

IMPROVE EFFICIENCY OF COOLING TOWER BY PASSIVATION

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ABSTRACT

The main objective of this paper is to improve and modernization of instrument and process of cooling tower. This paper will help worker to execute their work with minimum effort and easy way. By this paper utilization of time and money will less, so that productivity will increase. By the brainstorming and with the help of fishbone diagram, various problem are arrange. DIFFERENT TYPES OF PROBLEMS FACEING IN PROCESS are Hydrometer is not ok, sp. Gravity of brine water is not maintained, Meg concentration is not maintained, Nh3 level ok, tubes of cooling tower is not ok, uneven flow, Ph level is not ok .Compressor oil level ,Preventive maintenance is not done For overcome the problem facing of temperature difference in refrigeration system of utility various method are there. By this project various problem are solved such as temperature difference and many more. The term 'passivation' refers to treating metal with chemical baths in order to make them permanently resistant to corrosion. In some cases, passivation is the name given to the application of anti-corrosives (instead of a bath) to various metals. The process that is used to passivate copper, however, is a little different, as there is no way to truly alter this metal through chemical baths .Passivation requires a neutral to slightly alkaline pH. Circulating passivation chemicals with inhibitor should be circulated to have proper passive film Nevertheless, in order to change the metal surface from an active state to passive state. The electrode potential must be raised to a level above that of the passivation potential. Typically this is achieved by the use of PO4/polymers in the presence of oxygen.

Keyword: PASSIVATION, COOLING TOWER.

1. COOLING TOWER

A cooling tower is a heat rejection device that rejects waste heat to the atmosphere through the cooling of a water stream to a lower temperature. Cooling towers may either use the evaporation of water to remove process heat and cool the working fluid to near the wet-bulb air temperature or, in the case of closed circuit dry cooling towers, rely solely on air to cool the working fluid to near the dry-bulb air temperature.



FIG 1 : cooling tower

Common applications include cooling the circulating water used in oil refineries, petrochemical and other chemical plants, thermal power stations and HVAC systems for cooling buildings. The classification is based on the type of air induction into the tower: the main types of cooling towers are natural draft and induced draft cooling towers.the

major problem which prevails is the frequent failures of condenser tubes. The effect of condenser tube failure impact the plant in a great scale as it increased the shutdown time period of all unit is increased and it also affect components of plant.

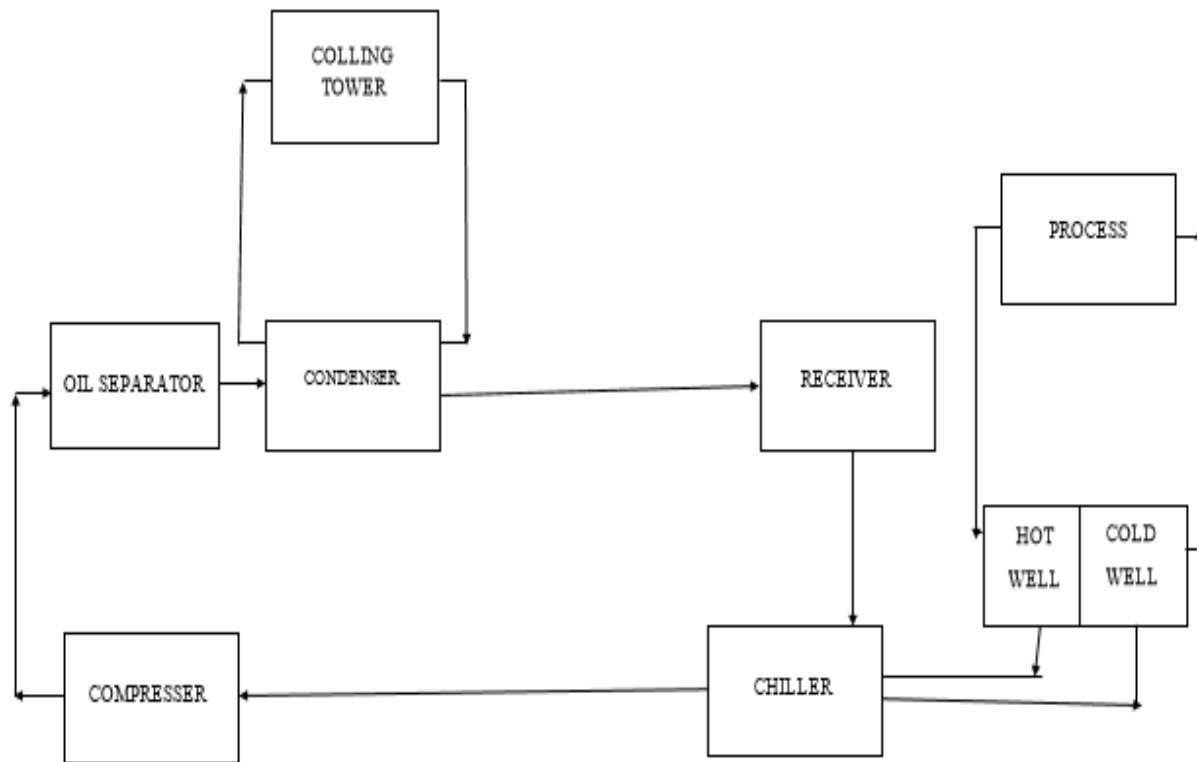


FIG 2 : Block Diagram Of Plant

1.1 Cooling Tower Problems

Industry uses such vast quantities of water that its importance in the economies and performance of Plant should not be overlooked. Particular attention must be paid to match the water quality from available source to the requirements of any specific plant, i.e., a comprehensive cooling water treatment program. Whatever the source, the water will contain impurities and these impurities will be varied both in character and amounts present, depending on the different sources. The most difficult characteristic of water to tame is its stability, that is, its corrosive or scaling forming tendency. Water, which may be quite stable in their specific environment, may become unstable once the environment is changed, and in whatever direction, either scaling or corrosive, the change will occur, these two tendencies are strictly inter-related and no net separation can be done.

1.1.1 Scale

Scale will interfere with efficient heat transfer and serve as a matrix for foulants to accumulate resulting in noticeable loss in cooling efficiency. Scale build-up results when a compound precipitates from the water phase because its solubility has exceeded. It differs from sludge because it usually is a dense, very adherent deposit of minerals and is tightly bonded to itself and to metal surfaces. Sludge, on the other hand, is the result of precipitation of minerals in a form that is loosely adherent to metal surfaces and other sludge particles. Crystallization of a compound directly on surface requires four simultaneous factors. They are: 1.) Super saturation, 2.) Nucleation, 3.) Adequate Contact Time, 4.) Scale Formation. Depending on the type of water used as makeup to the cooling system, deposits/scale of carbonate, sulphates, phosphates and silicates (as well as other salts of calcium, iron, manganese, magnesium and zinc) are also observed in cooling water deposits. Most importantly the corrosion inhibitor used as a

part of cooling water treatment contains phosphate based chemicals which tend to precipitate under specific condition that exist in cooling water system.

1.1.2. Fouling

Fouling is distinguished from scaling in that fouling deposits are formed from material suspended in water. A fouling deposit, however, will contain substantial amounts of scaling and corrosion products along with microbiological growth. Materials that cause fouling can occur in cooling system in five forms:

Biological growth.

Transported colloidal material in the recirculating water, e.g., iron, calcium carbonate and corrosion products.

Silt or suspended solids in the make-up water.

Airborne dust and particles carried into the system by air/water contact.

Substance such as oil leaking into the recirculating water from process

1.1.3. Microbiological Growth

Experience has shown that uncontrolled microbiological growth will render the best stabilization treatment inefficient. Microbiological organisms may be responsible for scaling or slugging even though the deposits or sludge may not be principally microbiological in nature. The micro-organisms may serve as a binder for the minerals which are found in the deposit.

These are of great interest in any chemical cooling water systems where Ammonia, Methanol, chlorine etc are present as contaminants.

Most problems encountered in cooling water systems involve bacteria, and to a lesser degree, algae and fungi. Bacteria, a major category of troublesome organisms, can be grouped into three classes: (I) aerobic slime formers, (ii) anaerobic corrosive, (iii) Nitrifying bacteria. Aerobic slime formers produce sticky and goeey deposit generally resembles mucus and may be coloured. These deposits can occur throughout a water system because most cooling water usually has sufficient oxygen for aerobic bacterial growth. A number of mechanisms exist by which anaerobic sulphate reducing organisms accelerate corrosion under anaerobic conditions. They include :Direct depolarization, Precipitation of ferrous sulphide at the anode. Creation of highly corrosive pH (frequently less than 3.0) under deposit as a result of Nitrous/Nitric acid H₂ and H₂S metabolic by-products.

All of these accelerate severe pitting corrosion on practically any metal surfaces. Corrosion attributed to these anaerobic is always manifested as a highly localized pitting. Iron depositing bacteria are very abundant in natural waters. The two species of iron-depositing bacteria of major importance in cooling water are Legionella and Sphaerostilus. Both species can use soluble (ferrous) iron as an energy source and convert it to an insoluble oxide or hydroxide form. Fresh deposits that are formed by iron depositors are frequently white to reddish-brown and voluminous. These deposits create fouling and concentration cell corrosion, as well as conditions for anaerobic bacteria to flourish.

1.1.4. Corrosion

Corrosion is the oxidation process by which metals are converted back into their native states. Iron, for example, is converted back into its oxide. The area over which metal is corroded (oxidized) is called the anode and that area over which the oxidizing agent is reduced is called the cathode. These areas are separated, but may actually be microscopically close together and as corrosion proceeds, electrons flow through the metal between these areas. For aqueous systems, cations migrate toward the cathode, while anions move toward the anode area. The flow of electrons through the metal is the corrosion current and is limited by the rate at which electrons are accepted by oxidizing agent (usually oxygen) at the cathode. Conductivity of the electrolyte (water) completes the electrochemical (corrosion or reaction) cell and controls the rate at which corrosion half-cell reactants and products can be transported to and from the reaction (or corrosion) site. Conditions that increase the conductivity of the water, e.g., high dissolved solids, or high temperature, generally increases the rate of corrosion.

2. Passivation

Passivation refers to the spontaneous formation of an ultrathin film of corrosion products, known as a passive film, on the metals' surface that act as a barrier to further oxidation. The chemical composition and microstructure of a passive film are different from the underlying metal. Typical passive film thickness on aluminium, stainless steels, and alloys is within 10 nanometres. The passive film is different from oxide layers that are formed upon heating and are in the micrometer thickness range – the passive film recovers if removed or damaged whereas the oxide layer does not. Passivation in natural environments such as air, water and soil at moderate pH is seen in such materials as aluminium, stainless steel, titanium, and silicon.



Fig -3 PASSIVATION

Passivation is primarily determined by metallurgical and environmental factors. The effect of pH is summarized using Pourbaix diagrams, but many other factors are influential. Some conditions that inhibit passivation include high pH for aluminium and zinc, low pH or the presence of chloride ions for stainless steel, high temperature for titanium (in which case the oxide dissolves into the metal, rather than the electrolyte) and fluoride ions for silicon. On the other hand, unusual conditions may result in passivation of materials that are normally unprotected, as the alkaline environment of concrete does for steel rebar. Exposure to a liquid metal such as mercury or hot solder can often circumvent passivation mechanisms.

2.1 How to passivate

The term 'passivation' refers to treating metal with chemical baths in order to make them permanently resistant to corrosion. In some cases, passivation is the name given to the application of anti-corrosives (instead of a bath) to various metals. The process that is used to passivate copper, however, is a little different, as there is no way to truly alter this metal through chemical baths. Passivation requires a neutral to slightly alkaline pH. Circulating passivation chemicals with inhibitor should be circulated to have proper passive film. Nevertheless, in order to change the metal surface from an active state to passive state. The electrode potential must be raised to a level above that of the passivation potential. Typically this is achieved by the use of PO₄/polymers in the presence of oxygen. Obviously the cooling water must be circulated over the tower to the necessary oxygen and heat load should be provided and chemical should be add accordingly. During the process fans should be switched off. The process for proper and effective passivation will need 3-4 days. Before the regular treatment is employed pH should be not more than 7.0 – 7.5 for the efficient use of chlorine or biocides. The easiest way to passivate is to have min pressure of 2-3 kg /cm² of circulation water for primary wash and then pass the coating by reducing it thickness by 100 ppm to 25 ppm, by this it take 4 day for each layer.

2.1 Procedure of Passivation

Pre-cleaning

Systems hold up : 100 M3

Circulation rate : min pressure of circulation water is 2-3 Kg/CM²

Product : Ist Day Katside 6423 100 ppm on hold up : 10 Kg.
IInd Day Katside 6565 100 ppm on hold up : 10 Kg.

Keep pH valued of circulating water 6.5-7.0 during Precleaning

Base of material : Non Oxidizing Biocide with dispersant

Temp required (heat Load) : min 3-50C delta T of cooling tower

Give 10 Blow Down after Completion of Pre-cleaning and before starting Passivation

Passivation:-

System hold up : 100 M3

Circulation rate : min pressure of circulation water is 2-3 Kg/CM2

Product :3 rd Day Sofaid 4170 100 ppm on hold up : 10 Kg.
4 th Day Sofaid 4170 50 ppm on hold up : 05 Kg.
5 th Day Sofaid 4170 35 ppm on hold up : 3.5 Kg.
6th Day Sofaid 4170 25 ppm on hold up : 2.5Kg.

Keep pH valued of circulating water 7.0-7.5 and No Blow down during Passivation

Base of material :Phosphonate Base Scale and Corrosion Inhibitor.

Temp required (heat Load) : min 2-40C delta T of cooling tower

Required time for Pre-cleaning and Passivation is 7 days.

3. Technical detail of material

KATS ORGANICS Corporation is a foremost Sole Proprietorship company which is betrothed in manufacturing pure and qualitative Treatment Chemical and we are trading of Water Testing Kits. Also we are engaged in offering Chemical Cleaning Services, Hydro Jetting Services and Monitoring Services. We are an ISO 9001:2008 certified company that is established in the year 2011 with an aim of providing qualitative chemicals as per the varied needs of the clients. We provide these chemicals in diverse industries that such as Petro Chemicals, Fertilizers, Power Plants, Textile, Pharmaceuticals, etc. Under the supervision of our Proprietor "Mr. Deepak Behare", we have gained tremendous success in this domain. Located at Vadodara (Gujarat, India), we are supported by a team of capable professionals who are considered as the strongest pillar of our firm

Sofaid 4170

SOFAID -4170 series has high performance, treatment chemicals for cooling towers having following advantages.

Scale Inhibitor, Corrosion Inhibitor, Dispersant Bio-Dispersant, Non-oxidizing biocides, Biocides, Bactericides, Algaecides, Fungicides.

3.1 Advantages of passivation

Passivation is a process that helps to prevent corrosion and pitting on surface.

The passivation process applies a thin transparent passive chemically inter film to stainless steel that reduce the reactivity of the metal

This film deters corrosion and oxidation.

For this plant since the load is decreased due to ageing it is not necessary to increase the number of tube. Due to this process tube life is increased so that change of new tube is delayed so productivity will increase. Maintenance work will reduce.

4. CONCLUSIONS

- The corrosion behavior of copper alloy depends on the presence of oxygen and other oxidizers because it is cathodic to the hydrogen electrode.
- During the primary corrosion reaction of cuprous oxide film is produced that is predominating responsible for the corrosion protection.
- The corrosion resistance of copper and copper base alloy in water is determined by the nature of the naturally occurring and protective corrosion products film.
- When the galvanized coating on carbon steel is maintained on cooling tower or other evaporative cooler surfaces, it functions to essentially slow down the rate of corrosion of the underlying steel. This promotes acceptable performance of the steel and maximizes the life span of the equipment while minimizing the overall cost of the material.

6. REFERENCES

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