A.N. Kvartenko, Zh.M. Govorova

RETROFIT TECHNOLOGIES OF COMPREHENSIVE GROUNDWATER CONDITIONING

In this paper, the authors analyze the quality of the groundwater in the north-western region of Ukraine and propose the reassessment of a number of retrofit technologies for their comprehensive treatment. The authors argue that the underground water is a multi-component system. The authors propose a set of biological, physical and chemical methods of water treatment for a synergistic effect.

The authors suggest reducing the number of consecutive water treatment units and using an advanced technology (activation of biological and physicochemical processes in a constant magnetic field). Another suggestion is the application of a set of technologies integrated into traditional methods of biological treatment. The authors also propose a consistent process of water treatment, so that the sub-processes within it were able to activate each other at each subsequent stage to achieve a synergistic effect. Degradation of organic iron requires a biologically active environment. The underlying technology can be transformed into more sophisticated process patterns depending on the quality of water exposed to treatment.

Key words: low alkaline groundwater, iron removal from the groundwater, aeration, iron and manganese oxidizing bacteria, bioreactors, biological treatment, water treatment in a constant magnetic field, hydraulic robot, filters.

References

1. Kraynov S.R., Shvets V.M. *Geokhimiya podzemnykh vod khozyaystvenno-pit'evogo naznacheniya* [Geochemistry of Potable Groundwater]. Moscow, Nedra Publ., 1987, 237 p.

2. Lukashevich O.D., Pilipenko V.G. Bezopasnost' pit'evogo vodosnabzheniya kak mezhvedomstvennaya problema [Safety of Drinking Water as an Interagency Problem]. *Bezopasnost' zhiznedeyatel'nosti* [Life Safety]. 2003, no. 12, pp. 30—35.

3. *Natsional'na dopovid' pro yakist' pitnoï vodi ta stan pitnogo vodopostachannya v Ukraïni u 2003 rotsi.* Rivne, NUVGP Publ., 2005.

4. Nikoladze G.I. *Uluchshenie kachestva podzemnykh vod* [Groundwater Quality Improvement]. Moscow, Stroyizdat Publ., 1987, 240 p.

5. Zhurba M.G., Govorova Zh.M., Vasechkin Yu.S. Optimizatsiya kompleksa tekhnologicheskikh protsessov vodoochistki [Optimization of Process Patterns of Water Treatment]. *Vodosnabzhenie i sanitarnaya tekhnika* [Water Supply and Sanitary Engineering]. 2001, no. 5, pp. 5—8.

6. Zhurba M.G., Govorova Zh.M., Kvartenko A.N., Govorov O.B. *Biokhimicheskoe obezzhelezivanie i demanganatsiya podzemnykh vod* [Biochemical Removal of Iron and Manganese from the Groundwater]. *Vodosnabzhenie i sanitarnaya tekhnika* [Water Supply and Sanitary Engineering]. 2006, no. 9, pp.17—23.

7. Kvartenko A.N. Konditsionirovanie nizkoshchelochnykh podzemnykh vod, soderzhashchikh zhelezoguminovye kompleksy [Conditioning of Low-alkaline Groundwater Containing Humic-iron Substances]. *Naukoviy visnik budivnitstva. Zbirnik nauko-vikh prats'.* [Scientific Bulletin of Construction. Collection of Scientific Works]. Harkiv, HDTUBA Publ., 2011, no. 63, pp. 406—414.

8. Safonov N.A., Kvartenko A.N., Safonov A.N. *Samopromyvayushchiesya vodoochistnye ustanovki (Tekhnologii, konstruktsii i raschet).* [Self-washing Water Treatment Plant (Technology, Design and Analysis)]. Rovno, RGTU Publ., 2000, 155 p.

9. Serpokrylov N.S., Vil'son E.V., Getmantsev S.V., Marochkin A.A. *Ekologiya ochistki stochnykh vod fiziko-khimicheskimi metodami* [Wastewater Treatment Using Physicochemical Methods]. Moscow, ASV Publ., 2009, 264 p.

10. Zhurba M.G., Kvartenko A.N. Aktivatsiya bioflokulyatsionnykh protsessov vodopodgotovki v postoyannom magnitnom pole [Activation of Bioflocculation Water Treatment Processes in the Constant Magnetic Field]. *Voda: khimiya i ekologiya* [Water: Chemistry and Ecology]. 2009, no. 3, pp. 20—27.

11. R. Moro et al., Physical Review Letters, 97, 123401, 18 September, 2006.

12. A. Michaelides, K. Morgenstern. Ice nano-clusters at hydrophobic metal surfaces. Science, no. 6, 17 June, 2007, pp. 597—601.

About the authors: **Kvartenko Aleksandr Nikolaevich** — Candidate of Technical Sciences, Associate Professor, Researcher, **Octane Firm State-owned Enterprise**, 9 Kavkazskaya st., Rivne, 330028, Ukraine; as-755@rambler.ru; +38 0362 26-36-32;

Govorova Zhanna Mikhaylovna — Doctor of Technical Sciences, Professor, Professor, Department of Water Supply, **Moscow State University of Civil Engineering (MGSU)**, 26 Yaroslavskoe shosse, Moscow, 129337, Russian Federation; fonsvit@bk.ru; +7 (499) 183-36-29.

For citation: Kvartenko A.N., Govorova Zh.M. Modernizirovannye tekhnologii kompleksnogo konditsionirovaniya podzemnykh vod [Retrofit Technologies of Comprehensive Groundwater Conditioning]. *Vestnik MGSU* [Proceedings of Moscow State University of Civil Engineering]. 2013, no. 5, pp. 118—125.