that maximal decomposition coefficient of phosphorite powder (Kdec. 99.95%) leads when using phosphoric acid with 35.69% of Р2О5. On a basis of Arrhenius there were derived the equations for optimal condition of phosphorite powder decomposition by phosphoric acid made by Central Kyzylkum phosphorite. Reaction rate kinetics and apparent energy activation for decomposition process have been investigated depending upon decomposition coefficient. It was established that high calcareous containing Central Kyzylkum phosphorites decomposed with optimal temperature and concentration condition have low apparent energy activation in ranges 11.62 – 15.23 кJ/mole.

**References**

1. Fedyanin S.N. Quality management of phosphorite in flow mining.// Transaction of Republic scientific and technical conference “Actual problems of chemical processing Central Kyzylkum phosphorite”, Tashkent, 2006, pp. 17-20 (in Russ.).

2. Hohlov А.V. Geography of world phosphate industry. // M.: Vlant, 2001. 41p.

3. Bliskovskiy V.Z., Mager V.O. Specifics of material composition of ore from Jeroy-Sardara deposits affecting on enrichment technology. // Technological mineralogy of phosphate ore, thesis of meeting report. On 17-18 November 1987, Cherkassy, 1987, pp. 42-43 (in Russ.).

4. Moldabekov Sh.M., Zhantasov K.T., Zhailmoldaeva Zh.K., Altyibaev Zh.M., Balabekov O.S., Koblanova O.O. Kinetics of decomposition of low-quality phosphorites by phosphoric acid and production of double superphosphate by cyclic method. //Sovremennyie naukoemkie tehnologii [Modern innovation technology], 2013, no.11, pp.107-112 (in Russ.).

5. Myirzahmetova B.B., Besterekov U.B., Petropavlovskiy I.A., Pochitalkina I.A., Kiselev V.G. Kinetics pattern of low-grade phosphorite decomposition by liquid way in condition of mother solution recycle. // Himicheskaya promishlennost segodnya [Chemical Industry today], 2012, no.5, pp.6-9 (in Russ.).

6. Petropavlovskiy I.A., Pochitalkina I.A., Kiselev V.G., Ahnazarova S.L., Myirzahmetova B.B. Production of mono basic calcium phosphate from lean phosphate raw material by liquid phases return way. // Himicheskaya tehnologiya [Chemical technology], 2012, no.8, pp.453-456 (in Russ.).

7. Klimenko R.N., Toshinskiy V.I., Dudka S.V. Kinetics of acid digestion of Syrian phosphorites. // Biсник ЧДТУ, 2010, no. 2, pp. 159-162 (in Russ.).

8. Research institute on fertilizers and insectofungicide named after Y.N.Samoylov NPO “Minfertilizer”, statement “Develop technology and settle industrial production novel type of nitrogen-phosphate – ammophosphate”. //Moscow, 1984. 91p. (in Russ.).

9. Purification Phosphoric Acid. Technical Information Bulletin. 2012. 29 р.

10. Pozin M.E. Technology of mineral salts. Volume 2. // L.: Chimiya, 1974. 1556 p. (in Russ.)

11. Shapkin M.A., Zavertyaeva T.I., Zinyuk R.Yu., Guller B.D. Double superphosphate: Technology and application. // L.: Chimiya, 1987. 216 p. (in Russ.)

12. Zuraev M.T. Double superphosphate based on Central Kyzylkum phosphorites: Thesis abstract. Tashkent, 1999. (in Russ.)

13. Turdialieva Sh.I., Alimov U.K., Namazov Sh.S. Concentration of Kyzylkum wet-process phosphoric acid and its rheological properties.// Himiya i himicheskaya tehnologiya [Chmical and chemical engineering], 2013, no.1, pp. 6-9 (in Russ.).

14. Alimov U.K., Namazov Sh.S., Reymov A.M. Нетрадиционный способ переработки фосфоритов Центральных Кызылкумов в стандартные удобрения. // Himicheskaya promishlennost [Chemical Industry], 2014, v. 91, no. 8, pp. 377-387 (in Russ.).

15. Alimov U.K., Namazov Sh.S., Seytnazarov A.R., Beglov B.M. Cyclic way of double superphosphate production from Central Kyzylkum phosphorites. // Himicheskaya promishlennost [Chemical Industry], 2013, v. 90, no. 8, pp. 375-381 (in Russ.).

16. Alimov U.K., Namazov Sh.S., Seytnazarov A.R., Reymov A.M. Investigation of double superphosphate production from Central Kyzylkum low-grade phosphorite. // Himicheskaya promishlennost [Chemical Industry], 2014, v. 91, no. 7, pp. 323-332 (in Russ.).

17. Rustamov H.R., Nurillaev Sh.P. Physical chemistry.// Tashkent: Science and technology, 2011. 376 p. (in Russ.).

18. Rabinovich V.A., Havin Z.Ya. Краткий химический справочник.// L.: Chimiya, 3-publishing revised and supplemented, 1991. 432 p. (in Russ.).

19. Semiohin I.A., Strahov B.V., Osipov A.I. Kinetics chemical reaction. // М.: Moscow state university, 1986. 232 p. (in Russ.).

20. Shamaev B.Ye. Processing Central Kyzylkum phosphorite by wet-processing phosphoric acid on phosphorus containing fertilizers: Thesis abstract. Tashkent, 2007. (in Russ.)

21. Ospanov H.K. Physicochemical basis of selective dissolution of minerals. // М.: Nedra, 1993. 175p. (in Russ.).

22. Amirova A.M. Complex fertilizer based on acid processing phosphate raw from Central Asian region and potassium chloride: Doctor Thesis abstract. Tashkent, 1993. (in Russ.).

**Simulation of hydrodynamic processes in a layer of a regular packing**

**Andreenko Matvey Viktorovich**, Angarsk State Technical University, graduate student of «Machinery and equip-ment of chemical plants»

665835, Irkutsk region, Angarsk, Str. Tchaikovsky, 60.

Tel.: 8-3955-678335

**Balchugov Alexey Valerevich**, Angarsk State Technical University, graduate student of «Machinery and equipment of chemical plants»

665835, Irkutsk region, Angarsk, Str. Tchaikovsky, 60.

Tel.: 8-3955-678335; e-mail: balchug@mail.ru

**Badenikov Artem Viktorovich**, Angarsk State Technical University, rector, professor. 665835, Irkutsk region, Angarsk, Str. Tchaikovsky, 60. Tel. 8-3955-671832; e-mail: rector@angtu.ru

***Keywords:*** *regular packing contact device, gas-liquid system, hydrodynamics, mathematical modeling, relative gas velocity.*

With the help of mathematical modeling of hydrodynamic processes in the layer of a shock-spray packing, the conditions under which there is a change in the hydrodynamic regimes of the interaction of gas and liquid are determined. It is shown that at the initial velocity of the liquid jet *w0* = 0.18-0.63 m/s and the relative gas velocity 7.0-8.3 m/s, a regime is formed in which the liquid jet under the influence of the gas head assumes a horizontal position. An increase in the gas velocity above 7.0-8.3 m/s leads to a curvature of the liquid jet and, as a consequence, to flooding the packing layer. It is established that the nature of the interaction of gas and liquid in the layer of the shock-spray packing depends on the initial velocity of the fluid, the relative gas velocity and the velocity of impact of the liquid jet against the wall of the packing section. An experimental verification of the reliability of the mathematical model is performed.

**References**

1. Andreenko M.V., Balchugov A.V., Kuzora I.E. Hydrodynamics shock-spray packing. Himicheskaya promyshlennost' segodnya. [Chemical industry today], 2016, no. 11, pp. 39-48 (in Russ.).

2. Balchugov A.V., Andreenko M.V., Badenikov A.V., Kuzora I.E. Regular packing for heat and mass transfer processes. RF № 2602118. Byull. №31. 10.11.2016. (in Russ.).

3. Pushnov A.S., Mikulenok I.O., Sevryukov A.S., Berengarten M.G. Classification structural attachments column apparatuses and classification methods in these processes, heat and mass transfer. Himicheskaya tekhnologiya [Chemical technology], 2014, no. 4, pp. 244-250 (in Russ.).

4. Shapovalov V.M. On the form of a free jet of a heavy dropping liquid in a gas flow. Izvestiya VolgGTU. [Bulletin of Volgograd State Technical University], 2013, no. 1 (104), pp. 58-61.

5. Ramm V.M. Absorption of gases. M.: RGB, 2009, p. 655 (in Russ.).

**Evalution of the effect of back mixing of the drying agent on technological and geometric parameters of a drum dryer**

**Golovanchikov Alexander Borisovich**
Volgograd State Technical University, Doctor of Technical Sciences, Professor, the head of the Department of the processes and devices of chemical and food industries.
400005, Volgograd, Lenina ave., 28, Volgograd State Technical University, Department "PAHPP"
Phone number: (8442) 24-84-31
E-mail: [pahp@vstu.ru](https://vk.com/write?email=pahp@vstu.ru)

**Merentsov Nikolay Anatolyevich**
Volgograd State Technical University, Ph.D., Associate Professor at the Department of processes and devices of chemical and food industries
400005, Volgograd, Lenina ave., 28, Volgograd State Technical University, Department "PAHPP"
Phone number: (8442) 24-84-31
E-mail: [pahp@vstu.ru](https://vk.com/write?email=pahp@vstu.ru), steeple@mail.ru
**Balashov Vyacheslav Alexandrovich**
Volgograd State Technical University, Ph.D., Associate Professor at the Department of processes and devices of chemical and food industries
400005, Volgograd, Lenina ave., 28, Volgograd State Technical University, Department "PAHPP"
Phone number: (8442) 24-84-31
E-mail: [pahp@vstu.ru](https://vk.com/write?email=pahp@vstu.ru)

***Keywords****: ideal displacement, backmixing, longitudinal diffusion, Peclet number, relative dryer agent moisture content.*

In this study it was proposed analytical equations of operational line and mass transfer for reel dryer with diffusion flow over dryer agent structure were derived. Longitudinal diffusion calculation algorithm. The algorithm considers Peclet number. The technological and geometrical parameters of reel dryer with considered flow structure were compared with traditional reel dryer with ideal displacement over two phases. The analogy of the results of the calculation of the drying process in a drum dryer by using a heat and mass transfer apparatus and a chemical reactor was considered. It was showed that the moisture content leap at the inlet of the drum and the nonlinearity of working line, which increases the number of transfer units and reduce the average driving force for mass transfer process are affect the necessity to increase the length of the drum dryer.

**References**

1. Lykov M.V. Drying in chemical industry. M.: Chimia, 1976. 432 p. (in Russ.)

2. Kasatkin A.G. Basic processes and apparatuses of chemical technology. M.: Alliance, 2008. 752 p. (in Russ.)

3. Pavlov K.F. Examples and problems in the course of processes and apparatuses of chemical technology. M.: Alliance, 2013. 576 p. (in Russ.)

4. Dytnersky Y.I. Basic processes and apparatuses of chemical technology: a manual for design. M.: Alliance, 2008. 493 p. (in Russ.)

5. Timonin A.S. Machines and equipment of chemical plants: textbook for universities. Kaluga: Noosphere, 2014. 872 p. (in Russ.)

6. Levenshpil O. Engineering design of chemical processes. M.: Chimia, 1969. 624 p. (in Russ.)

7. Kafarov V.V. Methods of Cybernetics in chemistry and chemical technology. M.: Chimia, 1985. 448 p. (in Russ.)

8. Ramm V.M. Absorption of gases. M.: Chimia, 1976. 656 p. (in Russ.)

9. Golovanchikov A.B., Simonov B.V. The use of computers in chemical technology and ecology. Part 4. Mass-transfer processes. Volgograd.: VSTU, 1997. 117 p. (in Russ.)

10. Ginzburg A.S., Gromov M.A., Krasovskaja G.I. Thermophysical characteristics of food products. M.: Pishevaya promyshlennost, 1980. 288 p. (in Russ.)

11. Frolov V.F. Modeling drying of dispersed materials. L.: Chimia, 1987. 208 p. (in Russ.)

12.Vygodskij M.J. Reference book on higher mathematics. M.: Science, 1966. 424 p. (in Russ.)