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THE SCHEMES SYNTHESIS FOR DRINKING WATER PURIFICATION

*M. Saleh**, *A. E. Usynina***, *O. M. Shikulskaya***,
*L. V. Boronina***, *W. Gornik****

**KTH Royal Institute of Technology (Sweden),*

***Astrakhan state university of architecture and construction (Russia),*

****TN Köln – Tehnology, Arts, Sciences (Cologne, Germany)*

Авторы статьи обосновали необходимость информационно-аналитической поддержки специалистов при принятии технических и управленческих решений по оптимальному выбору технологических схем очистки питьевой воды, выбрана и обоснована среда разработки, предложены проектные решения по созданию базы данных и пользовательского интерфейса для решения синтеза технологических схем очистки питьевой воды.

Ключевые слова: *очистка, питьевая вода, технологическая схема, синтез, анализ, база данных.*

Authors of paper proved need of information and analytical support of experts at acceptance of technical and administrative solutions at the optimum choice of technological schemes of drinking water cleaning, the development environment is chosen and proved, design solutions on creation of the database and the user interface for the solution of synthesis of technological schemes of cleaning of drinking water are proposed.

Keywords: *cleaning, drinking water, technological scheme, synthesis, analysis, database.*

The ecological condition of water resources of the majority of regions of the Russian Federation is near-critical or critical. Environmental protection, rational use and reproduction of natural resources, maintaining their biological diversity is one of the most relevant tasks of modern society. The pure problem occupies one of the major places in the solution of this task as a surface water is the most sensitive link of the environment. The major factors exerting negative impact on the level of rationality of use of water resources are use of outdated water capacious production technologies, insufficient degree of equipment of water intaking constructions the systems of instrument account and so forth. The problem requiring special attention is the remaining high level of negative anthropogenic impact on water objects.

In the conditions of not decreasing anthropogenic loads of water sources, insufficient financing on commissioning of new capacities of water supply systems, increases in requirements to quality of drinking water the special relevance

is acquired by a problem of the choice of methods of processing of water at design new and reconstruction of the existing stations of preparation of water [1].

As the tool of objective assessment of opportunities of these or those technological schemes of water purification by the staff of Complex research and design-technology institute of water supply, the sewerage, hydraulic engineering constructions and engineering hydrogeology Moscow (the Dr.Sci.Tech., prof. Zhurba N.G., the Dr.Sci.Tech. Nechayev A.P., PhD in Technological Sciences Ivleva G.A., etc.) qualifiers of technological purification of natural waters depending on the offered classes of water sources, factors of anthropogenic impact on them and a fazo-disperse condition of impurity in the purified waters are developed [2].

However, use of paper technology reduces efficiency and accuracy of adoption of engineering and administrative decisions [3]. IT are effectively applied in a biotechnosphere [4-5]. In this regard, ensuring computer support of process of the choice of technological schemes and technical devices of purification of natural waters is a current problem.

The purpose of work is creation of tools of computer support of formation and the optimum choice of technological schemes of cleaning of drinking water.

Design of the database of classification of technologies of purification of natural waters

In a designing process of the database allocate 3 stages: conceptual design (the DB conceptual model is created), logical design (the DB logical model for the chosen DBMS is created) and physical design (the DB files on the machine carrier are created).

The conceptual model represents objects and their interrelations without indication of ways of their physical storage. It is, in essence, model of subject domain. At a stage of conceptual design of the database information of the qualifier of technological purification of natural waters was formalized and structured. The database is provided to the third normal form providing lack of duplication of data.

The database is developed in the environment of Microsoft Access 2010. The choice of DBMS is caused by a number of its advantages: very simple graphic interface, storage of all this in one file, a large number of the offered Masters, prevalence, continuous updating by the producer, full compatibility with the Windows operating system, focus on the user with different vocational training, ample opportunities on import/export of data to various formats. Besides, use of Microsoft Access for the user is a little expensive owing to lack of need of its acquisition since it is a part of MS office.

The database is designed taking into account qualifying standards on speed, simplicity of updating, independence of data, sharing of data by many users, data security.

Development electronic qualifier of technologies of purification of natural waters

The user interface meeting the modern requirements for appearance and for access to internal functionality of system was developed for use of the database.

The program is intended for computer support of researches and engineering design of constructions of water purification of surface natural water.

Use of system begins with formation of reference books: a temporary factor of presence of impurity, groups of methods, subclasses of superficial water sources on the nature of their anthropogenic pollution, structural systems, symbols. After completion of formation of reference books with use of the corresponding interfaces information on technological methods and technological schemes is entered. Then qualifiers are filled: superficial water sources of economic and drinking water supply, the qualifier across Kulsky, the qualifier of superficial water sources on the nature of their anthropogenic pollution, the qualifier of technologies of water purification for group of impurity, the qualifier of technologies of water purification taking into account anthropogenic influence.

After completion of input of full information the system is ready for use on support of decision-making at the choice of the optimum technological scheme for design each case. The special interface is also developed for this purpose. All necessary information on a water source is entered: a time factor of influence of harmful impurity (up to three months in a year, during the whole year), water parameters (chromaticity, turbidity, temperature, a hydrogen indicator of pH, permanganatny oxidability, the general mineralization, quantity of cages of phytoplankton, rigidity). Types of impurity and information on ingredients of anthropogenic pollution get out of the corresponding lists. Then at the request of the user the system submits possible versions of technological schemes of cleaning of a reservoir. The final choice remains for the designer.

The program can be also used in educational process of training of engineers of a construction profile.

Conclusion

The developed system successfully underwent approbation. Its use allows to increase efficiency of design new and reconstruction of the existing stations of preparation of water due to reduction of time for the choice of technological schemes, to minimize probability of an error of the choice. It provides an optimum ratio of the price and quality of the project.

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ХАРАКТЕРИСТИКА ИСТОЧНИКОВ ЗАГРЯЗНЕНИЙ ПОВЕРХНОСТНЫХ СТОЧНЫХ ВОД СЕЛИТЕЛЬНЫХ ТЕРРИТОРИЙ

*Е. В. Давыдова**, *Л. В. Боронина**, *W. Gornik***

**Астраханский государственный*

архитектурно-строительный университет (Россия)

***TN Köln – Tehnology, Arts, Sciences (Cologne, Germany)*

Источники, вносящие в поверхностные воды, загрязняющие воду элементы, микроорганизмы и иные вещества, называют источниками загрязнений. Элементы или вещества, вызывающие превышение норм качества воды (установленные значения показателей качества воды по видам водопользования), называют загрязняющими веществами.

Ключевые слова: *поверхностный сток, взвешенные вещества, нефтепродукты, очистные устройства, ПДК.*

Sources contributing to surface water, elements that pollute water, microorganisms and other substances are called pollution sources. Elements or substances that cause excess water quality standards (established values of water quality indicators by type of water use) are called pollutants.

Keywords: *surface runoff, suspended solids, petroleum products, purification devices, MPC.*

Основным фактором загрязнения водных объектов является сброс в водоемы неочищенных или недостаточно очищенных сточных вод промышленными предприятиями, коммунальным и сельским хозяйством. Подсчитано, к примеру, что если город потребляет в день 600 тыс. м³ воды, то он дает около 500 тыс. м³ сточных вод. Остатки ядовитых химикатов и удобрений, которые вымываются из почвы, оказываются в водоеме и загрязняют их [1].

Сточные воды - это те воды, которые отводятся после использования в бытовой и производственной деятельности человека.

В настоящее время на промышленные хозяйственно-бытовые нужды расходуется 150 км³ в год на всем Земном шаре. Сравнительно с размером стабильного речного стока нашей планеты это не так много - менее 0,5%. Даже после основательной биологической очистки для обезвреживания эти воды необходимо разбавлять очищенной водой. Нормы разбавления иной раз слишком высоки. Так, кратность разбавления для стоков производства синтетических волокон составляет 1:185, для полиэтилена или полистирола-1:29. [2]

Ежегодно во всем мире на обеззараживание сточных вод затрачивается 55000 км³ чистой воды, что втрое больше, чем на остальные нужды человечества, и составляет 30% устойчивого стока всех рек Земного шара.