COOLING WATER SYSTEM PROBLEMS
&
CHEMICALS TREATMENTS

The problems associated with the use of water in cooling systems are serious but carefully prescribed and monitored **"Total Cooling Water Treatment"** program can curtail their occurrence. The damage will begin immediately. Equipment designed to last for years can break down in just days due to some form of uncontrolled corrosion scale, microbial growth or fouling. These problems are control by "Total Cooling water Treatment" program, which will include both chemical and mechanical methods for controlling problems.

For example, depending on the design and location and water Chemistry, water treatment program may include some or all of the following:

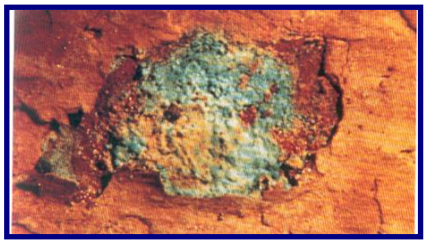
1) **Corrosion Inhibitor**
2) **Dispersant**
3) **Biocide**
4) **Scale Inhibitor**

Through the implementation and proper monitoring of these specialized total water treatments program, the problems associated with water in cooling systems can be controlled.

To make our program success, we incorporate monitoring tools to ensure that Treatment program of the system is become more effective every passing day

A. CORROSION:

Corrosion is an electrochemical reaction converting the metal into its oxide. Corrosion requires an anode, cathode & an electrolyte. The metal acts as an anode & cathode while water acts as an electrolyte.



FOLLOWING FACTORS AFFECT THE RATE OF CORROSION:

a) Metallurgy of the system
b) PH of circulating water
c) Dissolved gases
d) Dissolved and suspended solids
e) Water velocity
f) Temperature
g) Microbial growth

Under Deposit Corrosion View after Cleaning

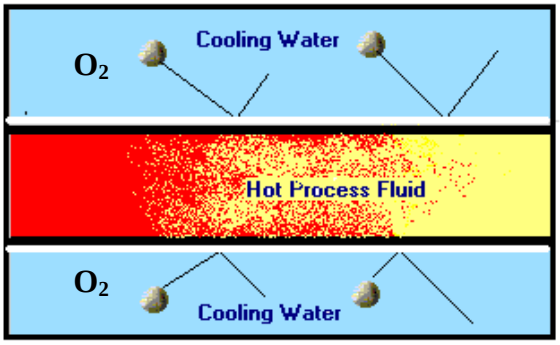
BARON Chemicals & Systems (P) Ltd.
H-5/ 21, Krishna Nagar, Delhi-110051. Tel:011-22418572, Mobil 9810158931 Fax 91-11-22023200

IMPORTANT TYPES OF CORROSION WHICH ARE FREQUENTLY FOUND IN COOLING SYSTEMS:

a) General type of corrosion
b) Localized corrosion
c) Corrosion due of velocity
d) Corrosion due to mechanical stress

HOW DO THE CORROSION INHIBITORS WORKS?

The Corrosion Inhibitors present in Water Treatment Chemicals form the passivation film on the metal surface. Thus this surface is impervious to ions transfer or oxygen attacks and this barrier is arresting the corrosion.
As the film is very thin, it in no way affects the heat transfer.



B. SCALING:

Scaling is defined as the hard and adherent deposits formed due to precipitation of sparingly soluble salts in water. The most commonly occurring scalants in cooling water systems are carbonates, sulphates, phosphates and silicates of calcium and magnesium.

The scale deposits give rise to the following problems in cooling water systems:
a) Reduced heat transfer decreasing the heat transfer efficiency.
b) Increased pressure drop on water side.
c) Under Deposit Corrosion.

FOLLOWING ARE THE FACTORS WHICH AFFECT THE SCALING IN COOLING WATER SYSTEM:

a) Temperature
b) pH
c) Solubility

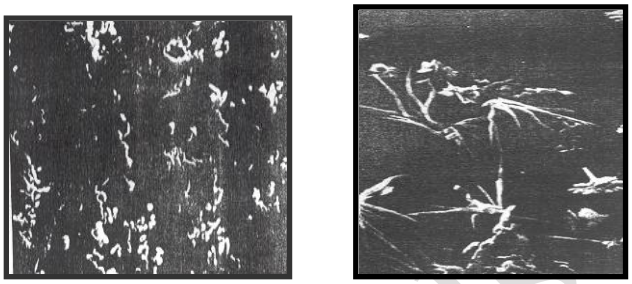
BARON Chemicals & Systems (P) Ltd.
H-5/ 21, Krishna Nagar, Delhi-110051. Tel:011-22418572, Mobil 9810158931 Fax 91-11-22023200

HOW DOES THE ANTISCALANT WORK?

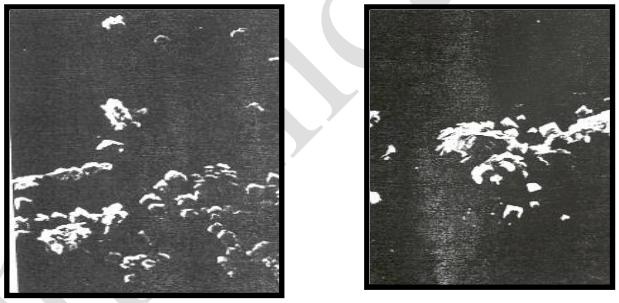
For scaling to form, the crystal of scaling salt has to grow sufficiently in size.

When the crystal is growing the ANTISCALANT is absorbed on the crystal, blocking the growth site. Thus the crystal cannot grow in size. Even it the crystal grows, it is imperfect and the structure is very fluffy. The small or fluffy crystals cannot form hard deposits hence Scaling does not occur. In presence of ANTISCALANT, the metal surface remains free from Scaling.

The ANTISCALANTS inhibit scale formation by increasing the solubility of scalants in water and help to remain higher levels of scalants in dissolved form.



Electron Photomicrographs showing scale without antiscalant



Electron Photomicrographs showing scale with antiscalant

B. FOULING :

Fouling is the deposition of suspended particles. The particulate matter generally accumulates at low velocity areas in the cooling water system. If cooling water is on the shell side of the heat exchanger then because of low velocity the fouling material settles on the shell side

Fouling Deposition

THE POTENTIAL FOULANTS IN COOLING WATER SYSTEMS ARE AS FOLLOWS:

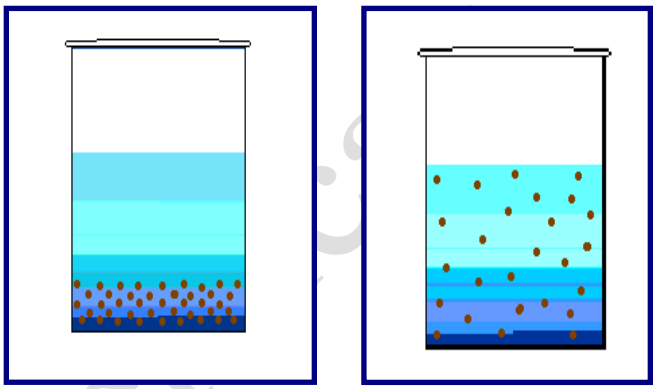
a) Dust and silt.
b) Corrosion Products.
c) Sand
d) Natural organics
e) Microbial matter

BARON Chemicals & Systems (P) Ltd.
H-5/ 21, Krishna Nagar, Delhi-110051. Tel:011-22418572, Mobil 9810158931 Fax 91-11-22023200

THE FOLLOWING FACTORS AFFECT THE FOULING OF THE SYSTEM:

a) Water characteristics
b) Temperature
c) Water velocity
d) Microbial growth

HOW DOES THE ANTIFOULANT WORK?



For fouling to take place, small suspended particles have to come together to form Agglomerate. Most of the suspended matter is in the colloidal state and have a small electric charge on them.

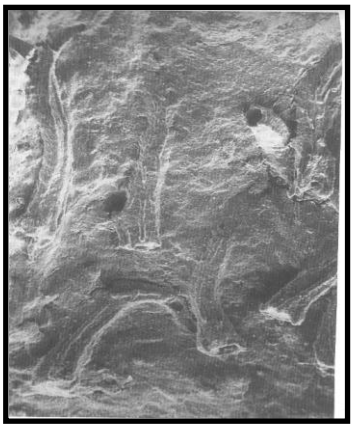
ANTIFOULANT is polymeric in nature and when it is absorbed on suspended particles, it will increase the negative charge on the particle. As like charges repel, the suspended particles are thus kept apart, preventing their agglomeration.

The particles thus stay dispersed in the water and are prevented from depositing and fouling the system.

C. MICROBIAL GROWTH :

Cooling water gives the excellent conditions for growth of various micro-organisms. The temperature and pH of circulating water are ideal conditions for the growth of algae and various bacteria's. Also the organic matter, inorganic salts, sunlight etc. provides abundance of nutrients for the growth of these micro-organisms. Following are the problems faced because of various microorganisms:

Microbial Growth



a) **Algae**: Air, water & sunlight are the three basic requirements for algae growth. Excessive growth of algae on the deck of cooling tower can choke the distributor nozzles and reduce the water flow through cooling tower thus reducing its efficiency. Excessive growth on the louvers, fill material increases the load on structure and may cause the failure of structure. Algae mass can also get carry into the heat exchangers and plug the exchanger tubes.

b) **Bacteria:** There are various species of bacteria found in cooling water system.

SOME OF THE MOST FREQUENTLY FOUND BACTERIA IN COOLING SYSTEM ARE:

I **Pseudomonas:** These are aerobic bacteria, which secrete slime. This slime acts as a binding material and fouls the System.

II **Sulphate Reducing Bacteria**: These are anaerobic bacteria which reduces sulphate ions to sulphides. These bacteria grow under the deposits and yields under deposit corrosion.

There are also other aerobic bacteria like nitrifying bacteria, which reduces the pH of circulating water and iron bacteria and sulphur oxidizing bacteria which hamper the efficiency of the system.

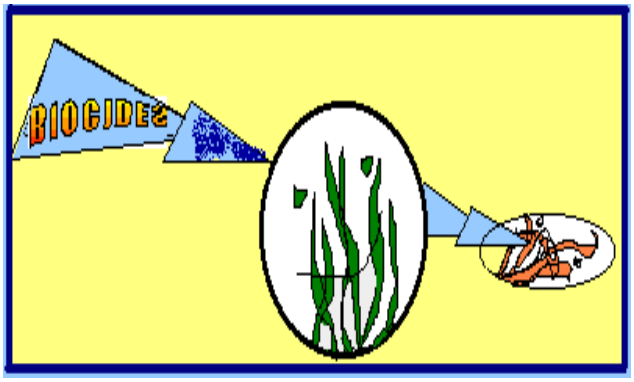
Sulphate Reducing Bacteria

HOW DO THE BIOCIDES WORK?

BIOCIDES are chemicals that interfere with basic process of a cell.

BIOCIDES act as a poisonous material to the Al cells. They will either rupture the cell wall or get the cell and damage the metabolism inside the cell.

We have extremely strong BIOCIDES, which wc kill Algae in few days of time. Regular dosage BIOCIDES will not allow Algae to grow, o destroyed. Killing of Algae is the visible sign of action of BIOCIDES as the dead Algae will turn fi Green to Yellowish-brown.



However, if initial growth of Algae is very high, it will be desirable to clean the Algae manually as much as possible. Otherwise, there is a chance of dead Algae becoming a large mass of foulants in the water and chocking the strainers in the pipelines.

BARON Chemicals & Systems (P) Ltd.
H-5/ 21, Krishna Nagar, Delhi-110051. Tel:011-22418572, Mobil 9810158931 Fax 91-11-22023200

Monitoring & Control

Monitoring of industrial water treatment system is essential to get feedback. The feedback indicates the effectiveness of treatment. There are other benefits also by proper monitoring of cooling water treatment.

1. Control of chemical underfeed or overdose.
2. Meeting pollution standards.
3. More effective treatment. Improved or better plant operation.
4. Savings in chemicals, water and energy.
5. Improved plant productivity.

Chemical Treatment Program will be monitor by

1. **Water Parameters Testing**
2. **Specialty Chemicals Residual Testing**
3. **Corrosion Coupon Monitor**
4. **Fouling Depositor**
5. **Microbiological Count Test**

Method of Monitoring

Monitoring can be manual or online. Manual monitoring is done for small system or in non critical water systems. Manual monitoring is also done in water systems where there is not much variation in water quality.

There are large plants like power plants and refineries where huge amount of water is used in cooling. Here the precision required is much higher than for smaller plants. This is achieved by online monitoring.

Water Parameters Monitored

In cooling water system the following parameters are generally measured.

1. Hardness (Both total and Calcium)
2. M. Alkalinity
3. Total Dissolved solids (TDS)
4. Total Suspended Solids (TSS)
5. pH
6. Chloride
7. Silica
8. Iron
9. Specialty Chemicals Residual.
10. Chlorine residual.
11. Other residuals

Depending on the treatment and the cooling water system the parameters are analyzed on per shift, daily or weekly basis. We have water testing Kits to test on site and other monitor equipments which can provide on cost basis.

BARON Chemicals & Systems (P) Ltd.
H-5/ 21, Krishna Nagar, Delhi-110051. Tel:011-22418572, Mobil 9810158931 Fax 91-11-22023200

DAILY WATER TESTING

Water testing (make up and recirculating) is to be done by our trained chemist at startup and we will provide the testing procedure to monitor the make up and recirculating water daily.

Monitoring of Corrosion rate

In cooling water treatment, monitoring of corrosion rate is important because corrosion cannot be totally eliminated but reduced. Monitoring gives feedback on the effectiveness of treatment. Corrosion monitoring is done by various methods but most common method is by "Test Coupons" Test coupons are generally installed in the following location

1. At the outlet of hottest condenser/cooler.
2. In cooling water return
3. In makeup water line

Corrosion rate is expressed in MPY(or mpy) Mils per year, IPY (or ipy) inches per year or MMPY(or mmpy) millimeters per year

BARON CORROSION COUPON RACK

a) The BARON **Corrosion Coupon Test Rack** is used to evaluate the effectiveness of chemical treatment programs on non-heat transfer surfaces. It comes with all accessories including a flow control valve. With these units corrosion rate can be measured at different water flow velocities. This method confirm ASTM standard and will be provide on cost basis

b) Imported **Corrosion Coupon** is per-weighted with accurate surface area and will be provide on cost basis

1 2 3 4

1. **Scale and Fouling Monitor Coupon**
2. **Fouling & Slime Monitor Coupon**
3. **Copper Monitor Coupon**
4. **MS Monitor Coupon**

BARON Chemicals & Systems (P) Ltd.
H-5/ 21, Krishna Nagar, Delhi-110051. Tel:011-22418572, Mobil 9810158931 Fax 91-11-22023200

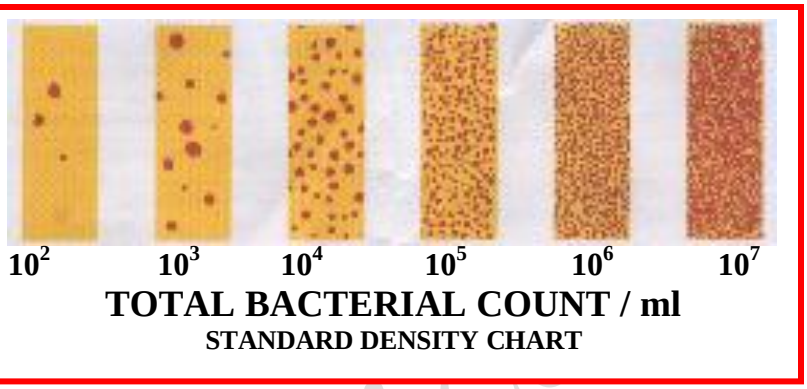
BARON
CHEMICALS & SYSTEMS PVT. LTD.

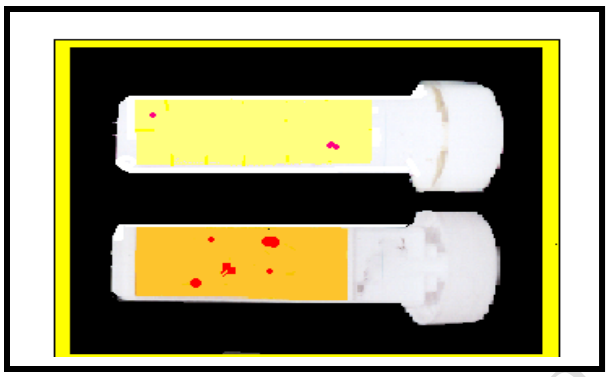
Technology
Reuse
Reduce
Recycle

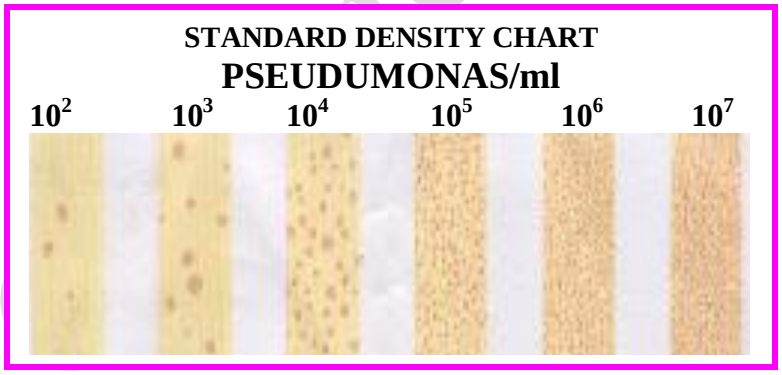
DIP SLIDE (Biological Growth Testing)

We will provide the Dip Slid for the testing of following microbiological growth and It gives freedom to test bacteria at anytime and anywhere

1.Total Bacterial Counts
2. Pseudomonas
3. Escherichia Coil (E. Coli)
4. Yeasts
5. Fungi
6. SRB



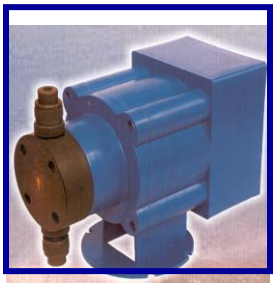




DIP SLIDE FOR MICROBIOLOGICAL GROWTH TESTS

Dosing Equipment & Systems

Looking to the specific demands of the customers, Chemical dosing pumps and dosing systems with pH & TDS Controller are being supplied for water Treatment.



BARON Chemicals & Systems (P) Ltd.
H-5/ 21, Krishna Nagar, Delhi-110051. Tel:011-22418572, Mobil 9810158931 Fax 91-11-22023200