

ZINC ORGANIC TREATMENT FOR POWER STATIONS

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Introduction:

Present condenser cooling water treatment can be broadly classified into 3 categories.

- 1.Plant operating at very low COC but without any treatment.
- 2.Plants using only antiscalant treatment with little or no corrosion control, and
- 3.Plants using Zinc and Orthophosphate treatment for systems operating at high COC

Of the above, Zinc and Ortho Phosphate treatment gives maximum corrosion scale control but typically expensive. These also require stringent PH control.

Of late, discharge of orthophosphate containing effluent has become an environmental concern. The presence of Orthophosphate in effluent is known to cause algal blooms in receiving water bodies.

Ion Exchange (I) Ltd has developed an alternate treatment that overcomes these limitations namely Zinc Organic treatment. This treatment programme operates at alkaline and scaling conditions. The use of high efficiency dispersants and phosphonate controls Scaling even upto RSI of 4.0. Corrosion control is achieved by controlled use of zinc only and this treatment avoids orthophosphate completely. As a result, not only is the effluent more environment friendly, but algae growth in cooling water is also lesser.

This was tried at a power plant in Andhra Pradesh. The power station was commissioned in the middle of 1997. Initially, no treatment was employed and instead the system was operated at low COC (<1.3)

The plant is located in an area with water scarcity. As a result, the plant management decided to go in for chemical treatment that would blow down and reduce water consumption.

Ion exchange (I) Ltd, was awarded and the cooling water treatment was started in February 1998.

System Details (Design Basis):

Recirculation : 8500M³/Hr.

Hold up Volume : 1800 M³

Delta T	:	9-10°C
CoC	:	6-7
HIT	:	56 Hrs
MOC	:	Mild Steel, Stainless Steel, Copper

Treatment Programme

Product	Description	Dosage
I-9270	Corrosion & Scale Inhibitor	30 ppm on bleed off
I-9024	Cathodic Inhibitor	10 ppm on bleed off
I-9079	Bio Dispersant	3 ppm on bleed off
I-7106	Biocide	50 ppm on hold up Volume once in two months
I-9087	Biocide	Volume once in two months

Additional 3 ppm of biodispersant is slug dosed 1 hour before biocide dosing. This treatment programme was specifically designed by IEL as a cost-effective alternate to conventionally used programmes available as mentioned above.

Control Parameters:

Parameter	Unit	Control Limits	Actual Averages
PH	ppm as CaCO ₃	7.5-8.0	7.85
CaH	ppm as CaCO ₃	450	300
Alk	ppm as Cl	-----	42
Cl	ppm as Cl	250	90
Condmicro S/cm		----	1263
CoC TH	-----	6-7	6-51

(Please refer attached graphs for month wise averages)

Performance:

Performance of treatment was found entirely satisfactory from day one with respect to:

- Water Conservation: The system has always operated at the desired high COC
- Condenser Cleanliness: Excellent control maintained throughout the last 3 years.
- Corrosion Control: Always below 3 mpy on Mild Steel and virtually nil on SS

Treatment Upgradation

As a part of continuous improvement installation of a side stream filter was recommended. Subsequent to this, even the small quantity of ash/silt noticed in the condenser during turn around has disparaged.

During March ' 200, SRB counts of CW increases alarmingly. On investigation, it was found that the make up water SRB had increased to beyond 800+/100 ml. As a result, counts in CW could not be controlled.

Biocide dosing was increased temporarily to once/week and customer was advised to install a chlorination system.

The chlorination system was commissioned on 13th July 200. Immediately, SRB counts have become negligible. Simultaneously, biocide dosing has been cut back substantially (one dose per month).

Monitoring:

- PH & FRC of CW is monitored every 4 hours to regulate acid and chlorine dosing.
- Detailed water analysis (CW & M/u) is carried out once in a day to maintain CoC and to regulate chemical dosing.
- Performance parameters such as load, vacuum, CW & Steam temperatures are logged daily.
- Corrosion rates are determined monthly and detailed microbial evaluations is carried out once in 6 months.

The careful attention paid to monitoring has been the key factor in making a success of this treatment programme. As can be seen from the attached data, all parameters are maintained very close to desired levels continuously.

The treatment programme at this power plant has proven that IEI's Zinc-organic phosphate treatment is a viable and highly cost-effective programme for power stations.

Subsequently the same treatment programme has been used at a number of installations. Power plant as well as others with equally successful results.

Rough Estimate of Zinc Organic Treatment for power Plants

System Details

Recirculation rate: 30000 M³/Hr.
 Hold Up volume: 10000M³
 Delta T (°C) : 09
 Evaporation : 437.4M³/Hr.
 MOC : Mild Steel and Stainless Steel

Typical Make Up Water (Considered)

PH	Total Hardness	Ca-Hardness	Mg-Hardness	Alkalinity
8.0	100	60	40	100
Chloride (Cl)	Silica (SiO ₂)	Turbidity (NTU)	Iron (Fe)	Sulfate (SO ₄)
20	15	<2.0	0.05	15

System Characteristics:

COC	3.0	4.0	5.0	6.0
Blowdown (M ³ /Hr.)	218.7	145.8	109.35	87.48
HTI	31.68	47.53	63.37	79.22

- **: Savings in water by operating cooling water at 6 COC instead of 3.0 – 131.22 M3/Hr.**

Treatment Recommendation (per day):

COC	3.0	4.0	5.0	6.0
I 9270 (ppm)Kgs	20/105	25/88	30/79	35/74
I 9024 (ppm)/Kgs	10/53	10/35	10/27	10/21
I 9079 (ppm)/Kgs	5/27	5/18	5/14	5/11
H ₂ SO ₄ (Kgs)	480	560	660	700

*Note: Generally continuous gas chlorination is adequate for control of microbiologically induced corrosion. Sulfuric acid addition is for PH correction. Cooling tower water PH has to be maintained strictly in the range of 7.0 to 8.0.

Treatment Cost per Day:

COC	3.0	4.0	5.0	6.0
I 9270 (Rs125/Kg)	13125.00	11000.00	9875.00	9250.00
I 9024 Rs.60/Kg)	3180.00	2100.00	1620.00	1260.00
I 9079 (Rs.160/Kg)	4320.00	2880.00	2240.00	1760.00
H ₂ SO ₄ (RS.5/Kg)	2400.00	2800.00	3300.00	3500.00
TOTAL (Rupees)	23025.00	18780.00	17305.00	15770.00
Cost.M ³ with acid	35.00	32.00	31.00	30.00
Cost.M³ without acid	31.05	27.50	25.00	23.50