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WATER TREATMENT WITH CORROSION AND SALT ACCUMULATION INHIBITORS FOR RECYCLING WATER SUPPLY

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Abstract:

The purpose of this work is to develop an effective method inhibitor and bactericidal protection of heat exchange equipment reverse cycles of water supply for coke production from corrosion damage using purified phenolic waste water for their recharge.

Keywords: Corrosion, Water Supply, Inhibitor, Nitrification, Salt Accumulation, Water Treatment.

INTRODUCTION

Inhibitory water treatment is a method of dealing with dissolved copper, calcium, magnesium, iron, and manganese compounds that produce salt deposits, affect the color of water, cause corrosion, and lower network pressure.

The use of scale and corrosion inhibitors in water allows heat and power equipment to run more efficiently. [1]

The usage of organophosphonic acids and their derivatives of organophosphonates as scale and corrosion inhibitors began in the 1960s.

The drugs containing oxyethylidene diphosphonic acid, nitrilotrimethylphosphonic acid and their derivatives are widely used.

The safe and effective use of corrosion inhibitors is only possible with the correct dosage.

Inhibitory water treatment is most often used in the field of heat supply, hot water supply, as well as for industrial purposes. Rational use of water in industry is carried out according tom he principle of creating closed systems of circulating water supply and development of low-waste and "dry" technologies. Implementation of the dry method extinguishing coke helps prevent air pollution, but when his raises the problem of eliminating the excess of purified biochemical installations (BCU) wastewater. The most rational way to solve this task is to use them to make up cooling water circulation cycles of enterprises. The purpose of this work is to develop an effective method inhibitor and bactericidal protection of heat exchange equipment reverse cycles of water supply for coke production from corrosion damage using purified phenolic waste water for their recharge.

Analysis of the circulating water of the cooling cycle of the UGS Kharkiv coke plantshow its increased corrosion activity with the manifestation of local types of destruction.

Cooling of gas storage facilities at KhKZ uses regular make-up with mixture artesian and biochemically purified phenolic water. Besides, cycle conditioning must be carried out with the addition of corrosion inhibitors based on water glass and phosphates, adding at this biocide. Promising direction of reagent water treatment is the use of multicomponent compositions, for example, in the composition which include mixtures of corrosion inhibitors and nitrification inhibitors based on thiocyanate derivatives. Laboratory research to determine the optimal composition a mixture of artesian water and water purified after BHU for replenishment the circulating cycle was investigated in a laboratory setup simulating the work of the circulating system. Evaluation of the corrosiveness of the circulating water when dosing corrosion inhibitors was carried out gravimetric method. Recycled water replenishment was carried out prepared solution at a temperature of 30 ºC, the temperature of the circulating water was 55 ºC with an evaporation coefficient of 2.3.. According to the research, the best ratio of a blend of artesian and filtered water following BCU is 4: 1. An increase in the percentage of cleaned water. The pH and alkalinity of the circulating water are reduced by phenolic water. As a result, it is proposed to generate make-up water by adding a composition consisting of a mixture of a corrosion inhibitor and a nitrification inhibitor in a 4: 1 ratio to a mixture of artesian and filtered water following BHU. Make-up water is prepared in a separate container before entering the circulating system, where it undergoes extra filtration and UV radiation processing. In the presence of corrosion activators chloride and thiocyanate ions, the composition consists of a phosphate-silicate mixture and derivatives thiocyanate acid (nitrification inhibitor). Salt was used as a nitrification inhibitor, formed by the interaction of thiocyanate ammonium (sodium) with phosphoric acid It is known inappropriate use of phosphate-silicate mixtures in the presence of ammonium salts in the circulating system,which accumulate, for example, in

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phenolic waste water by-product coke production, since at the same time in reverse cycles cooling, the oxidation of ammonium nitrogen takes place, the release of ionshydrogen and acidification of the medium to pH 5.5-6.0.

At such pH values the protective effect of the inhibitor mixture is reduced and it is ineffective. When using a composition containing inhibitors nitrification, a high selectivity of suppression vital activity of nitrifying bacteria, high protective action against corrosion due to the suppression of vital functions microorganisms-nitrifiers in water and due to high adsorption action of a phosphate-silicate corrosion inhibitor. As a result of research, the ratio of the inhibitor corrosion to the nitrogen-containing component of the nitrification inhibitor, which is 100: 1-50: 1 calculated by weight, respectively. when conducting laboratory studies, the nitrifying agent was dosed in the form of an aqueous solution with a concentration of 2-5% wt., and phosphate-silicate the mixture was added to the circulating system as a 10-15% aqueous solution. The concentration of nitrifying agent in the circulating system was maintained at the level 1-3 mg / dm and phosphate-silicate mixture - 100-300 mg / dm3.

Besides, the use of microfilters and UV rays also reduces the amount of suspended solids in the circulating system to the standard indicators and uninterrupted operation of heat exchange equipment. The use of this composition reduces the rate of corrosion of carbonaceous steel to values of 0.1-0.2 mm / year. The possibility of using for make-up is shown experimentally circulating water supply system for phenolic wastewater coke production and / or biologically treated waste water Achieved reduction of the corrosion process from 0.7-0.8 mm / year to 0.12-0.13 mm / year using the proposed inhibitor composition. After dosing composition content of nitrites and nitrates in water decreases to 0.5-0.7 mg / dm3 water pH rises from 5.5 to 7.5, corrosion steel decreases. As a result of the high selectivity of suppressing nitrifying activity, the suggested technical solution provides a high level of corrosion protection. microorganisms and strong phosphate and silicate adsorption capability on smooth functioning and a carbon steel surface by lowering the amount of suspended matter in heat exchange equipment substances. As a result, the use of these fluids in the recycling of water supply is recommended. You can nearly totally switch to a closed technological system with this facility. The plant's water usage is based on the pyrogenetic moisture of coal, which allows for a 2 to 3 fold reduction in the use of fresh industrial water. The use of corrosion inhibitors (phosphates and silicates), as well as nitrification inhibitor based on HCNS can reduce the rate general and microbiological corrosion of carbon steel to permissible limits with a uniform nature of the corrosion process, and also reduce the amount of suspended particles in circulating water (50-90 mg / dm .Rational use of water is achieved due to the ability to make-up of recycling water supply systems use industrial waste water from the by-product coke industry (and / or treated waste water water after CCU), which allows to reduce the discharge of water. Corrosion is a subject of interest to interdisciplinary research communities, combining fields of materials science, chemistry, physics, metallurgy and chemical engineering. In order to understand mechanisms of corrosion and the function of corrosion inhibitors, the reactions at the interfaces between the corrosive electrolyte and a steel surface, particularly at the initial stages of the corrosion process, need to be described. Naturally, these reactions are strongly affected by the nature and properties of the steel surfaces. It is however seen that the majority of recent corrosion and corrosion-inhibition investigations are limited to electrochemical testing, with *ex situ* analysis of the treated steels (post-exposure analysis). The characterization of materials and their surface properties, such as texture and morphology, are not being considered in most studies. Similarly, *in situ* investigations of the initial stages of the corrosion reactions using advanced surface characterization techniques are scarce. In this review, attention is brought to the importance of surface features of carbon steels, such as texture and surface energy, along with defects dislocation related to mechanical processing of carbon steels. This work is extended to a critical review of surface analytical techniques used for characterization of carbon steels in corrosive media with particular focus on examining steel surfaces treated with corrosion inhibitors. Further, emerging surface analysis techniques and their applicability to analyse carbon steels in corrosive media are discussed. The importance of surface properties is commonly addressed by surface scientists as well as researchers in other chemistry fields such as nanotechnology, fuel cells, and catalysis. This article is expected to appeal to a broad scientific community, including but not limited to corrosion scientists, material chemists, analytical chemists, metal physicists, corrosion and materials engineers. Any of these problems – or more usually a combination of them – result in costly unscheduled downtime, reduced capacity, increased water usage, high operation and maintenance costs, expensive parts replacements, and acid cleaning operations which reduce the life of the cooling system. There is no single method of treating cooling water. Selection of water treatment program for a specific system

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depends on: 1. System design, including system capacity, cooling tower type, basin depth, materials of construction, flow rates, heat transfer rates, temperature drop and associated accessories 2. Water, including make up water composition / quality, availability of pre-treatment and assumed cycle of concentration 3. Contaminants, including process leaks and airborne debris 4. Wastewater discharge restrictions 5. Surrounding environment and air quality In this course, we will discuss the reasons and means for controlling scale, corrosion and biological fouling.

CONCLUSION

The choice of treatment is basically a mater of economics. In a once-through system, a very large volume of water passes through the system only once. Protection can be obtained with relatively few parts per million (ppm) of treatment because the water does not change in composition significantly while passing through the equipment. In an open re-circulation system, more chemical may be present because the water composition changes significantly through the evaporation process. Corrosive and scaling constituents are concentrated. However, treatment chemicals also concentrate by evaporation, therefore, after the initial dosages only moderate dosages will maintain the higher level of treatment needed for these systems. In a closed re-circulation system, water composition remains fairly constant. There is very little loss of either water or treatment chemical. The best form of treatment recommendation for closed water system includes the dosage of film forming inhibitors such as nitrites and molybdate.

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