Why is ClO_2Sure the In-Situ Generation of Chlorine Dioxide by Oxidation?

ClO_2Sure is a blend of chlorine oxide anions, with chlorine dioxide being the active biocide, which is only released when the pH decreases in the target water stream to below pH 8.7. The chlorine dioxide is then produced in equilibrium with sodium chlorite—the active substance precursor—and sodium hypochlorite, the oxidiser. Below pH 8.7, hypochlorous acid is released from sodium hypochlorite, which converts the sodium chlorite into chlorine dioxide via the reaction:

$$2ClO_2^- + HOCl \leftrightarrow 2ClO_2 + Cl^- + OH^-$$

Why is ClO_2Sure More Efficient Than Standard Chlorine Dioxide?

As the chlorine dioxide is consumed, a key by-product is sodium chlorite, which, to maintain the stability of the reversible equilibrium reaction, is then regenerated back into chlorine dioxide via the reaction above, increasing the overall biocidal efficiency.

Why Does ClO_2Sure Not Enter the Gas Phase?

A pivotal advantage of ClO_2Sure is that the stable generation of chlorine dioxide from sodium chlorite is neither volatile nor gas-generating. The chlorine dioxide remains permanently in the liquid phase, making it easier to use, safer to handle, and odour-free.

This is a significant and distinct improvement over conventionally produced chlorine dioxide, which generates a limited-solubility gas that is more difficult to work with and has associated exposure and safety concerns due to chlorine dioxide gas.

How Efficient is the ClO_2Sure Reaction in Generating Chlorine Dioxide?

To drive the reaction and maintain equilibrium stability, the concentrations of hypochlorite and chlorite must always be greater than the chlorine dioxide present. Chlorine dioxide will continue to be released until all the chlorite is fully consumed.

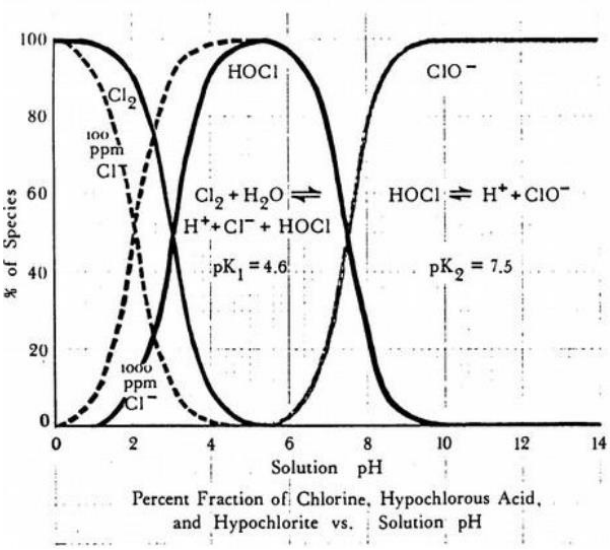
Why is Chlorine Dioxide Not Easily Measured in Treated Water?

There are several key reasons why chlorine dioxide is difficult to measure with field or on-site test kits, which is common with equilibrium formulations like ClO_2Sure.

- The chlorine dioxide present is in a matrix equilibrium where, to remain balanced, the ClO_2 level must always be lower in concentration than the hypochlorite/chlorite present. This means that not all the chlorine dioxide is present in a recordable form at any one time, resulting in lower readings.
- Field-based ClO_2 measuring methods require the neutralisation of other chlorine compounds present in the sample. This destabilises the equilibrium, which constantly attempts to rebalance, causing test results to be inaccurate. Precise and accurate laboratory conditions and equipment are necessary to obtain true measurements of the chlorine dioxide in the sample.

What is a Surrogate?

Surrogate compounds are regularly used in chemistry to measure one compound that is present in consistent ratios to the target. This is often applied in matrix or equilibrium formulations where measurement methodologies require neutralisation, which interferes with the matrix. As the surrogate does not require neutralisation, an accurate measurement of the target can be determined.



Percent Fraction of Chlorine, Hypochlorous Acid, and Hypochlorite vs. Solution pH

This method is widely used in chemistry, even for well-known chemicals like sodium hypochlorite, where hypochlorous acid is in equilibrium with the hypochlorite ion in water and can only be measured under the correct pH conditions.

Similarly, surrogate methods are applied in:

- Benzene and solvent testing
- Artificial sweetener detection in food applications
- Drug monitoring, such as THC screening in marijuana testing

How to Measure ClO_2Sure?

The most accurate and straightforward method to measure ClO_2Sure is by determining the total free chlorine compounds in test samples. As a surrogate, sodium hypochlorite compounds—hypochlorous acid and the hypochlorite ion—are in direct ratio to the chlorine dioxide present in the sample. Multiply the **total free chlorine measured by the conversion factor 1.9** to accurately determine the ClO_2 concentration.

For example:
A total free chlorine measurement of **0.2 ppm** is equivalent to **0.38 ppm** of chlorine dioxide.