**Сonversion technologies of chlorine-free water-soluble complex fertilizers production**

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**Keywords:** chlorine-free fertilizers, conversion, ammonium nitrate, potassium-ammonium phosphate, potassium chloride, technological scheme.

The paper dwells upon the relevant issue of obtaining water-soluble chlorine-free complex fertilizers based on technical products for greenhouse facilities. There have been investigations of conversion ways to obtain water-soluble chlorine-free complex fertilizers based on chemical potassium chloride, ammophoses, ammonium nitrate and urea. The study also involved the influence of basic technological parameters of conversion and rinsing processes on the composition of the obtained fertilizers, i.e. potassium nitrate and potassium ammonium phosphate. Optimum process conditions have been determined as well as process operating mode to enable high-quality product recovery confirmed by industrial testing results under the conditions of real production process together with product testing in both open and under-glass grounds. The most rational techniques for disposing of exhausted conversion solutions have been proposed, i.e. production of liquid and suspended liquid complex fertilizers on their basis along with the production of granulated complex fertilizers of various grades. A universal fail-safe process layout for the production of potassium ammonium phosphate and potassium nitrate has been developed.

**References**

1. Zvorykin A.Ya., Perel'man F.M. Physico-chemical basis of the method of production of a new type of concentrated chlorine-free fertilizers // Zhurnal neorganicheskoy khimii. [Journal of inorganic chemistry] – 1956. – V. 1, no. 7. – pp. 1523–1532.( in Russ ).

2. N.S. Kurnakov, A.Ya. Zvorykin, V.Ya. Ketkovich. Solid solutions of potassium and ammonium phosphates, // ISFKhA [NSFChA], 1947, V. 16, no. 3. – pp.108-126. ( in Russ ).

3. Sokolovskiy A.A., Yakhontova E.L. The application of equilibrium solubility diagrams in technology of mineral salts. // M.: Khimiya [Chemistry], 1982. ( in Russ ).

4. Kudryashova O.S. et al. System of K+, NH4+ // NO3-, Cl- – H2O. // Zhurnal neorganicheskoy khimii [Journal of inorganic chemistry]. 1996. V.41. № 9. pp. 1543-1557. ( in Russ ).

5. Vorob'ev N.I., Dormeshkin O.B., Shatilo V.I. Preparation of chlorine-free water-soluble NPK fertilizers by conversion method // Vestsi Natsyyanal'nay akademii navuk. Ser. khim. navuk. [News of National Academy of Sciences. Series of Chemical Sciences]–2004.–№ 1.–pp. 96–101.

6. Patent 7282 RB, MKI7 C05 D1/02 Method of producing of water-soluble chlorine-free complex fertilizers and method of producing of suspended liquid complex fertilizers / Vorob'ev N.I., Dormeshkin O.B., Shatilo V.I., Sagaydak D.I., Matveentseva M.S., Ostrovskiy L.K. №a20020313; Filed: 12.04.2002; Date of patent: 30.09.2005 // Afitsyyny byuleten' dzyarzhaunaga patentnaga vedamstva Respubliki Belarus' [Official Bulletin of State Patent Department of the Republic of Belarus], №3, 2005.

7. Patent 7410 RB, MKI7 C05 G1/06 Method of producing of water soluble complex NPK fertilizer with low chlorine content and method of producing of suspended liquid complex fertilizers / Vorob'ev N.I., Dormeshkin O.B., Shatilo V.I. № a20020526; Filed: 19.06.2002; Date of patent: 30.09.2005 // Afitsyyny byuleten' dzyarzhaunaga patentnaga vedamstva Respubliki Belarus' [Official Bulletin of State Patent Department of the Republic of Belarus], №6, 2005.

8. Patent 15896 RB, MPK C 01B 25/45, C 05G 1/00 Method of producing of potassium ammonium phosphate and granular complex fertilizers / Dormeshkin O.B., Vorob'ev N.I., Shatilo V.I., Novik D.M. № a20100532 Filed: 08.04.2010; Date of patent: 30.06.2012 // Afitsyyny byuleten' dzyarzhaunaga patentnaga vedamstva Respubliki Belarus' [Official Bulletin of State Patent Department of the Republic of Belarus], №3, 2005.

9. Vorob'ev, N.I. Investigation of the process of obtaining of potassium nitrate by conversion method / N.I. Vorob'ev, O.B. Dormeshkin, D.M. Novik // Ves. Nats. akad. navuk Belarusі. Ser. khim. navuk. [News of National Academy of Sciences of of Belarus. Series of Chemical Sciences] – 2002. – № 4. – pp. 8–13.

10. Vorob'ev, N.I. Investigation of the influence of urea on the process of obtaining of potassium nitrate by conversion method / N.I. Vorob'ev, O.B. Dormeshkin, D.M. Novik // Trudy BGTU. Ser. III, Khimiya i tekhnologiya neorgan. v-v [Proceedings of BSTU. Series III, Chemistry and technology of inorganic substances]. – Minsk, 2002. – V. 10 – pp. 151–158.

11. Method of producing of potassium nitrate: pat. 5950 Republic of Belarus, MKI7 C 01 D 9/10, C 05 C 5/02 / N.I. Vorob'ev, O.B. Dormeshkin, D.M. Novik, A.F. Minakovskiy; Assignee: Belarusian State Technological University – № a 20000815; Filed: 31.08.00; Date of patent: 30.03.04 // Afіtsyyny byul. / Nats. tsentr іntelektual. Ulasnastsі [Official Bulletin / National Center of Intellectual Property], № 1, 2004.

12. Method of producing of potassium nitrate and method of producing of liquid complex fertilizer: pat. 7470 Republic of Belarus, MKI7 C 01D 9/10, C 05D 1/02, C 05 C 5/02, 9/00 / O.B. Dormeshkin, N.I. Vorob'ev, D.M. Novik, N.K. Lisay; Assignee: Belarusian State Technological University – № a 20020223; Filed: 15.03.02; Date of patent: 30.12.05 // Afіtsyyny byul. / Nats. tsentr іntelektual. Ulasnastsі [Official Bulletin / National Center of Intellectual Property], №4, 2005.

13. Investigation of corrosion activity of liquid fertilizer on the basis of the stock solutions / V.B. Drozdovich, O.B. Dormeshkin, N.P. Ivanova, D.M. Novik, A.N. Rabochiy // Trudy BGTU. Ser. III, Khimiya i tekhnologiya neorganicheskikh veshchestv [Proceedings of BSTU. Series III, Chemistry and technology of inorganic substances]. – Minsk, 2003. – V. 11 – pp. 162-166.

14. Method of producing of potassium nitrate and NPK and NK complex fertilizers: pat. Republic of Belarus № 15779, MPK C 01 D 9/10, C 05 G 1/00 / O.B. Dormeshkin, N. I. Vorob'ev, D.M. Novik; Assignee: BSTU. – № a20100238; Filed: 18.02.10; Date of patent: 18.01.12. // Afіtsyyny byul. / Nats. tsentr іntelektual. Ulasnastsі [Official Bulletin / National Center of Intellectual Property], №2, 2012.

**Kinetic regularities and mathematical model of dissolution process of potassium salt of carboxymethylcellulose in water**

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**Keyword:** carboxymethylcellulose, dissolution process, induction period of dissolution, kinetic curves, kinetic coefficient, degree of substitution.

It has been investigated the dissolution process of the potassium salt of carboxymethylcellulose (K-CMC) in water with various degree of substitution by carboxymethyl groups in macrochain. It has been established that the dissolution process of this polymer is accompanied by induction transition. It has been shown that with growth of degree of substitution the induction period time is reduced. The empirical equation describing the dependence of induction period of polymer solution in water on degree of its substitution with carboxymethyl groups and temperature has been proposed. Some equations describing the decrease process of the concentration of soluble polymer and increase of its concentration in the solvent have been proposed. The kinetic coefficient values due to degree of substitution have been experimentally determined. It has been shown that the equilibrium in these systems is achieved when the chemical potentials of the solid polymer and its solution are equal. Beginning from this moment, the dissolution rate of solid polymer and its crystallization from solution as are equal. In this case the concentration of its saturation depends on properties of polymer, solvent and temperature.

**References**

1. Rustamov Ya. A., Ragimov A.B., Karamamedov G.A. et al. Encapsulation mineral fertilizer granules polystyrene derivatives, a polymer chain containing hydrophilic groups. Jurn. Prikl. chimii. [Journal of Applied Chemistry], 1988. v.61. no3. pp. 468-471 (in Russ.)
2. Rustamov Ya.A., Karamamedov G.A., Aslanov K.A. Certificate of authorship 1651521 (USSR). A method for controlling the prolonged action of ammonia nitrate. 1991.Ne being published.
3. Akselrud G.A., Molchanov A.D. Dissolution of the solids. M., Chemistry, 1977, p. 272.
4. Lykov A.V. Theory of drying. M ., Energia, 1968. p. 472.
5. Bytensky V.Ya., Kuznetsova E.A., Production of cellulose ethers. L ., Chemistry, 1974. pp.160-174.
6. Petropavlovskiy G.A. Hydrophilic partially substituted cellulose esters purposes, and their modification by chemical crosslinking. L ., Science, 1988.p. 106.
7. Tager A.A. Physical chemistry of polymers. M ., Chemistry, 1968, pp. 314-325.

**Best Available Techniques in Oil Refinery**

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**Keywords:** Oil refinery, Best Available Techniques (BAT), Reference Books on Best Available Techniques, JSC "Gazpromneft-MNPZ", reconstruction and modernization programme, biological wastewater treatment plant, combined oil refining unit (CORU).

Larger Russian industries (including oil refineries) experience now a transition to environmental regulation based on Best Available Techniques. In the near future it is necessary to complete a comparative study of resource efficiency and environmental performance to identify technological parameters of Best Available Techniques. JSC "Gazpromneft-MNPZ" experience proves that modernization programmes form the basis for the continual reduction of negative environmental impacts of oil refineries. The enterprise is ready to take an active part both in the sector benchmarking and in pilot projects in the field of transfer to environmental regulation based on Best Available Techniques.

**References**

1. Molokanov U.K. Processes and units in oil and gas refinery: [text-book](http://www.multitran.ru/c/m.exe?t=259410_1_2&s1=%F3%F7%E5%E1%ED%E8%EA) for technical colleges. Moscow. Khimiya [Chemistry] 1980 (in Russ)
2. GOST R 14.13-2007. National Standard of the Russian Federation. Environmental Management. Integrated environmental impact assessment of industries within the framework of industrial environmental monitoring (in Russ)
3. GOST R 54097-2010. National Standard of Russian Federation. Resource saving. Best Available Techniques. Identification methodology (in Russ)
4. Federal Law 21.07.2014 N 219- FZ ’On introduction of changes to the Federal Law ‘On Environmental Protection’ and certain other legislative acts of the Russian Federation’ (in Russ)
5. Mezenceva O.V., Grevcov O.V. Approaches to the development of the new BAT based regulation system. Nauchno prakticheskij zhurnal Ekologiya proizvodstva [The scientific-practical journal ‘Production and Environment’]. 2015, no 3, p. 44‑45 (in Russ)
6. Maksimenko Yu.L., Gorkina I.D., Kuchkarov Z.A., Filicheva T.P. Best Available Techniques: Environment or Economics. Federalny zhurnal «Ekologiya 2030». [Federal journal ‘Ecology 2030’]. 2014, no 5, September-October, pp. 6‑9 (in Russ)
7. Begak M. V., Boravskaya T. V., Root Yu., Molchanova Ya. P., Zakharov A. I., Sivkov S. P. Best Available Techniques and integrated environmental permits: implementation perspectives in Russia. M.: ООО «JurInfoR-Press», 2010 (in Russ)
8. Guseva  Т. V., Begak M. V., Molchanova Ya. P., Averochkin E. M., Vartanyan M. A. Perspectives of Best Available Techniques implementation and transition to integrated environmental permits in Russia in glass and ceramic industry. Steklo i keramika [Glass and Ceramic]. 2014, no 7. p. 26‑36. (in Russ).

**Investigation of modification of elemental sulfur   
by cyclic diene hydrocarbons**

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**Keywords:** Sulfur, surplus, modification, modified sulfur, cyclic diene hydrocarbons, high-molecular compounds.

Russia is a major producer of elemental sulfur. In 2014, production was   
6,0 million tons, the level of consumption was 2,45 million tons. A surplus of 3,5 million tons was sold to foreign markets (exports). The problem of implementation of excess sulfur which is caused by the limited volume of domestic market and the high competition in foreign markets is in the long term possible. Solution of the problem of accumulation of excess of sulfur is expansion of area of its use in other industries, including construction (production of road and construction materials on the basis of sulfur) that will give opportunity of sale of additional volumes of sulfur.The modified sulfur can be used as cement for production of the construction materials possessing increased qualitative and operation properties. Results of research of stage of copolymerization of the modified sulfur receiving process are given. Influence of mixing time, amount of the modifier, way of giving of the modifier is studied, comparison of efficiency of modifiers is carried out. Number of samples with different characteristics is received.

**References**

1. Chem-Courier. Chem-Expert. Sulfur. Statistics, <http://www.him-kurier.ru/>
2. Skripunov D. A., Filatova O.E. Problem of surplus of gas sulfur, decision variants. Gasochem, 2011 (in Russ.).
3. Motin N.V., Alekhina M.N., Skripunov D.A. Modern problems of production and application of technical sulfur in various industries. Scientific and practical conference "Prospects and problems of implementation in civil, industrial and road construction of sulfur composites", SOPS, 2013, pp. 27-36 (in Russ.).
4. McBee W.C., Sullivan T.A. Sulfur in construction materials. Bulletin/Bureau of Mines, 1985, 678, 31 p.
5. Patent RU2196787, [C08G75/14](http://www.freepatent.ru/MPK/C/C08/C08G/C08G75/C08G7514). Method to produce modified sulfur. Kirillov V.N., Pronin B.F. et al. 2003 (in Russ.).
6. Patent RU2220095C2, [C01B17/00](http://worldwide.espacenet.com/publicationDetails/biblio?DB=EPODOC&II=0&ND=3&adjacent=true&locale=ru_ru&FT=D&date=20031227&CC=RU&NR=2220095C2&KC=C2). Method to produce sulfuric binding agents and sulfuric binding agent. Faranski Roman, 2003 (in Russ.).
7. Voronkov M.G. Reactions of organic compounds with sulfur, Nauka [Science], 1979, 368 p. (in Russ.).
8. Grunwald V.R. Gas sulfur technology. Khimiya [Chemistry], 1992, 272 p. (in Russ.).
9. Malin K.M. Sulfuric acid manufacturer’s handbook. Khimiya [Chemistry], 1971, pp. 38-50 (in Russ.).
10. Wiewiorowski T.K., Tuoro F.J. The sulfur-hydrogen sulfide system. Journal of physical chemistry, 1966, vol.70, no. 1, pp.234-238/
11. Patent WO2006134130A1, [C04B24/00](http://worldwide.espacenet.com/publicationDetails/biblio?DB=EPODOC&II=0&ND=3&adjacent=true&locale=ru_ru&FT=D&date=20061221&CC=WO&NR=2006134130A1&KC=A1). Modified sulphur and product comprising modified sulphur as binder. Reynhout Marinus Johannes, Van Trier Rob Aloysius Maria, Verbist Guy Lode Magda Maria, 2006.

**Production problems of synthetic esters as bases contemporary lubricants**

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**Keywords:** grease, synthetic base, oil base, ethers, esters, fatty acids.

The problematic issues of organizing production of domestic synthetic esters and ethers to be used as the basic components of advanced plastic lubricants with improved freezing resistance, thermal stability, fire-resistance and chemical resistance are defined. Current manufacturing states of synthetic esters and ethers, and crude for their domestic and foreign manufacturing is presented. Contemporary and advanced technologies, (including electrochemical ones) of obtaining esters and ethers, and aliphatic acids based on domestic raw materials are considered (which is specially sound during economic sanctions).

**References**

1. Lubricants. Production, application, properties. Handbook: under edit Маng Т., Drezel’ U. Translation from English 2 edition – Spb.: TsOP "Professiya", 2012. – 994 p., ил., p.p.108-130. ( in Russ).
2. [WWW.Gorrrrtehnikf.ru/masla\_motornye](http://www.gorrrrtehnikf.ru/masla_motornye)
3. Alimov А.P. Research scope for application of oligomers vinyl ethers as bases or base components of synthetic lubricant oils. Sb. Nauchn. Tr..VNII NP, М:TsNIITEneftekhim, 1982. –v. 42. –p.35. ( in Russ).
4. Khirosi М., Khirosi I. "Synthesis and application of oligomers α-olefines".

Sekiyu Gakkaysi, З-ЗЗ-рап Pet7o6., 1976, 19, № 11, с. 897-905 ( v.I); 19, № 12, p. 1001-1004 ( v.II). Perevody VTsP А -42V71, A-42472.

5 Yagi Masataro Developments of Synthetic Lubricants in Japan, "CEER. Chem. Econ. & Eng. Rev.", 1978, v. 10,40 №5-6, р.52-56.

6, Shkilevich N.N., Usanov А.А., Malysheva Е.V., Karpov А.V., Karpovа Е.А. Vinyl ethers based polymers application instead of non Russian origin viscosity additives and base oils. World of oil products, 2012, № 12, p. 20-22., ( in Russ).

1. Patent USA № 2967203, 260-615, 1961.
2. Brennan J.A., Wide-temperature Range Syn.tb.etic Hydrocarbon Fluids, "Ind. &Eng. Chem. Prod. Res. & Develop.", 1980, v. 19, us. 1, p. 2-6.
3. Vins V.V. , Usanov А.А., Shkilevich N.N., Karpov А.V. Manufacture and application of Russian origin esters. World of oil products, 2012, № 12, p. 17-19. ( in Russ).
4. R.Zh, Economics of industry. – 1994. -12 К 14.
5. BIKI. 1993. v. 10.-p.5.
6. Freydlin G.N. Aliphatic dicarboxylic acids. М., Khimiya, 1978
7. Semenov М.V. Master's dissertation auto abstract. – М., RKhTU. 1996. ( in Russ).
8. Khill R.N. Fibers of synthetic polymers. In,. lit.. -1957, p. 123 ( in Russ).
9. Patent USA № 3896011, . 204-59, Publ. 1975.
10. Patent USSR № 812166, С 07 С 55/20, 1974. ( in Russ).
11. Patent USSR № 1111685, С 07 С 55/20, 1978. ( in Russ).
12. Certificate of authorship USSR № 1091504, кл. С 07 С 68/50, 1982.
13. Remorov B.S..., Ponkratov V.P., Аvrutskaya I.А., Fioshin М.Y. Electro synthesis of isopropyl formic acid on graphite anode in the presence of salt nickel salts.- Elektrokhimiya, 1980, т.16, № 6.
14. Certificate of authorship USSR № 791733, С 07 С 51/16, 1979.
15. Certificate of authorship USSR № 891628, С 07 С 51/16, 1979.
16. Certificate of authorship USSR № 891629, С 07 С 51/16, 1979.
17. Remorov B.S.. Master's dissertation auto abstract. – МKhТI, 1980. ( in Russ).
18. Kryshchenko К.I. Master's dissertation. – М., МKhТI, 1975. ( in Russ).
19. Тоmilov А.P., Fioshin М.Y, Smirnov V.А. Electrochemical synthesis of organic materials. – L. Khimiya, , 1976 ( in Russ).
20. Коsheleva А.М. Master's dissertation.Кrasnoyarsk. –IKhKhT SO RAN, 2014. ( in Russ).

**«Anhydrol» - inhibitor side processes of the new generation**

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**Keywords:** extractive distillation, extract ant, hydrolysis, inhibitor.

This article сontains data on inhibitors of hydrolysis of dimethylformamide (DMF) produced by the Research and Development Center and used in PJSC «Nizhnekamskneftekhim». Development researches of local DMF hydrolysis inhibitor were carried out as part of the program of import phase-out; inhibitor would not disgrace the properties and efficiency of currently used import inhibitor. The new hydrolysis inhibitor of DMF has the trademark «Ingidrol». «Inhidrol» is a composition of amine-containing compounds in a solvent with the basic substance weight ratio is not less than 50 %. It was experimentally proved that DMF keeps high hydrolytic stability in the presence of the inhibitor. The new agent effect on the extractant selectivity was studied. The relative volatility of the system izopren-isoamylene in the presence of «Ingidrol» with DMF were presented. The noncorrosiveness of the inhibitor was loufirmed. During the industrial use of ingidrol we obtained the results, which overcome all technical and economic chareteristics previously obtained for the inhibitors of dimethylformamide.

**References**

1 – Inhibition of polymerization of diolefines in the processes of separation and storage. Karakuleva G.I., Vinogradova I.V., Belyaev V.A. Thematic reviewes «The synthetic rubber industry», M.: TSNIIteneftehim, 1974. UDC 66.095.263:661.715.352:66.048 (In Russ).

2 – Pavlov S.Y. Isolation and purification of monomers for synthetic rubber. L. Chemistry. (In Russ).

3 - Patent A.S. USSR 1091500 от 13.05.1981 г. (In Russ).

4 - Patent A.S. USSR 1586111 от 24.10.1988 г (In Russ).

5 - Patent A.S. USSR 1780297 от 24.01.1991 г. (In Russ).

6 - Patent RU 2114102 С1 С07С231/22, С07С7/08/// A method of inhibiting the hydrolysis of dimethylformamide or dimethylacetamide in the processes of allocation of diene hydrocarbons by extractive distillation. Application 95104289/04 23.03.1995 (In Russ).

**Model of chemical kinetics and identification of cationic copolymerization of isobutylene isoprene kinetic constants**

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**Keywords:** isobutylene, isoprene, cationic copolymerization, kinetic constant, chemical kinetics.

The model of chemical kinetics in the ideal mexedreaitor flow of cationic copolymerization of isobutylene isoprene process (the catalyst is AlCl3, the solvent is CH3Cl, synthesis temperature ≥ 173 K) has been developed. It was found that the kinetics of the process includes elementary reactions initiation, chain propagation, chain termination and transfer of active chains to the isobutylene and isoprene molecules. The Arrhenius dependence of kinetic constants of the process was identified on the base of known experimental data on the kinetics of copolymerization (isoprene conversion curve) and molecular-weight characteristics of butyl rubber. Adequacy of the developed model was acknowledged by comparing the calculated on the model characteristics both independent experimental molecular-weight characteristics, and unsaturation of butyl rubber.

**References**

1. Butyl Rubber: A techno-commercial profile. Chemical Weekly, 2009, V. 55, no. 12, pp. 207-211.

2. Sangalov Yu.A., Minsker K.S., Zaikov G.E. Polymers derived from isobutylene. Synthesis, properties, application. Utrecht, Boston, Koln, Tokyo, Netherlands: VSP, 2001.

3. Thiele S.K.-H., Wilson D.R. Alternate transition metal complex based diene polymerization // Journal of Macromolecular Science, 2003, V. 43(С), no. 4. pp. 581-628.

4. Akhrem I.S., Orlinkov A.V., Chulochnikova T.V. et al. The effect of the counterion composition on the chain restriction in the cationic polymerization of isobutylene // Russ. Chem. Bull., 1996, V. 45, no. 5, pp. 1124-1127.

5. Sigwalt P., Moreau M. Carbocationic polymerization: mechanisms and kinetics of propagation reactions // Progress in Polymer Science, 2006, V. 31, no. 1, pp.44-120.

6. Kennedy J.P., Melby E., Johnston J. An attempt to adapt superacid chemistry for "living" carbenium ion polimerization // J. of Macromol. Sci., 1974, V. 8(A), no. 3, pp. 463-468.

7. Kennedy J.P., Thomas R. Polymerization of isobutene using radioactive methyl chloride// J. of Polym. Sci., 1961, V. 55, no. 161, pp. 311-320.

8. Fink J.K. Physical chemistry in depth. New York: John Wiley & Sons, 2009.

9. Stroock D.W. An introduction to Markov processes. Second edition. Graduate Texts in Mathematics, 230. Springer, Heidelberg, 2014.

10. Markina E.A., Chelnokova S.Z., Sofronova O.V. et al. Production of butyl rubber by suspension polymerisation using a modified catalytic system // Journal International Polymer Science and Technology, 2010, V. 37, no. 3, pp. 7-10.

11. Merzhanov A.G. Combustion and explosion processes in physical chemistry and technology of inorganic materials. Russ. Chem. Rev., 2003, V. 72, no. 4, pp. 289-310.

**The practical aspects of alkaline wastewater neutralization with carbon dioxide in an industrial scale**

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An experimental study of the process of neutralization of alkaline waste water from a large chemical JSC "Kazanorgsintez" using carbon dioxide was carried out. It was shown that using of carbon dioxide both in the laboratory and in industrial conditions has the advantages in relation to using of sulfuric acid: the ability of neutralization process automation and of practical elimination of operating staff from the process; the principal exception of a number of recurrent technical operations with dangerous and corrosive products - sulfuric acid; in accident-caused apparatus failure the excess of carbon dioxide will not reduce the pH below 5.5-6 units. The received experience of introduction of the method of alkaline wastewater neutralization using carbon dioxide to the industrial wastewater treatment plants shows the viability and validity of the conclusions and suggestions that were made earlier on the basis of theoretical considerations and the results of model tests.

**References**

1. Ramm V.M. Gases adsorbtion. M.: Himija [Chemistry]. – 1976, 656 s. (in Russ.).

2. Dankverts P.V. Gas-liquids reaction. Tr. with engl. M.: Himija [Chemistry]. – 1973, 296 s. (in Russ.).

3. Astartita Dzh. Mass transfer with chemical reaction. Tr. with engl. Edited by. L.A. Serafimova. L. :Himija [Chemistry]. – 1971, 224 s. (in Russ.).

4. Nekrasov B.V. Basics of general chemistry. – Third edition. – M.:Himija [Chemistry]. – 1973, 656 s. (in Russ.).

5. Eigenschaften der Kohlensaeure. Industriegasverband e.V. Koeln, 2002, 35 s. (in Germ.).

6. Gamer P., Dzhekson D., Serston I.. Purification of water for industry. Tr. with engl. M.: Izdatelstvo literatury po stroitelstvu [Publishing literature on construction]. –1968, 416 s. (in Russ.).

7. Bashirov R.R. The reducing of environmental hazard of multi-alkali wastewater from enterprise of organic synthesis using resource sorption methods. Diss. cand. of techn. sci (PhD). Kazan, march 2, 2011, 148 s. (in Russ.).

8. Bashirov R.R., Gafurov R.R., Mukhametshin I.R., Shulaev M.V. The research of neutralization of alkaline wastewater from basic organic synthesis production with using of carbon dioxide. Himicheskaja promyshlennost segodnja [Chemical industry today], 2010, no. 3., s. 44 – 51. (in Russ.).

9. Taube P.R., Baranova A.G.. Chemistry and Microbiology of water. M.: Vysshaja shkola [Graduate School], 1983, 280 s. (in Russ.).

10. Kapp H. Zur Interpretation der Säurekapazität des Abwassers. Wasser Abwasser GWF, 1983, no.3, s. 127–130. (in Germ.)

11. Bejts R. Determination of pH. Theory and practice. Izdatelstvo "Himija", leningradskoe otdelenie [Publishing house "Chemistry", Leningrad Branch], 1968, 398 s. (in Russ.).