Application of CDD-5000 (0.5 % Chlorine Dioxide) in Cooling Water Treatment

Chlorine Dioxide Chemistry:

Chlorine dioxide's chemistry is best summarized not by what it reacts with so much as by what it does not react with. Chlorine dioxide does not react with water nor does its chemical form or biocidal activity change with changes in pH. Chlorine dioxide also does not react with ammoniacal or most organic contaminants and treatment chemicals present in the cooling water. Consequently, the dosage required for biocidal control remains fairly constant over a wide range of cooling water conditions. This makes chlorine dioxide an excellent choice for cooling water that has a high pH, or that has high levels of organic or ammoniacal contamination.

Chlorine Dioxide by CDD-5000 method:

- CDD-5000 contains 2 powders A and B
- Take and fill the container with the exact amount of tap water as shown on the label (1L, 5L, 10L, 50L, etc)
- First add component A to water in container and then add component B.
- Gently swirl the liquid and securely close the container.
- Wait for 4 hours for reaction to complete.
- After reaction CDD-5000 (0.5 % solution of chlorine dioxide) is ready for use

Cooling tower Treatment with CDD-5000:

Since the primary function of a biocide is to protect the heat exchangers and other metal parts of the cooling system, chlorine dioxide should be applied directly into the suction of the cooling system's recalculating pump. Alternatively, it may be applied beneath the water in the sump as close to the pump intake as possible. Depending upon how critical the cooling system is, two different treatment schemes may be used: an intermittent treatment scheme and a continuous treatment scheme. Since both treatment schemes are based upon establishing a chlorine dioxide residual, to be effective the chlorine dioxide demand of the cooling water must be known. Typically the chlorine dioxide demand is determined over a 5 minute time interval. Equation 3 shows the relationship between chlorine dioxide demand, dose and residual **3. Residual = Dose - Demand**

An intermittent treatment program may be used for less critical cooling systems. This program applies CDD-5000 three times a day (dawn, dusk and midnight) at a dose sufficient to achieve a 0.5-1.0 ppm chlorine dioxide residual This dose is based upon the cooling system recirculation rate. The duration of each dosing period is half an hour or four turnovers of the total cooling system volume, whichever is greater.

Continuous Treatment

A Continuous treatment program, which is much more expensive,can be used for critical cooling systems. This program applies CDD-5000 continuously at a dose sufficient to achieve e a 0.1 - 0.2 ppm chlorine dioxide residual. This dose is again based upon recirculation rate.

CDD-5000 Treatment Example

The water of an industrial cooling tower with a total system volume of 40 m3.The following table and calculation gives the estimated daily CDD-5000 requirement

SR. No.	Daily water capacity (Lit)	Required dose of CDD-5000 per cycle (Lit)	CDD-5000 Required (Lit) per cycle
1	40000	0.3	2.4
2	40000	0.4	3.2
3	40000	0.5	4

Calculation of CDD-5000 dose:

$$\text{CDD-5000 required} = \frac{\text{Required dose rate (PPM)}}{5000} * \text{Quantity of Water (Lit)}$$

CDD-5000 Analysis

While CDD-5000 (0.5% chlorine Dioxide) concentrations may be determined by many different methods, two methods have been commercialized and are in widespread use: the DPD (N,N-diethyl-pohenylenediamine) method and the CPR (chlorophenol red method). Since the DPD method is normally used to also determine chlorine concentrations, it is widely available. However, it must be modified so that it reads only chlorine dioxide. In contrast, the CPR method is not as widely used but is specific for chlorine dioxide.

DPD Method

Both chlorine and chlorine dioxide react with DPD to give a red-colored solution. The intensity of the red color is proportional to their concentrations. Glycine, NH2CH2COOH, is added prior to the DPD to react with and mask chlorine in the sample. If a test kit calibrated for chlorine is used, the result must be multiplied by 1.9 to correct for the higher equivalent weight of chlorine dioxide.

CPR Method

The CPR method specifically determines chlorine dioxide concentration based upon its ability to convert red CPR to a colorless product. The amount of the red CPR that is bleached is proportional the chlorine dioxide concentration.

CDD-5000 Service

The implementation and administration of a chlorine dioxide treatment program for cooling tower microbiological control requires several different steps. Consequently, many plants have found it cost effective to employ a water service company to implement and administer their chlorine dioxide programs. These companies typically provide the following services:
1) Determine the CDD-5000 demand of the water
2) Size, design, and provide the CDD-5000 system
3) Determine the optimum application point and treatment strategy

FACTORY OFFICE
Plot No. 43/44/45 Gut No. 411 at Village Urawade, Taluka Mulshi District, Pune - Maharashtra, Pincode - 412111
+91-020-22923390 / +91-8007716655

US OFFICE
SVS AQUA USA INC & MICHAEL MARTIN,
127 Stream Rd Winterport, Me - 04496
usa@svsaqua.com

OFFICE
Mahavir Chambers, 520 New Rasta Peth, Pune 411011
+91 020-26067098 / 26061820
FAX +91 02026062163
customercare@svsaqua.com

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