Catalytic Chlorine Dioxide

Cloxide™ *Catalytic* – the next generation

Clearwater Technology Plc has introduced an innovative approach to surpass conventional chlorine dioxide generation.

Cloxide™ *Catalytic* incorporates reliable, proven components and technologies to take advantage of chlorine dioxide's unique properties.

Step One….. No matter how you make chlorine dioxide, you must first start with chlorous acid. Chlorous acid is a simple compound that occurs when the sodium (Na^+) ion in sodium chlorite ($NaClO_2$) is replaced with hydrogen (H^+) ion. The resultant compound, chlorous acid ($HClO_2$), is the real precursor for the formation of chlorine dioxide (ClO_2), and its formation is shown in Reaction (1).

$$Na^+ClO_2^- + H^+ \rightarrow H^+ ClO_2^- + Na^+ \quad (1)$$

In traditional technologies, H^+ is added to the sodium chlorite in high concentrations by mixing acid to encourage the displacement of Na^+ with H^+ , thus promoting the formation of chlorous acid. However, given that the sodium remains in solution, the equilibrium of the reaction cannot be shifted entirely to chlorous acid, unless a large excess of acid is added. Therefore, under normal circumstances, a mixed solution exists, as shown in Reaction (1). The inability of Reaction (1) to go to completion inhibits the further formation of chlorine dioxide by limiting the amount of chlorous acid available, especially in dilute solutions or if a weak acid is used.

Cloxide™ *Catalytic* forms a solution of chlorous acid without residual Na^+. By using cation exchange resin in the H^+ form, we are able to remove the Na^+ from the sodium chlorite and replace it with H^+ to form pure chlorous acid. When the cation resin is exhausted, i.e. all of the cationic sites are in the Na^+ form, the resin must be regenerated with a hydrogen source. This may be done either on-site or off-site, depending upon the conditions of the application.

It is important to remember that the acid used during regeneration does not enter into the production of chlorous acid and never contacts the sodium chlorite. The acid is merely used as a hydrogen source for the regeneration of the cation exchange resin.

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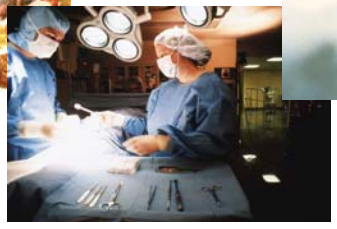

Clearwater Technology Limited is the leading British Chlorine Dioxide total solutions provider.

Previously regulated to very specific needs in water treatment, new technology is creating a unique opportunity for Chlorine Dioxide to be applied throughout a wide range of applications that call for the prevention of microbial growth such as slimes and moulds, together with total pathogen control against such organisms as Cryptosporidium, Pseudomonas, Legionella and many more.

Chlorine Dioxide has been called the "ideal" biocide for a number of reasons:

- It works against a wide variety of bacteria, yeasts, viruses, fungi, protozoa, spores, moulds, mildews and other microbes. It is especially effective in killing Giardia, Cryptosporidiumand Legionella
- It exhibits rapid kill of target organisms, often in seconds.
- It is effective at very low concentrations and over a wide pH range.
- It is effective across a wide temperature range including water up to 80ºC
- It biodegrades in the environment.
- Unlike many other biocides, e.g. chlorine, it does not react with primary organics to form harmful trihalomethanes (THM's).
- It eradicates biofilm, and used as part of a preventative programme, eliminates recurrence within pipe work, equipment and systems.

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Step Two ….. Chlorine Dioxide

Once chlorous acid is formed, the reaction to chlorine dioxide may proceed in one of two ways:- via the disproportionateness of chlorous acid to chlorine dioxide or via the oxidation of chlorous acid to chlorine dioxide.

$$5\ HClO_2 \rightarrow 4\ ClO_2 + HCl + 2\ H_2O \quad (2)$$

or

$$HClO_2 - e^- \rightarrow ClO_2 + H^+ \quad (3)$$

Reaction (2) is extremely time and concentration dependent, and reaction (3) often yields unwanted by-products from the addition of chlorine, used here as a common oxidiser, or from over oxidation during chlorination or during electrochemical oxidation.

Typical conversion of chlorous acid to chlorine dioxide via Reaction (2) is less than 65% after one hour, leaving residual chlorite in the chlorine dioxide product. Typical conversion of chlorous acid to chlorine dioxide via Reaction (3) can be as high as 95%, but these conversion efficiencies require high concentrations of chlorous acid and chlorine, often in the presence of additional acid, or complicated and expensive electrochemical generators. Neither of these processes has proved suitable for the commercial and small industrial market

Cloxide™ ***Catalytic*** generates chlorine dioxide from chlorous acid without chlorine or excess acid, without chemical mixing, without electricity, and without residual chlorite in the chlorine dioxide product stream.

By utilising catalytic technology in the Conversion Cartridge, we convert virtually all (>98.5%) of the chlorous acid to chlorine dioxide via Reaction (2) instantaneously and in dilute solution.

This means that there is virtually no chlorite residual *(as confirmed by independent analysis)* in the chlorine dioxide product. No storage of chlorine dioxide required.

Further, since **Cloxide™** ***Catalytic*** can operate under high pressures, the chlorine dioxide product can be dosed directly into pressurised lines without the need for additional booster equipment. All this occurs with chlorine dioxide concentrations of less than 700 mg/litre.

For full technical and installation details please contact Your local Clearwater Chlorine Dioxide Product Specialist

New delivery technologies bring the power of chlorine dioxide without the expense and complication of on-site generation or high level training.

Typical applications are:-

- Constant dosing of drinking water, cold and hot water systems within building services
- Product washing and system disinfection throughout the food industry. Disinfection and neutralisation as part of C.I.P. systems
- Cooling Tower Water
- Intense disinfection for hydro-therapy pool and ancillary services within hospitals
- Elimination of white water mould and pink slime in swimming pools, including filter and balance tank biofilm build-up
- Improved disinfection within Spa Pools
- Eliminate fouling by micro-orgamisms in water softeners
- Treating bacteria in car/ vehicle wash recycling water
- Prevents the formation of slime and odour causing bacteria and fungi within ice making machines
- Tank Cleaning

Clearwater Technology -

"Imagination"

"Innovation"

"Implementation"

Clearwater

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