

Bactericidal fibrous carbonaceous material for water treatment

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Abstract

The problem of disinfection of drinking water in mobile applications low volume relevant in the present time. The solution to this problem lies in creating highly efficient sorption materials with antibacterial properties.

This work is dedicated to the development of bactericidal carbonaceous material for use in compact filters. Proposed modification of active carbon fabric (ACF) by an electrochemical method, since it provides a sufficiently strong fixation of metallic copper on the surface of the coal fibers.

For the electrochemical deposition on the surface ACF of copper has been developed an electrolytic cell comprising a cathode in the shape of a frame in which were fixed the coal the fabric, and two copper anode. As a result of electrolysis at ACF stood out metallic copper, evenly covering the surface of the fabric on both sides.

The experiments on studying of influence of conditions of electrochemical deposition of copper on the ACF at its antibacterial properties. The application of copper on the surface of the coal tissue was carried out from solutions of electrolytes of different composition: sulfuric acid, ammoniacal and glycerate. The influence of the current in the range of 2 to 10 A. And duration of electrolysis is from 360 to 1200 seconds at a constant amount of electricity.

Conducted study of bactericidal properties ACF, modified copper against the bacteria *Escherichia coli*. Using the disk diffusion method (a method of "zones") determined the sensitivity of microorganisms to antibacterial derived material.

For this purpose the used agar solid medium comprising a plain agar (pH 7.4), lactose, basic fuchsin saturated alcohol and 10% aqueous Na₂SO₃. It is established that the sorbent that has a sufficiently high bactericidal activity can be obtained by the application of copper electrochemical method of glycerate of the electrolyte.

Using the scanning electron microscope carried out electron diffraction studies of the obtained samples of the sorbent. It is established that the increase in voltage during electrolysis promotes the formation of the copper crystals of a smaller size that contributes to the bactericidal activity impregnated ACF against the cells of the bacteria *Escherichia coli*.

References

- [1] Organization of the state sanitary and epidemiological inspection in sphere of effluents disinfecting. MU (regulations) 2.1.5.800-99. *Russian Ministry of Health. Moscow. 2000.* 13p. (russian)
- [2] S.L. Glushankov, E.A. Farberova, E.I. Zorina, E.A. Tingaeva. Improvement of technology of AG-5 granulose active carbon with small grains obtaining. *Magazine of Applied Chemistry. 2014.* Vol.87. B.6. P.714-720. (russian)
- [3] E.A. Farberova, V.F. Olontsev, E.A. Tingaeva. Investigation of the conditions for active carbons from fruit pits for medical purposes obtaining. *Butlerov Communications. 2016.* Vol.47. No.8. P.73-79. DOI: 10.37952/ROI-jbc-01/16-47-8-73
- [4] E.S. Vavilov, I.N. Kovalyov, A.V. Tolchev. Catalyst surface effect onto the morphology of the obtained hydrocarbonic nanomaterials. *Butlerov Communications. 2016.* Vol.48. No.12. P.138-142. DOI: 10.37952/ROI-jbc-01/16-48-12-138

- Full Paper** _____ E.A. Farberova, E.A. Tingaeva, A.Y. Katisheva, S.A. Smirnov, and G.A. Starkova
- [5] M.V. Astakhov, A.T. Kalashnik, E.E. Kazenas, V.V. Kozlov, T.L. Lepkova, F.S. Tabarov. Development of a carbon composite on the carbon fibers basis from a viscose sliver for super-condenser electrodes. *Butlerov Communications*. **2016**. Vol.48. No.10. P.43-48. DOI: 10.37952/ROI-jbc-01/16-48-10-43
 - [6] I.N. Ermolenko, I.P. Lyublner, N.V. Gulko. Element-containing carbon fibres. *Minsk: Science and Technology*. **1982**. 272p.
 - [7] E.A. Farberova, E.A. Tingaeva, A.S. Maximov. Obtaining of sorption material with bactericidal properties for use in water treatment. *PNIPU bulletin. Engineering Chemistry and Biotechnology*. Perm. **2012**. No.14. P.193-197. (russian)
 - [8] *Patent 2070438 (Russia)* Adsorption and bactericidal carbon material and way of its manufacture. Pimenov A.V., Liberman A.I., Schmidt D.L. Opubl. in B.I. **1996**. No.35.
 - [9] *Patent 2135262 (Russia)* Method of a filtering element modification. Revina A.A., Haylova E.B., Choubina A.M., etc. Published in Bulletin. **2007**. No.18.
 - [10] M.A. Belenkiy, A.F. Ivanov. Electrodeposition of metal platings. *Moscow: Metallurgy*. **1985**. 288p. (russian)
 - [11] Berezin N.B., Mavletov M.N., Yarullin A.Z., Mezhevich Zh.V. The modified electrolytes on the basis of aminocomplexes. *Butlerov Communications*. **2016**. Vol.48. No.11. P.58-70. DOI: 10.37952/ROI-jbc-01/16-48-11-58