

ЭКОЛОГИЯ, ЭНЕРГОСБЕРЕЖЕНИЕ

УДК.628

DOI: 10.35803/1694-5298.2020.2.308-313

Т.Н. Каримов¹, Н. Байгazy кызы¹, М. Т.Каримова¹, А. Кулахметов¹, Г.А. Эгембердиева¹
¹КГУСТА им. Н. Исанова, г. Бишкек Кыргызская Республика

T.N. Karimov¹, N. Baigazy kyuzy¹, M.T. Karimova¹, A.M. Kulahmetov¹, G.A. Egemberdieva¹
¹KSUCTA n.a. N. Isanov, Bishkek, Kyrgyz Republic
(tashmukhamied@mail.ru, bayygazieva-nazira@rambler.ru, malval@mail.ru,
Unicefambassador@gmail.com, gulshat_egemberdieva@mail.ru)

REAGENT-FREE TECHNOLOGY FOR THE PREPARATION OF POTABLE WATER FROM SURFACE SOURCES OF THE KYRGYZ REPUBLIC

БЕЗРЕАГЕНТНАЯ ТЕХНОЛОГИЯ ПОДГОТОВКИ ВОДЫ ПИТЬЕВОГО КАЧЕСТВА ИЗ ПОВЕРХНОСТНЫХ ИСТОЧНИКОВ КЫРГЫЗСКОЙ РЕСПУБЛИКИ

Таза суунун жетишсиздиги ичели-карын инфекцияларынын, гепатиттин жана анкаган-ичели-карын ооруларынын жайылмышын, патологиясынын пайда болушунун жана адамдын организминде канцерогендик жана мутагендик факторлордун таасиринин күчөшүрү мөлгөли себеби болуп саналат. Айрым учурларда таза суу жана канализация түтүндөрүнөн жоготуу массалык ооруларга жана эпидемиянын жайылмышына алып келет. Жер үстүндөгү жана жер астындагы суулардын химиялык жана биологиялык булгангына байланыштуу калктын ден-соолугуна келтирилген коркунучту аныктоо боюнча илимий изилдөөлөрдүн өркүндөтүлүшү биологиялык жана химиялык булгануунун антропогендик таасири менен байланышкан ооруларды азайтуу боюнча максаттуу шарапаларды зарылдыгына тастыктайт.

Өзгөчө сөздөр: табигый суу, жер үстүндөгү булактар, фильтрлер, чыпкалоочу чөйрөлөр, жергиликтүү табигый материалдар, дренаждык шайман, сууну тазалоо, бөлүштүрүүчү түзүлүштөр

Отсутствие чистой воды является основной причиной распространения кишечных инфекций, гепатита и болезней желудочно-кишечного тракта, возникновения патологий и усиления воздействия на организм человека канцерогенных и мутагенных факторов. В отдельных случаях отсутствие доступа к чистой воде и системам канализации приводит к массовым заболеваниям и распространению эпидемий. Развитие исследований по выявлению риска для здоровья населения в связи с химическим и биологическим загрязнением поверхностных и подземных вод подтверждает необходимость целенаправленных действий для сокращения заболеваемости, связанной с антропогенным воздействием биологических и химических загрязнений.

Ключевые слова: природная вода, поверхностные источники, фильтры, фильтрующая загрузка, местные природные материалы, дренажное устройство, осветление воды, распределительные устройства.

The lack of clean water is the main reason for the spread of intestinal infections, hepatitis and diseases of the gastrointestinal tract, the occurrence of pathologies and the increased impact on the human body of carcinogenic and mutagenic factors. In some cases, the lack of access to clean water and sewage systems leads to massive diseases and the spread of epidemics. The

development of research to identify the risk to public health in connection with chemical and biological pollution of surface and ground waters confirms the need for targeted action to reduce morbidity associated with the anthropogenic impact of biological and chemical pollution.

Key words: *natural water, surface sources, filters, filter media, local natural materials, drainage device, water clarification, distribution devices.*

The main source of water supply in the Kyrgyz Republic is groundwater and surface water.

There are 1,008 centralized water supply systems in the republic, of which 76.3% of the population uses for household and drinking needs, mainly living in cities and regional centers, including 70.3% in Osh oblast; in Jalal-Abad 79.4%; in Talas - 71.3; in Issyk-Kul-91.3; in Naryn and Chui regions - 91% each.

Currently, due to significant wear and tear of water supply systems, the use of outdated shut-off and control valves, a lack of qualified specialists, a low level of operation, and other reasons, significant losses of drinking water occur, which leads to a waste of large funds and does not allow ensuring uninterrupted supply of the population of the republic, and objects of public utilities with drinking water.

The sanitary and technical condition of the existing water pipelines is deteriorating from year to year due to untimely repair and restoration work: 242 out of 1008 water pipelines do not disinfect the water supplied to the population, more than 130 sources of centralized water supply and waterworks do not have sufficiently reliable sanitary protection zones.

Due to the pollution of surface waters, nearby underground waters become unsuitable for drinking needs. These circumstances dictate the need to develop new technologies and water treatment devices capable of purifying natural waters to the required quality and quantity. In this regard, the question arises of developing effective filters operating on local raw materials, taking into account the latest achievements of science and technology.

The task of our proposed technology for obtaining drinking water from surface sources of the Kyrgyz Republic is to improve the quality of treated water while reducing its cost, expanding the area of use of the installation for natural water purification. The technology belongs to the field of reagent-free natural water treatment, water supply to small towns, rural settlements and enterprises of various industries.

The purpose of the proposed technology is to increase the degree of water purification to the qualification "drinking water" and to generate electricity for the needs of the installation. This goal is achieved by the fact that the technological scheme consists of a water intake device 1, a microelectric power station 2, a thin-layer settler 3, a fast non-pressure filter with a combined loading 4, an electrolysis chamber 5, a pure water reservoir 6, channel 7 shown in Fig. one.

The proposed installation works as follows. From the water supply source, water is taken by a water intake device 1 and fed into channel 7, on which a microelectric power station is installed to generate electricity for the needs of installations, then the water enters a thin-layer settler 3, where water settles and suspended particles are removed, after which with a concentration of suspended particles up to 50 mg / l treated water enters the fast gravity filter, which is loaded combined loading 4, and then the water in a gravity flow mode enters the electrolysis unit 5, where the water is disinfected and partially desalted, after which the treated water is sent to the clean water reservoir 6.

The proposed installation will allow, at low cost, to increase the degree of purification of the treated water in comparison with similar 1.5-2 times with the generation of electricity.

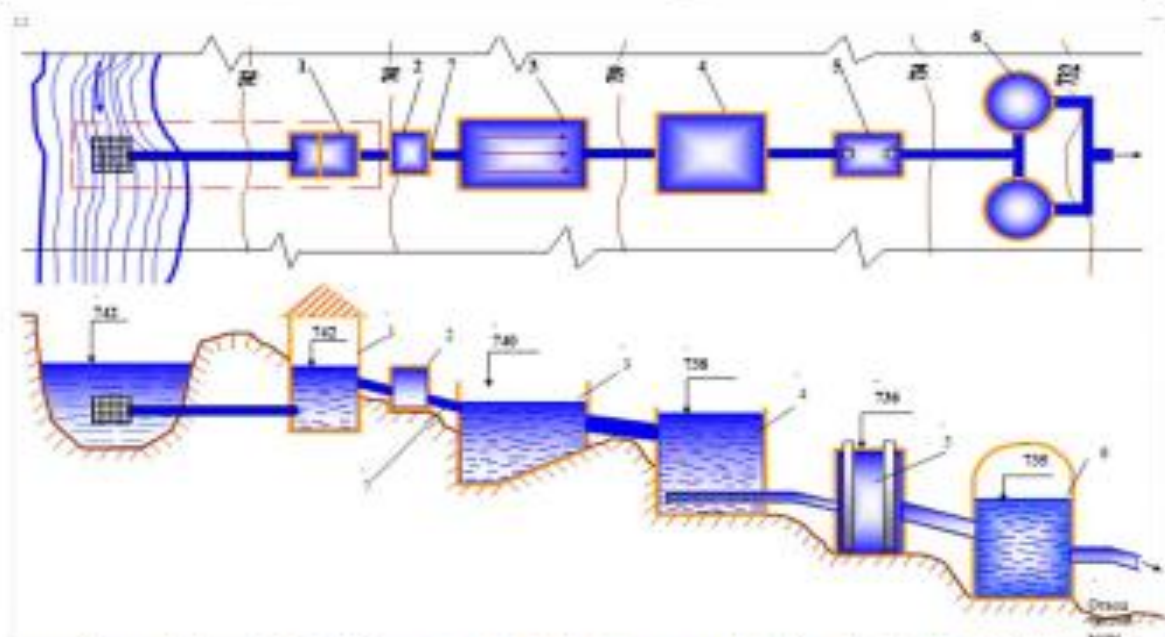


Figure: 1. 1-water intake; 2 – micro hydroelectric power plant; 3-settling tank; 4 – filter; 5 – disinfection device; 6-tank of clean water; 7- channel.

The proposed technological scheme includes a filter 4. A filter with pressure-vibrational regeneration refers to devices for water purification by filtration. The objective is to improve the efficiency of filtration and regeneration of the filter media. The problem is solved by the fact that the filter with pressure-vibrational regeneration, containing a housing with a filter loading, a branch pipe for supply of the liquid to be purified, located above the filtering load, a branch pipe for draining the filtrate located under the filtering load, a branch pipe for draining the washing liquid and a device for creating a hydrodynamic distribution chute along the filter above the filtering load, the inlet of which is connected to the branch pipe for supplying the purified liquid, and the outlet - with a branch pipe for drainage of the flushing liquid, communicated with the side pocket, and perforated pipes located along the perimeter of the body in the area of the filter loading, connected to the branch pipe for removal of the filtrate and with pipes installed along the side walls of the body. Equipped with devices for creating a hydrodynamic flow during regeneration, consisting of tangentially installed nozzle pipes, the surfaces of the cavities of the narrowed parts of which are made of grooved with a screw thread, while the filtering load consists of three layers: the upper and lower supporting layers are made of crushed stone, and the middle one is from fibrous basalt in the form of spheres 5-7 cm in diameter. 3 ill. The filter belongs to devices for water purification by filtration in the preparation of drinking water

The task of the filter we propose is to improve the efficiency of filtration and regeneration of the filter media in the conditions of the Kyrgyz Republic.

The task is solved by the fact that the filter is with pressure-vibrational regeneration. Containing housing with filter media. A branch pipe for supplying the liquid to be cleaned located above the filtering load, a branch pipe for removing the filtrate located under the filtering load, a branch pipe for removing the washing liquid and a device for creating a hydrodynamic flow during regeneration, according to the invention. Equipped with drainage and flushing system. Including a distribution chute located along the filter above the filtering load, the inlet of which is connected to the branch pipe for supplying the liquid to be cleaned, and the outlet to the branch pipe for draining

the flushing liquid, communicated with the side pocket installed on the filter housing, and located along the perimeter of the housing in the filtering zone loading - perforated pipes connected to a branch pipe for removing the filtrate and with branch pipes installed along the side walls of the body, equipped with devices for creating a hydrodynamic flow during regeneration, made in the form of tangentially installed nozzle pipes, the surfaces of the cavities of the constricted parts of which are corrugated with a screw thread, while the filter media consists of three layers: the upper and lower supporting layers are made of crushed stone, and the middle one is made of fibrous basalt in the form of balls with a diameter of 5-7 cm.

The claimed technical solution is illustrated by drawings, where Figure 2 shows a plan view of a filter with pressure-vibration regeneration: Figure 2 is a side view of the filter, section: Figure 3 is a device for creating a hydrodynamic flow during regeneration of a filtering load.

The filter with pressure-vibrational regeneration contains a housing 1 with a filtering loading, consisting of upper 2 and lower 3 supporting layers made of crushed stone, between which layer 4 is placed. Made in the form of quartz sand. In the housing 1 there are a branch pipe 5 located above the filtering load for supplying the liquid to be cleaned with a valve 6 and a branch pipe 7 with a valve K for draining the washing liquid, and under it there is a branch pipe 9 with a valve 10 for removing the filtrate and a branch pipe 11 with a valve 12 for flushing liquid. Along the body 1 of the filter above the filtering loading there is a distribution chute 13, connected by the inlet to the branch pipe 5, and the outlet to the branch pipe 7, which is connected through the valve 8 to the side pocket 14. Installed on the side wall outside the body 1. Along the perimeter of the body 1, perforated pipes 15

are located in the area of the filtering load, connected to the nozzle 9 for removing the filtrate, the nozzle 11 for supplying the washing liquid and with nozzles 16 installed along the side walls of the housing 1 and equipped with tangentially located nozzle 11 nozzles 17.

Hole pipes 15 with nozzles 16 and nozzles 17 together with the distribution chute 13 form a drainage-washing system of the filter, which acts during the regeneration of the filtering load according to the pressure-vibration principle.

The inlet part of the nozzle pipe 17 (Fig. 3) is made in the form of a diffuser 18. The smaller side 19 is adjacent to the narrowed outlet part 20. It has a corrugated inner surface, on which screw grooves are made.

The filter with pressure-driven vibration regeneration works as follows.

The liquid (water) to be cleaned enters through the supply pipeline (shown in Fig. 2) and is fed through the open valve 6 of the branch pipe 5 to the distribution chute 13. Overflowing through the edges of which it falls onto the filter load with the closed valve 8 of the branch pipe 7. Cleaned in the filter load, water enters the perforated pipes 15. From where, through the open valve K) of the branch pipe 9, it is discharged to the consumer when the valve 12 of the branch pipe 11 is closed.

If the filter media is contaminated to an unacceptable value, it becomes necessary to flush it. In this regeneration mode, the water supply to the consumer is stopped by closing valves 6 and K), and valves 12 and 8 are opened.

The regeneration process of the filter media is intensified through the use of nozzle pipes 17 (Fig. 3). The water entering through the pipe 16 enters the diffuser 18. In the conical opening of the smaller side 19 of which it undergoes compression with an increase in the speed of movement, and upon leaving it, a sharp expansion, accompanied by the occurrence of the phenomenon of hydrodynamic vibration. The further movement of water through the cavity 20 due to the execution of its corrugated surface is accompanied by multiple repetitions of water entering the compression and expansion zones providing continuity and stability of hydrodynamic vibrations. The screw

threads in the cavity 20 help to twist the outgoing water flow. The combined action of hydrodynamic vibration and the rotational motion of the wash water jet into the filter media provides effective cleaning of balls of fibrous basalt and crushed stone layers from contamination. Further, the rinsing water with washed out impurities under pressure rises to the distribution chute 13 and through it is discharged through the open valve 8 of the branch pipe 7 into the side pocket 14 and is discharged into the sewer through the outlet pipeline.

Thus, the inventive filter operates with periodic alternation of filtration and regeneration washing of the filter media, providing an increase in the efficiency of their implementation.

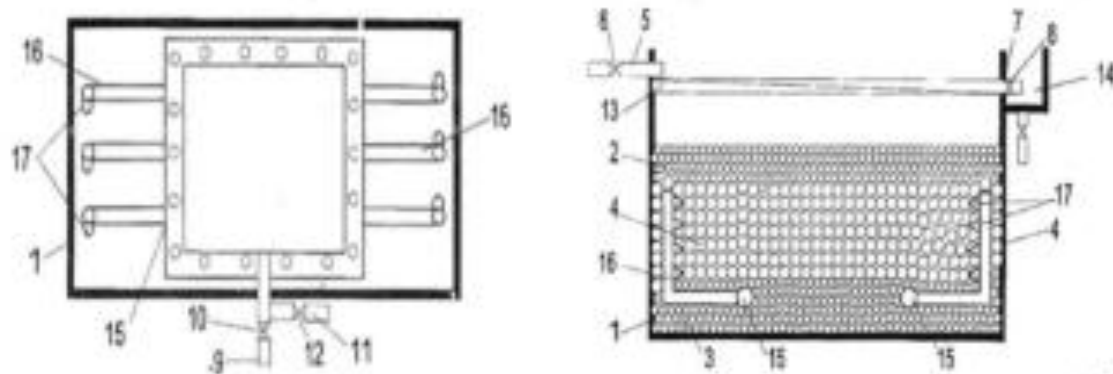


Figure: 2

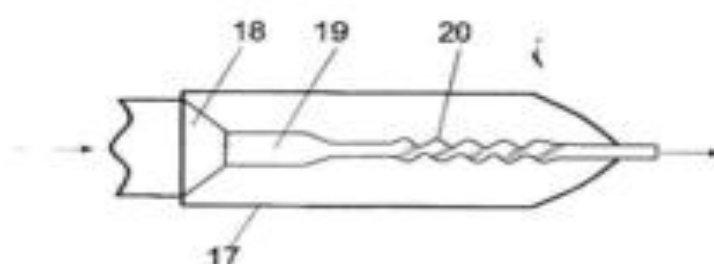


Figure: 3

Improvement of water supply and sewerage systems will create additional reserves of water resources.

The department "Water supply, sewerage and hydraulic engineering" KGUSTA for two years has been conducting research on the use of cheap local raw materials for filtering loading of water purification filters. Quartz sand from Kyrgyz deposits was used as loading. As a result of the research, it was revealed that the duration of the filtration cycle is doubled, the water quality meets all the requirements of GOST and SES of the Kyrgyz Republic. For surface water purification, a "Filter" is proposed, capable of purifying water up to 85%, for suspended solids up to 92%.

To solve the problem of preparation of drinking water, a technology for purifying water from surface sources is proposed, which corresponds to GOST "Drinking water".

Bibliography

1. Karimov T.K., Karimova M.T., Baigazy kyzy N., Maatkalova J., Abdykalykov A.A. \ Analysis of Groundwater Resources in the Kyrgyz Republic. // *Journal of Environmental Management and Tourism*, Craiova, Romania, (Volume X, Fall), 5(37) 2019: C-984-990.
2. Каримов Т.Х. Экологическая и санитарно-гигиеническая безопасность источников водоснабжения Кыргызской Республики [Текст] / Т.Х.Каримов // *Международный научно-исследовательский журнал «Евразийский Союз Ученых»*, – 2019. – №4-2 (61). – С.24-30.
3. Каримов Т.Х. Мониторинг реки Чу и ее основных притоков [Текст] / Т.Х.Каримов , Б.Р.Рахманбеков // *Вестник КГУСТА*. – Бишкек: 2018. – №3(61). – С.109-114.
4. Каримов Т.Х., Омурзакова А.Б., Аманов А.М. \ Исследование скорого безнапорного фильтра с фильтрующей загрузкой из отходов сахарного производства в КР. \ *Open Access Peer-reviewed Journal Science Review №1(8)*, 2018 С:12-17 Warsaw, Poland.
5. Каримов Т.Х. \Запасы водных ресурсов Кыргызской Республики и их использование \ *European Journal of Technical and Natural Sciences*, 3 -2016 Austria, Vienna, С.59-62
6. Каримов Т.Х. Фильтр с угольно-базальтовой загрузкой для получения питьевой воды [Текст] / Т.Х.Каримов, Ж.Н.Осмонов // VI Международной научно-практической конференции: в 2 частях. - Пенза: 2016. - С: 34-37.
7. Karimov T.K. The main characteristics of the water supply and sewerage systems of the Chui, Talas and Issyk-kul provinces \ *International Scientific and Practical Conference «World science»*. Изд.: ROST (Dubai) Том: 2Номер: 4 (20) 2017 С: 14-16.
8. Шатманов О.Т., Каримов Т.Х., Дуйшебаев С.С. Экологические аспекты доступа к питьевой воде в Кыргызской Республике. [Текст] / О.Т.Шатманов, Т.Х.Каримов, С.С.Дуйшебаев // *Инновации на транспорте и в машиностроении, Сборник трудов IV международной научно-практической конференции*. - Санкт-Петербург: 2016. - Том IV. - С.156-160.
9. Байгазы кызы Н., Каримов Н.Т Каримов Т.Х., \Обеспечение чистой водой населения сельской местности [Текст] / Байгазы кызы Н., Н.Т.Каримов Т.Х.Каримов // *Вестник КГУСТА*, выпуск 3 (49), Бишкек, 2015. С.117-122.
10. Осмонов Ж.Н. К вопросу водоснабжения сельских населенных пунктов Кыргызской Республики [Текст] / Ж.Н.Осмонов // *Вестник КГУСТА*. Бишкек:2019. - №2(64). – с. 313-317.