ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF ARTIFICIAL INTELLIGENCE

ISSN: 2692-5206, Impact Factor: 12,23
American Academic publishers, volume 05, issue 05,2025

Journal: https://www.academicpublishers.org/journals/index.php/ijai

EFFECTIVE TECHNOLOGIES OF REMOTE CLEANING OF HEAT EXCHANGERS

Kulturaeva Shabnam Abdusodikovna
Tashkent institute of chemical technology,
sh.kulturaeva@tkti.uz,
Xakimova Malika O'ktam kizi
Tashkent institute of chemical technology,
malikabudur0406@gmail.com
Jobborova Maftuna Akrom kizi
Tashkent institute of chemical technology,
m.jabborova@tkti.uz

Annotation: Research works aimed at increasing the use and efficiency of collectors of flat solar water heaters in world renewable energy systems. Today, new methods to increase the efficiency of thermal energy generation are widely used by thermal power structures.The inner walls of boilers, steam boilers and heat exchanger pipes are exposed to salts in the water used over time. Several methods are used to clean the equipment. However, viewed from this perspective, the invention and development of an environmentally friendly, cost-effective, highly efficient method that does not affect metal is one of the top priorities.The article describes the types of dismantled and non-dismantled heat exchangers for cleaning and protection from pollution, as well as methods of cleaning heat exchangers, the degree of its pollution, construction, features of substances constituting the surface.

Keywords. Ultrasound, Calcium Carbonate, Crystalline, Lamination, Layer, Technology, Generator, Welding, Hydration, Colloid, Mixture.

The volume of investment in renewable energy sources, in particular solar energy, is increasing and occupying one of the leading positions in the scale of its use. Globally, the depletion of traditional fuel resources will necessitate the introduction of solar energy installations.
In particular, due to the use of solar energy-based devices in hot water supply systems, it is possible to save up to 60% of primary energy resources consumed in this system, and due to the use of solar devices with high efficiency in the system, this indicator can be further increased. In this regard, the use of systems based on high-efficiency solar energy installations, from an energy and environmental point of view, is of political importance in the world, and their use to solve the problems of eliminating climate change is of relevant and necessary importance.
Research activities aimed at increasing the use and efficiency of collectors of flat solar water heaters in world renewable energy sources in hot water supply systems are being carried out.
Decree of the President of the Republic of Uzbekistan dated February 7, 2017 No. UP 4947 "On the Strategy of Actions for Further Development of the Republic of Uzbekistan", dated February 1, 2019 N UP 5646 "On measures to radically improve the management system of the fuel and energy industry of the Republic of Uzbekistan" Decree of the President of the Republic of Uzbekistan dated February 7, 2017 N UP-4947 "On actions to further rationalize the Republic of Uzbekistan The tasks in this area are defined in the Decree of July 9, 2019 No. PP-4388 "On measures to ensure sustainable provision of the economy and the population with energy resources, financial improvement and improvement of the management system of the oil and gas industry" and other regulatory legal documents related to this activity.

ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF ARTIFICIAL INTELLIGENCE

ISSN: 2692-5206, Impact Factor: 12,23
American Academic publishers, volume 05, issue 05,2025

Journal: https://www.academicpublishers.org/journals/index.php/ijai

Today, new methods to increase the efficiency of thermal energy generation are widely used by thermal power structures.

The tasks of using metals, heat, natural resources (coal, oil, natural gas), that is, economical and rational combustion of fuel, energy saving from them, protecting the environment, extending the life of thermal power facilities, are the tasks facing energy technology professionals.

The inner walls of boilers, steam boilers and heat exchanger pipes are exposed to salts in the water used over time. The appearance of smudges can be prevented by cleaning the water entering the heat exchangers in several ways. Slime formed in heat exchangers is extracted by hydromechanical, hydrodynamic, hydrochemical, electrohydropules and ultrasonic methods.

Several methods are used to clean the equipment. However, viewed from this perspective, the invention and development of an environmentally friendly, cost-effective, highly efficient method that does not affect metal is one of the top priorities.

In agriculture, any technological process takes place through the use of thermal energy, most of which is produced by steam and hot water boilers.

The decentralized location of agricultural facilities over the entire farm area does not allow the accumulation of steam and hot water production in powerful boilers, where it is recommended to use chemical treatment of water to prevent scale-up. In agriculture, mainly low-capacity boilers are used for steam output up to 1 t/h and a capacity of 1.15 m3. The use of chemical water treatment is not economically viable, since the cost of the equipment exceeds the cost of the boiler, in addition, additional on-duty personnel - highly qualified laboratory assistants are required. As a result, in the boiler rooms of agricultural enterprises the water is practically not cleaned, which leads to the formation of scraps on the heating surfaces of boilers.

Due to the fact that the dash has a weak thermal conductivity, overheating of the metal of heat-conducting surfaces occurs, and if its thickness is large, the water circulation is disturbed, the metal burns out, and the service life of the boiler is reduced. In addition, fuel combustion increases. A multitude of estimates indicate that every millimeter of emissions leads to fuel overconsumption by up to 2% or more.

Currently, there are many methods and devices for cleaning boilers. But the most common, and in some cases irreplaceable, is the dissolution of sediments formed on heat-conducting surfaces with the help of special devices with various reagents. Specialized devices known for cleaning boilers are of sizes that do not allow them to be brought into the boiler room, which can cause the equipment to defrost when used during the fall-winter period. For these reasons and because of their high cost, they are not widely used in agricultural enterprises. In addition, there are currently no engineering calculation methods available, and installations for this are not commercially produced. Further, there are no science-based recommendations on optimal cleaning regimes. Therefore, it is necessary to establish a justification of modes and design parameters of the small-sized installation to enhance the process of decarbonization of boilers, to make them downtime.

Various methods and means are known to clean and protect heat exchangers from the blast. All methods are divided into two types: disassembled and disassembled. The method of cleaning the heat exchanger is selected individually in each individual case, taking into account its degree of contamination, design, properties and content of substances constituting the surface.

Development and implementation of energy-saving technologies is necessary to improve the non-reagent methods to reduce the rate of rock formation in heat exchangers. The high costs of cleaning and repair of equipment at oil refineries also determines the relevance of the chosen topic.

ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF ARTIFICIAL INTELLIGENCE

ISSN: 2692-5206, Impact Factor: 12,23
American Academic publishers, volume 05, issue 05,2025

Journal: https://www.academicpublishers.org/journals/index.php/ijai

Thermal exchanger protection and cleaning methods consist of ultrasound, electromagnetic, etc. All of them contribute to the crystallization of solid salts in the water column and do not allow the crystals to reach the size required for sediment formation.

The ultrasonic method differs in that it affects the formation and subsidence of the blast in several ways at once. First, water by means of ultrasound helps the crystals of solid salt formed by ultrasonically heated water are destroyed and separated. A dash is formed in a solid when a solid body comes into contact with a liquid. Under the influence of ultrasound, calcium carbonate crystals in water, their average size decreases to about 10 to 1 micron, increasing their number and total surface area. With the action of ultrasound in water, the number of crystallization centers increases dramatically (approx. 1000 times). This leads to the formation of debris on the surface of the water column due to heat exchange.

Secondly, ultrasound can propagate over the surface and prevent rashes from forming on it. And if there is already a layer of dash on the surface of heat exchange, ultrasound removes it, which is performed in combination with cleaning and breaking off the dash fragments.

With a significant thickness of the previously formed dash layer, there is a risk of clogging of the canals. Therefore, one of the main requirements for the successful use of the ultrasonic technology is the pre-cleaning of the old layer of rock deposits.

Structurally, the ultrasonic setup is a pulse generator loaded with two magnetic transducers. The transducers are attached to the outer surfaces of the heat exchanger at certain points by electric welding and the generator is powered from 220 V mains.

The electromagnetic method shows that the mechanism of action of the magnetic field on water and its compounds is not fully determined and is explained by polar phenomena and deformation of salt ions. During processing, the hydration of ions decreases, ions converge on each other and form a crystalline form of salt.

One theory is based on the effect of the magnetic field on colloidal mixtures of water, according to the other, the structure of water changes.

When a magnetic field is applied, crystallization centers are formed, due to the release of solid salts that are insoluble in a water volume. Thus, instead of solid mash, a finely dispersed clay is observed that is migrating in water, which is easily removed from the surface.

It has been produced at the present time, devices of permanent magnetic and electromagnetic types. The terms of use of magnetic water purifier devices are:

1. water heating should be carried out at a temperature not higher than 95 ° C;
2. carbonate hardness - not higher than 9 mEq/l;
3. The content of dissolved oxygen does not exceed 3 mg / l, and the sum of chlorides and sulfates - not more than 50 mg / l.

References:

1. Decree of the President of the Republic of Uzbekistan. About the Strategy of Actions for Further Development of the Republic of Uzbekistan. February 7, 2017. PF 4947.
2. Decree of the President of the Republic of Uzbekistan. On measures to radically improve the management system of the fuel and energy industry of the Republic of Uzbekistan. February 1, 2019. PF 5646.
3. Decree of the President of the Republic of Uzbekistan. About the Action Strategy for further development of the Republic of Uzbekistan. July 7, 2017. Issue PF-4947.

ISSN: 2692-5206, Impact Factor: 12,23
American Academic publishers, volume 05, issue 05,2025
Journal: https://www.academicpublishers.org/journals/index.php/ijai

4. Decree of the President of the Republic of Uzbekistan. On measures to improve the financial recovery and improvement of the management system of the oil and gas industry, sustainable provision of the economy and the population with energy resources. July 9, 2019. PQ-4388.
5. Glikina F.B. i Dr. Zašita kotelnых staley ot korrozii pri udalenii plotnых jelezookisnых otlojeniy rastvorami solyanoy kislotы./ Teploenergetika, 1985, No. 2, p.64-66.
6. Koshoridze S.I., Levin Yu.K. Mehanizm snijeniya nakipi pri magnitnoy obrabotke vodnogo potoka // Fundamentalnые issledovaniya. – 2014. – No9.– S. 2433–2439.
7. Khadjibaev A., Erkinov A., Shokirov A. INVESTIGATION OF THE PROCESS OF GRINDING OF SOLID OIL REFINERY WASTE IN THE IMPACT CENTRIFUGAL MILL //International Journal of Artificial Intelligence. – 2025. – T. 1. – №. 2. – C. 478-482.
8. Erkinov A., Xadjibayev A. USE OF ROTOR CLASSIFIERS IN THE POWDER SEPARATION PROCESS IN THE FOOD INDUSTRY //International Journal of Artificial Intelligence. – 2025. – T. 1. – №. 2. – C. 458-460.
9. Xadjibayev A., Jobborova M., Erkinov A. ADVANTAGES AND DISADVANTAGES OF U-SHAPED HEAT EXCHANGERS: A SCIENTIFIC ANALYSIS //International Journal of Artificial Intelligence. – 2025. – T. 1. – №. 2. – C. 461-464.
10. Tokhtasheva M., Erkinov A. THE STRUCTURE, STRUCTURE AND APPLICATION OF 3D PRINTER FILAMENTS: ANALYSIS AND PROSPECTS //Journal of Applied Science and Social Science. – 2025. – T. 1. – №. 2. – C. 796-799.
11. Lyamin A., Xadjibayev A., Erkinov A. STUDYING THE THERMAL CONDUCTIVITY OF MATERIALS //International Journal of Artificial Intelligence. – 2025. – T. 1. – №. 3. – C. 328-336.
12. Shonazarovna A. S. et al. DEVELOPMENT AND OPTIMIZATION OF EFFICIENT TECHNOLOGICAL PROCESSES FOR THE REGENERATION OF TRANSFORMER OIL //AMERICAN JOURNAL OF EDUCATION AND LEARNING. – 2025. – T. 3. – №. 3. – C. 1104-1107.
13. Xadjibayev A., Jobborova M., Erkinov A. ADVANTAGES AND DISADVANTAGES OF U-SHAPED HEAT EXCHANGERS: A SCIENTIFIC ANALYSIS //International Journal of Artificial Intelligence. – 2025. – T. 1. – №. 2. – C. 461-464.
14. Эркинов А. К. Компьютерное моделирование гидродинамики воздушного потока в зоне разделения роторного классификатора. – 2021.
15. Erkinov A. K., Xadjibayev A. S., Shokirov A. P. Rotor klassifikatorining ajratish zonasida havo oqimining gidrodinamikasini kompyuterda modellashtirish //Строительство и образование. – 2025. – T. 4. – №. 2. – C. 295-299.
16. Annaev N. A. et al. Compacting solid waste from chemical industries //AIP Conference Proceedings. – AIP Publishing, 2022. – T. 2432. – №. 1.