CSA CHEMICAL SYSTEMS AUSTRALIA
Specialty Chemicals

ABN 51080680039

PRODUCT APPRAISAL

OxyPro
Chlorine Dioxide Water Sanitation

Description: ***Oxy-Pro*** is a chlorine dioxide generation program for use as a water sanitiser & as a food processing aid. ***Oxy-Pro*** uses a three part precursor program to generate a chlorine dioxide solution for on-site application.

Background: It has long been recognised that chlorine dioxide has superior performance to elemental chlorine & chlorine releasing compounds when used as a biocide. Chlorine dioxide does not readily react with nitrogenous organic compounds; therefore, biocidal activity is not wasted on contaminants that are not necessarily related to the presence on micro-organisms in the treated water. For example, it is possible to have a water stream that contains a high concentration of proteins that are not the result of microbial growth, such as in meat processing waters & spin chillers. In such a situation hypochlorous acid (from elemental chlorine, hypochlorite or other chlorine release compounds) readily reacts with proteins in the water; thereby, leaving less free available chlorine remaining to kill micro-organisms. Hence, the high chlorine dose rates which are required to achieve sanitation. Conversely chlorine dioxide is primarily involved in reactions with organic compounds which are representative of the presence of micro-organisms in the process water. Further, when waters are heavily contaminated with micro-organisms, high concentrations of nitrogenous compounds may be present to reduce the efficacy of hypochlorous acid &, therefore, increase the dose rate required to achieve sanitation: once again, chlorine dioxide is a better alternative in those situations, as it is not diminished due to reactions with nitrogenous organic contaminants. The reduced number of organic contaminants with which chlorine dioxide will react is often referred to as its selectivity; this property is related to chlorine dioxide having a lower oxidation potential than hypochlorous acid.

While chlorine dioxide is less reactive than hypochlorous acid it is far more powerful (having a higher oxidation capacity), meaning that less of it is required to perform a biocidal task than is hypochlorous acid. Chlorine dioxides selectivity & its higher oxidation capacity make it far more effective than hypochlorous acid at much lower dose rates.

However, due to its inability to be stored as a stable aqueous solution, chlorine dioxide products have required complex mixing & activation apparatus to accurately control precursor chemicals, such as hydrochloric acid. ***Oxy-Pro*** overcomes that disadvantage by utilising a less hazardous three-part precursor system without mineral acids; our program uses a combination of sodium chlorite, sodium hypochlorite & an organic acid to create a chlorine dioxide solution with a concentration of up to 1,800mg/L. The activated solution may be applied manually or with a diaphragm pump, peristaltic pump, venturi injector or hydraulic injector.

Features & Benefits: For the reasons outlined above ***Oxy-Pro*** is ideal for sanitation of drinking water & sanitation or bleaching functions in food processing operations as outlined in the Food Standard (1.3.3) for Processing Aids.

It is a superior method of chlorine dioxide generation because:

- It uses liquid components which are easily mixed manually or with automated mixing & control systems
- Its stated mixing rates create relatively stable activated solutions that do not demand degassing dosing pumps
- It uses an organic acid for activation which is less hazardous than mineral acid activation systems
- Its stated mixing rates create activated solutions with concentrations well below the explosion risk level

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Use: ***Oxy-Pro*** is designed to be activated on site in a batch tank or with an automatic mixing system to achieve a chlorine dioxide solution with a concentration of between 450mg/L & 1,800mg/L. The resulting solution should then be dosed into the treated water to achieve the residual concentration required to verify sanitation; typically, residuals between 0.2mg/L & 0.8mg/L are sufficient to sanitise drinking water & to stop microbial fouling. When a system is heavily fouled, a one-off off-line treatment may be required to sanitise the system.

When chlorine dioxide is used as a processing aid for food products, care should be taken to ensure that residuals are within the guidelines set out in Standard 1.3.3 of the Food Standards Code.

Oxy-Pro **is activated using the ratios set out in the table at right. Note that the stated volumes are to be added to each litre of activated solution**

Chlorine dioxide strength	Part A required	Part B required	Part C required
450mg/L (450ppm / 0.045%)	12ml/L	6ml/L	10ml/L
900mg/L (900ppm / 0.090%)	24ml/L	12ml/L	20ml/L
1,350mg/L (1,350ppm / 0.135%)	36ml/L	18ml/L	30ml/L
1,800mg/L (1,800ppm / 0.180%)	48ml/L	24ml/L	40ml/L

The following dose rates must be observed when using *Oxy-Pro* in water treatment or food processing applications

Application	Maximum residual concentrations in treated media	Recommended dose rate of activated solution & additional notes
Sanitation of drinking water in accordance with the Australian Drinking Water Guidelines	0.4mg/L chlorine dioxide or 0.8mg/L sodium chlorite	Dose the activated solution at a rate of approximately 1mg/L of chlorine dioxide & adjust as required to sanitise the system while meeting the residual limits
As a food processing aid in accordance with clauses 11, 12 & 14 of Standard 1.3.3 of the Food Standards Code	1mg/Kg as chlorine dioxide (Clause 11) 1mg/Kg as available chlorine (Clause 12) 1mg/Kg as available chlorine (Clause 14)	The dose rate may be as high as is required to achieve the required technological function in the process, provided the maximum permitted level is not exceeded in the food product
Industrial cooling & process waters	5mg/L will generally be sufficient to maintain sanitation in industrial cooling & process waters	Dose the activated solution at a rate of approximately 5mg/L of chlorine dioxide & adjust according to the KPIs set for the system / process
Remediation of cooling, process or drinking water pipework that has been heavily fouled by micro-organisms	50mg/L as chlorine dioxide	Dose the activated solution at a rate of approximately 50mg/L of chlorine dioxide & adjust as required to maintain a residual of 50mg/L for the time required to fully decontaminate the system. Flush the system fully with fresh water following remediation

To calculate the required volume of activated solution required to treat a volume of water, multiply the volume by the required dose (in mg/L) divided by 1,000,000 then divide the result by the solution strength divided by 100. For example, to calculate the required volume of activated solution to treat 1,000 litres with 1mg/L of chlorine dioxide from a 1,800mg/L solution, use the following formula:

	Volume to be treated		Required dose rate of chlorine dioxide		Solution strength		Volume of activated solution required
Volumes & concentrations	1,000 litres		1mg/L (ppm)		1,800mg/L (0.18%)		555 millilitres
Calculations required	1,000	x	(1/1,000,000)	/	(0.18 / 100)	=	0.555

Safety & Disposal: When handling & mixing precursor chemicals or applying the activated solution, care must be taken to ensure that all necessary personal protective equipment is in good order & condition & is used properly. While solutions that are prepared in accordance with the above instructions are recognised as non-hazardous according to the Model WHS Regulations, all precautionary measures described in the products SDS must be observed.

Empty containers should be triple rinsed & disposed of by legal means, including: return to the manufacturer for recycling, delivery to local waste management authority, being buried or incinerated at a licensed waste disposal facility.

For additional information, the SDS may be accessed in Chemwatch & is available from **CSA** on request.

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