

ABSTRACT

of the thesis research of **Zhassandykyzy Maral**

on the topic: «Research and development of automatic data acquisition system and recycling water supply quality control», submitted to the competition for PhD degree on the specialty 6D075100 – «Informatics, computing techniques and control»

Timeliness of the topic. Growth of population and industrial production of modern megapolises demand solving the problem of the cities provision with drinking water. Production of good tap water is the focal area of the city infrastructure development. Almaty city is not an exclusion and it experiences a lot of difficulties, connected with water consumption, which might negatively affect the dynamic growth of the city being the financial and economic center of the Central Asia and Kazakhstan. An important direction to lower the level of drinking water consumption from the city's water distribution system is introducing the recycling water supply at industrial, transport and service enterprises. Water large consumers are car washes, the number of which is continuously growing. Multiple checks of car washes by the city administration's inspecting services witness the solution actuality of the problem thereof.

Therefore, the study, founding and implementation of domestic automated, compact, budget and efficient water reuse installations, easily adapted to the technology of the most existing in the city car washes is the currently central scientific-technical and ecological problem of the country.

Aim of the thesis. The aim of the work is the analysis, research and development of the new treatment unit and search, by means of computer simulation and technological solution control, which allows reducing the negative ecological affect of Car Wash Industry enterprises. Solution performance is reached at the expense of upgrading the water reuse quality control level.

To gain the set aim we solve the following **tasks**:

- studying the modern tendencies of computerization and development of Car Wash Industry, distributing the leading countries experience on organization and development of high profit business thereof, observing hard ecological requirements;
- analyzing the cause-effect relations, keeping out of wide introducing the computerized tunnel, portal and mobile car washes in our country;
- studying the constructive features of car washes water reuse, their specifications and peculiarities of computation;
- analysis of mathematical and computer models of hydraulic devices and structures, used for discharge treatment with filtration means;
- analysis and research of three D computer models of water cleaning from salt ions and organic impurities by means of different natural sorbents, mined in the northern-eastern Kazakhstan;

- developing the pilot installation, simulating the hydraulic processes in the filter bed from natural sorbents;
- developing the computer and semiempirical model of the processes in filtration plate holders, filled with natural sorbents; carrying out numerical computation to assess water treatment cost efficiency;
- computerized simulation in the MatLab 6.5 medium, 3Ds max filtration processes in the hydraulic channel with changeable adsorption plate holders;
- designing in the automation medium LOGO! SoftComfort 8.1, TIA portal and creating the software for automation of compact hydraulic channel with changeable adsorption plate holders using microprocessor computing techniques.

Subject of research is the process of the car wash water reuse hydraulic channel cleaning with automated changeable adsorption plate holders.

Scientific novelty of the work herein is as follows:

1. There have been studied cause-effect relations of drinking water consumption by Almaty city car washes, analyzed and detected constructive features of far abroad, Russia and Kazakhstan car washes' circulation water supply systems (Car Wash Industry);
2. We have developed the three D mathematical and computerized model of the processes, taking place in the changeable filtration plate holders. There has been offered the semiempirical model for adsorbent effective layer computing in the changeable plate holders.
3. There have been made calculations, assessed the performance and ecological feasibility of car washes' oil containing waters by means of changeable adsorptive plate holders.
4. There has been carried out the computer-aided simulation of filtration processes in hydraulic channels with changeable adsorptive plate holders.
5. There have been set up and conducted semi-industrial tests of the pilot installation for hydraulic channels cleaning using the changeable adsorptive plate holders.
6. Have been elaborated scientific-practical recommendations on developing and operating the automated complex of car washes circulation water supply system by means of hydraulic channel with changeable adsorptive plate holders.
7. There has been offered the hydraulic channel design and software, allowing computerizing the Almaty city car washes upgraded circulation water supply systems control.

Research techniques. To solve the set tasks there have been used structural analysis methods, mathematical and computer simulation, as well as simulation and experimental technologies of designing and constructing the systems of car washes automated control systems.

Work's practical relevance

Subsequent to the results of thesis's research work there has been obtained the design of treatment channel with adsorptive plate holders of circulation water supply system for small car washes (Car Wash Industry) (provisional patent RK 2017/0080.1 dated January 30, 2017).

There is an act on introducing the obtained in the thesis research work scientific outcomes at the laboratory of Lublin technical university (Lublin, Poland), where there has been made a pilot installation for studying the filtration features of bulk sorbents for changeable adsorptive plate holders. Apart from that, there has been conducted the pilot testing of the thesis outcomes at the car wash «Baysan», Almaty city.

Practical approval. The thesis's principal provisions and research outcomes have been reported and discussed at scientific seminar of the chair «Computer and software engineering», KazNITU named after Satpayev K.I., and at International Satpayev Readings «Role and place of young scientists in implementing the new policy of Kazakhstan» (Almaty, 2016), «Fifth National Congress of Environmental Engineering (Web of Science)», (Poland, 2016), IX International scientific-practical conference «Problems and prospects of modern science» (Moscow, 2016), International on-line scientific-practical conference «Energy and resources saving technologies: experience and prospects», (Kyzylorda, 2017), International scientific-practical conference «Integration of science, education and production – the basis for the Nation Plan implementation» (Saginov Readings #9) June 22-23 (Karaganda, 2017).

Publications. There have been published 12 works on the thesis topic, including 4 articles – in the scientific editions, recommended by the Committee for control in the education and science area of MES RK; 3 articles – in the journals, incoming the SCOPUS database, 5 articles – in the proceedings of international conferences, 1 of which is in the Scopus database.

Dissertation structure and scope. The dissertation with a volume of 111 hard copy pages consists of introduction, four sections and conclusion; includes 5 tables, 67 figures, 139 references sources and 4 attachments.

In the introduction we showed the timeliness, described the problems, connected with the topic being researched. We have given the work's concept, research objective and tasks, scientific novelty and work's practical utility and research techniques.

The dissertation's first chapter contains the analysis of CAR WASH INDUSTRY technology's modern state, mathematical and computation provision in our country and abroad. We have shown the causes and means of overcoming the disadvantages of CAR WASH INDUSTRY technology in Kazakhstan and CIS countries compared to highly profitable automated tunnel self-service car washes in the developed countries of the West and South-East Asia.

The second chapter of the thesis considered the methods of computation and mathematical simulation of technological processes of car washes water reuse

treatment installations operation, developed mathematical and computation model of two-component filtration of emulsified oil-products in the water.

The third chapter of the dissertation describes the animation model of hydraulic channel with changeable adsorptive plate holders.

The third chapter of the thesis analyses the wastewater treating processes design, which might be considered as an automated control double-mode process.

The conclusion reflects the main outcomes and conclusions of the thesis herein.

There have been published 12 works on the thesis topic:

1 Zhasandykyzy M. **Control over car wash circulation water supply system** // "Modern science intensive technologies» # 3 (part 2) 2016, p.p. 236–240.

2 Zhasandykyzy M. Computer-aided simulation of car wash cleaning channel adsorptive cassettes in the media Pdetoolbox // proceedings of International Satpayev readings «Role and place of young scientists in implementing the new economic policy of Kazakhstan », Volume II, April 12, 2016, Almaty, Kazakhstan, p.p. 276–280.

3 Zhasandykyzy M. **Computer interfaces of car wash circulation water supply control system** // «Bulletin of KazNITU» #4 (116), 2016–09–02, p.p. 272–276.

4 Zhasandykyzy M., Tashev A.A. Applying adsorptive cleaning plate holders in transport enterprises water reuse systems// ISI international scientific investigations of IX International scientific-practical conference «Problems and prospects of the modern science», #9, July, 2016 (part 1), p.p. 84–87.

5 Zhasandykyzy M., Tashev A.A., Wojcik W., Sakitzhanov M.Sh. Use of adsorptive cleaning plate holders in circulation water supply system at transport companies // KSU named after Korkyt Ata, Kyzylorda, 30.03.2017, Collected works of the international scientific-practical on-line conference «Energy–and resources saving technologies: experience and prospects», p.p.153–157, 2017.

6 Zhasandykyzy M., W.Wojcik, Tashev A.A., Kalizhanova A.U. Animated simulation of channels cleaning technological processes with changeable adsorptive plate holders // Bulletin of PSU.

7 Zhasandykyzy M., W. Wojcik, Tashev A.A. Simulation of filtration processes (process) in hydraulic channels with changeable adsorptive cassettes // Bulletin of KazNITU, #3, p.p. 136–141, 2017.

8 Zhasandykyzy M., W. Wojcik, Tashev A.A., Kashaganova G.B. The car wash purification channel work's simulation model developed in the automated technological process of VMware workstation pro // International scientific-practical conference «Integration of science, education and production – the basis of the Nation Plan implementation» (Saginov readings #9).

9 Kucheruk V., Palamarchuk E., Kulakov P., Natalia Storozhuk, W. Wojcik, Zhassandykyzy M. Measuring of the relative milk mass fraction in water-milk solution //PrzeglądElektrotechniczny(Scopus). – R.93 NR3/2017. P. 83–87,

10 Vedmitskyi, Y.G. , Kukharchuk V.V., Hraniak V.F., W. Wojcik, Zhassandykyzy M., Yesmakhanova L. New non-system physical quantities for vibration monitoring of transient processes at hydropower facilities, integral vibratory accelerations // Przegląd Elektrotechniczny (Scopus), R.93 NR3/2017. –P. 69–72 .

11 W. Wojcik, V.P. Osipenko, V.I. Litvinenko, N. Askarova, Zhassandykyzy M. Hydroecological investigations of water objects located in urban areas // Fifth National Congress of Environmental Engineering V, May 29– June 1, 2016, Lublin, Poland - Environmental V (Scopus), P. 155 – 159.

12 Zhassandykyzy M. Tashev A.A., W. Wojcik, A.U. Kalizhanova, Konrad Gromaszek: Water recycling automation of car wash with cleaning channel and changeable adsorptive plate holders // Przegląd Elektrotechniczny (Scopus), R.93 NR3/2017, P. 144–147.

13 There exists the act of semi-industrial tests and there is submitted an application for provisional patent RK 2017/0080.1 dated January 30, 2017.