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Improvement of Water Softening Method for Cooling Systems of Locomotives of Railway Depots

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Annotation: Ensuring the needs of all sectors of the national economy with clean drinking water in sufficient quantity and quality is given great importance and is considered one of the important issues. Information on water, technical composition and analysis of railway enterprises is presented.

Keywords: Water softening, salts, hydraulic mixtures, cooling systems, locomotive depot, water reserves.

Currently, great importance is attached to providing the needs of the population and all sectors of the national economy with clean drinking water in sufficient quantity and quality, and it is considered one of the important issues. In a number of regions of our republic, underground water reserves are mainly used for drinking water supply. These waters remain unfit for drinking as a result of their natural formation or the addition of wastewater from various types of industries.

In many cases, the amount of dissolved salts in the water exceeds the required level, mainly consists of calcium and magnesium carbonate salts that give hardness. However, these salts create hardness in water and make it unsuitable for drinking, steam rooms, and energy use. Water hardness is a common problem for water supply, industrial enterprise and district heating systems.

This problem is mainly noticeable when underground and ground water is used for household drinking water supply. For example, when underground water is mainly used for water supply, it characterizes the hardness due to the presence of 70-80% of mineral compounds, hydrocarbonate calcium. Calcium and magnesium ions, which give water hardness, form poorly soluble compounds on the surface of heat exchangers, heat-electric devices, and pipes, which means that their efficiency will decrease sharply, fuel will be wasted, and they will have to be stopped frequently to clean them from deposits. is correct.

The use of such groundwater for drinking and technical purposes requires the combined use of water softening and water treatment. To reduce the hardness of water, the following methods are used: thermal, reagent, ion exchange, membrane, magnetic treatment and generalized methods of different sections. Even the listed methods, despite their widespread use, have a number of disadvantages due to the complexity of preparation of initial water, treatment of waste water and their disposal, as well as the large consumption of reagents. A number of important works on water supply and wastewater treatment are currently being carried out in our republic. Limited water resources and technical and economic considerations make it necessary to use water circulation in the water use system.

Termiz locomotive depot is the property of JSC "Uzbekiston temir yollari" "Termiz Regional Railway Station". Termiz locomotive depot was established in 1917. Termiz locomotive depot was built in 1917. Initially, the Veyernii shop (currently the TEM-2 locomotive repair shop) was built. The total area of the Veyernyi building is

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580 m2, its walls are made of stone blocks, and the roof is covered with reinforced concrete. During these years, a steam boiler room, a pumping station and an oil distribution tower were put into operation. In 1917, repair and operation of steam locomotives was started at the depot, and trains were delivered to their destinations on time.

Termiz locomotive depot is considered one of the most advanced developing enterprises within the Termiz regional railway network. There is no doubt that the company has ambitious goals and will rise to an even higher level in the future, and will have its place not only in the Termiz regional railway hub, but also in the joint-stock society.

Salts in the water of the locomotive depot, their amount, by conducting an analysis and collecting data, a comparative analysis of the technical condition of the water of the Termiz locomotive depot, on its example and on the example of industrial enterprises, on the level of hardness of water in cooling systems and other indicators. transfer was achieved. The article provides comparative information on the composition and analysis of water.

The requirements for water quality for technological processes are extremely diverse, depending on the specific characteristics of production, and in a number of cases, they are much higher than the requirements for drinking water. They are determined by special departmental normative documents. It limits water hardness when used in the paper and textile industry, and in the production of man-made fibers.

Water softening is the process of freeing water from salts. Water from various sources (rivers, lakes, ponds, reservoirs, springs, streams, wells) is usually used to cool internal combustion engines, power steam boilers of locomotives and other steam power plants. Such water contains more or less dissolved salts, organic substances, and mechanical compounds. The greatest damage during the operation of the boiler or engine is caused by the presence of hardness salts (scale formers) in the water.

Table 1. It was obtained in the laboratory of the Termiz locomotive depot for water softening data (as of 05.05.2022-05.14.2022)

T/R	The date	Water hardness, mg	General alkalinity	Amount of phosphate ions	The amount of chloride ions	The amount of nitrate ions	Validity
1	05.05.2022	0,2	1,6	_	5,0	2608	Valid
2	06.05.2022	0,2	1,6	_	5,0	2608	Valid
3	07.05.2022	0,2	1,6	_	5,0	2594	Valid
4	08.05.2022	0,2	1,5	_	5,0	2594	Valid
5	09.05.2022	0,2	1,5	_	5,0	2594	Valid
6	10.05.2022	0,2	1,5	_	5,0	2594	Valid
7	11.05.2022	0,2	1,5	_	5,0	_	Valid
8	12.05.2022	0,2	1,0	_	5,0	1173	Valid
9	13.05.2022	0,2	2,0	_	5,0	2608	Valid
10	14.05.2022	0,2	2,0	_	5,0	2608	Valid

Water hardness causes various malfunctions in the cooling systems of locomotives. The purpose of the research is to prevent possible failures, to study the operation of water softening technology in accordance with the standard requirements, and to develop recommendations for their more effective operation.

The task of studying the composition of locomotive depot water and collecting data on it, as well as conducting laboratory analyzes of water used for cooling systems in the locomotive depot, was determined.

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The data obtained from the laboratory department of Termiz locomotive depot of water used for cooling systems of locomotives are presented in the following tables.

Table 2. It was obtained in the laboratory of the Termiz locomotive depot for water softening data (as of 05.10.2022-14.10.2022)

T/R	The date	Water hardness, mg	General alkalinity	Amount of phosphate ions	The amount of chloride ions	The amount of nitrate ions	Validity
1	05.10.2022	0,2	2,5	_	5,0	2526	Valid
2	06.10.2022	0,2	2,5	_	5,0	2526	Valid
3	07.10.2022	0,2	0,2	_	5,0	_ qo`shimcha 65kg nitrit 0,5 NOH	Valid
4	08.10.2022	0,2	2,2	_	5,0	2622	Valid
5	09.10.2022	0,2	2,2	_	5,0	2650	Valid
6	10.10.2022	0,2	2,2	_	5,0	2650	Valid
7	11.10.2022	0,2	2,2	_	5,0	2650	Valid
8	12.10.2022	0,2	2,2	_	5,0	2650	Valid
9	13.10.2022	0,2	2,2	_	5,0	2650	Valid
10	14.10.2022	0,2	2,2	_	5,0	2650	Valid

Table 3. It was obtained in the laboratory of the Termiz locomotive depot for water softening data (as of 28.04.2021-07.05.2021)

T/R	The date	Water hardness, mg	General alkalinity	Amount of phosphate ions	The amount of chloride ions	The amount of nitrate ions	Validity
1	28.04.2021	0,2	40	_	2,0	2622	Valid
2	29.04.2021	0,2	40	_	2,0	2622	Valid
3	30.04.2021	0,2	40	_	2,0	2622	Valid
4	01.05.2021	0,2	40	_	2,0	2622	Valid
5	02.05.2021	0,2	40	_	5,0	2628	Valid
6	03.05.2021	0,2	40	_	5,0	2624	Valid
7	04.05.2021	0,2	40	_	5,0	2622	Valid
8	05.05.2021	0,2	40	_	5,0	2624	Valid
9	06.05.2021	0,2	40	_	2,0	1622	Valid
10	07.05.2021	0,2	40	_	0,5	1242	Valid

The following methods are used to remove water hardness:

Physical methods: boiling and distilling water are the basis of this method. When boiling, the temporary hardness disappears, the water partially softens. When distilled, the general hardness of water disappears, water becomes completely soft.

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Chemical methods. These methods include alkalizing, soda, phosphating, and ionizing. All of these are based on converting salts dissolved in water into poorly soluble compounds as a result of a chemical reaction or removing them from an aqueous solution due to ion exchange with the help of ions.

The working principle of the sodium cationite filter. The existing hardness in the water cannot be overcome, so in order to soften the water, you must start by purifying the water. It is necessary to purify the water from excess salts and substances that cause water hardness. Today there are two groups of such methods:

- Chemical - it uses chemical reactions and various harmful agents in its work;
- Physical - when connected to water by irradiating and neutralizing the work of harmful ions.

Each of the proposed methods has advantages and disadvantages. The oldest device remains the floating water ion filter. Its device is simple and it works on a cheap principle. The composition of such a device includes the following elements: With cationite water softening, source water is filtered through a cationite layer (cationite filter). At the same time, Ca2+ and Mg2+ cations move from water to the cation exchanger, Na+ or H+ cations move equivalently from the cation exchanger to the water, after which the water becomes soft. Various organic or mineral materials of natural origin or artificially prepared (it is more common) are used as cation exchangers [1,2,3].

Water for cooling diesel locomotives must not form scale and corrosion in parts of the water system. Depending on the quality of the source water and the quality of the cooling water, a number of methods are used to treat it in water softening plants. In the locomotive depots of the joint-stock company "Uzbekistan Railways", the sodium-cationite method based on the ion exchange reaction is used to reduce the hardness of water. The essence of the sodium-cation exchange method is the ability of specially prepared water-insoluble substances, called cation exchangers, to replace their cations with calcium and magnesium cations, which determine the hardness of the source water.

From the research carried out in the Termiz locomotive depot, it is possible to know that the water used in the locomotive depot has a significant effect on the efficient operation of the depot. As a result of research, it is possible to know that the performance of locomotives at the Termiz locomotive depot depends on their cooling systems. We can see the need to use water with the content specified in regulatory documents as a result of conducting research [3,4,5].

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