

# GO<sub>2</sub><sup>TM</sup>: A WIDE-SPECTRUM DISINFECTANT FOR THE SEA FOOD INDUSTRY

## 1. What is GO<sub>2</sub>?

GO<sub>2</sub> is a two-component powder kit that creates a 4,000 PPM chlorine dioxide (CLO<sub>2</sub>) concentrate when mixed in ordinary tap water. GO<sub>2</sub> is a convenient, advanced method to produce high purity CLO<sub>2</sub> in solution. GO<sub>2</sub> has a shelf life of up to 30 days in concentrate form. The shelf life in dry powder form is 5 years, depending on storage conditions. CLO<sub>2</sub> is easily diluted into target water as a biocide. CLO<sub>2</sub> penetrates and kills bacterial slime layers and destroys all known pathogens. The only residue is common salt, at level less than are present in fresh water. GO<sub>2</sub> does not form toxic and carcinogenic chlorination by-products. Nor does it produce a build-up of toxic organic or inorganic by-products, such as bromates, THM's, HAA's and MX. This makes CLO<sub>2</sub> the most eco-friendly water disinfectant available.

## 2. Application Areas

### Aquaculture Industry:

#### Live Fish

- ▶ Water disinfection in breeding and growing ponds
- ▶ Maintenance of ornamental ponds and aquaria
- ▶ Egg hatcheries
- ▶ Transportation Water
- ▶ Disease treatment during holding

#### Aquaculture

- ▶ Elimination of all water-borne viruses
- ▶ Algae removal
- ▶ Disease prevention treatment
- ▶ Fish larval rearing
- ▶ Shrimp larval rearing
- ▶ Spraying in feed
- ▶ Treatment of diseases

#### Fish Industry:

- ▶ General disinfection on fishing boats
- ▶ Wholesale/Retail fish washing
- ▶ Shelf-life extension through washing
- ▶ Dipping de-scaled and gutted fish
- ▶ Spray/Dipping for fish and shellfish
- ▶ In sorting/grading water for fish and shellfish

- ▶ Ice manufacture (extends shelf life)
- ▶ Equipment, surfaces and general facility disinfection
- ▶ Disinfection of retail display cabinets
- ▶ Waste water treatment including *Red* water
- ▶ Food Processing Aid
- ▶ Ornamental fish and aquaria

Despite the fact that contaminated food and effluent is a problem endemic to the seafood industry, ineffectual biocides and disinfectants are presently used to clean product, process water, equipment and facilities. Nothing is added to ice or water to assist shelf-life extension.

Water is extensively used in processing facilities. The quality of the process water is of great importance in the prevention of contamination. The use of contaminated water in food processing plants spreads infection across the entire distribution system and complete batches of product. Water, regardless of the source, always contains bacteria and viruses, including coliforms, E. Coli, salmonella, legionella, listeria monocytogenes and deadly fish viruses such as ISA, VHS, KHV. The fish industry generates large quantities of waste and contaminated effluent water. CLO<sub>2</sub> is an effective disinfectant for effluent waste water, with the capacity to carry a high residual.



## Commonly available disinfectants contain the following chemicals:

- ▶ Amphoteric (ampholytic) compounds
- ▶ Phenolic compounds
- ▶ Peracetic acid
- ▶ Chlorine and chlorine-releasing compounds
- ▶ Quaternary ammonium compounds

The above chemicals have numerous disadvantages. Their disinfectant properties are limited by many factors, as listed below:

- ▶ Peracetic acid and Quat compounds require high doses.
- ▶ Peracetic acid produces acetic acid, which is excellent nourishment for micro organisms. Bacteria grow more efficiently as a side-effect of Peracetic acid use.
- ▶ The concentration of available chlorine needs to be as high as 200 to 300 mg/liter. CLO<sub>2</sub> is effective at 20 mg to 30 mg/liter and less.
- ▶ To reduce breakdown during storage, a hypochlorite solution should be maintained at pH 6 to pH 9. All the above chemicals have pH limitations and are outside the effective range. Hypochlorite is more efficient if the concentration and temperature are raised and/or the pH is lowered.
- ▶ Disinfection capabilities are diminished in the presence of fats, oils, proteins, body fluids etc.
- ▶ Conventional disinfectants are non-effective against wide ranges of bacteria, spores, fungi. Chlorine does not kill viruses.
- ▶ Conventional disinfectants are both temperature and contact-time dependent. Long exposure time is required.
- ▶ Conventional chemicals are corrosive, hazardous materials that stain common metals.
- ▶ Conventional disinfectants develop toxic gases and irritate the eyes, mucous tissues and skin of personnel.
- ▶ Chlorine is used as a treatment for wash water. There are frequent problems with taste tainting, smells and unpleasant working environments at high levels.

GO<sub>2</sub> is a very powerful biocide with multiple advantages over other products used in the industry. GO<sub>2</sub> can be used as a short-term bath at the first sign of bacterial or fungal infection, in order to reduce the risk of opportunistic infection. GO<sub>2</sub> can be used for the short term transport of alevins, fry or smolts where stocking densities are high. The movement of fry from the hatchery to nursery ponds or growing cages requires the application of a biocide in these areas as there is a high risk of infection caused by surface contact and de-scaling.

GO<sub>2</sub> can be added to water/ice used in processing any fish, or displaying and preserving it at retail establishments. Ice used to pack fish should be manufactured with GO<sub>2</sub>. The slow release of CLO<sub>2</sub> gas onto the surface of fish as the ice melts prevents spoilage and odors during transport. GO<sub>2</sub> minimizes the microbial content of water thereby improving quality, safety and extending the shelf-life of products.

CLO<sub>2</sub> is effective in treating wastewater discharges and removing odor problems associated with fish processing plants.

CLO<sub>2</sub> is proven effective against botulism organisms and other food contaminants such as salmonella, staphylococcus, streptococcus etc. Even the most resistant strains of fungi are completely destroyed in 60 seconds. Tricophyton mentagrophytes are killed in 5 minutes. The most difficult organisms of all (spore formers) are destroyed in 5 minutes. This is many times faster than most chemicals; yet GO<sub>2</sub> requires no restrictions on use in direct contact with food.



### 3. GO<sub>2</sub> Germicidal Spectrum

BACTERIA		FUNGI	
Pseudomonas Aeruginosa	Campylobacter Jejuni	Candida Albicans	Trichophyton Rubrum
Pseudomona Specie	Flavobacterium Species	Scopulariosis Species	Aspergillus Niger
Enterobarcer Cloaceae	Yersinia Enterolitica	Trichophyton	Aspergillus Flavus
Enterobarcter Hafnia	Clostridium Sporogenus	Mucor Species	Fusarium Specie
Proteus Vulgaris	Clostridium Dificile	Saahromyces Cerevisiae	Fonsecaea Pedrosoi
Klebsiella Pneumoniae	Clostridium Perfringens		
Salmonella Typhi	Fusobacterium Nucleatum	VIRUS	
Salmonella Enteritidis	Bacilus Subtilis	Herpes Virus I	Poliovirus
Salmonella Gallinarum	Bacilus Circulans	Herpes Virus II	Encephalomyocerditis (EMS)
Salmonella Typhimorium	Bacilus Megatarium	Adenovirus Echovirus	Vaccina Virus
Salmonella Choleraesuis	Bacilus Cereus	Coxsackievirus	Vesicular Stomatitis Virus
Salmonella Typhosa	Bifedibacter Liberium	Influenza	Para Influenza
Corynebacterium Nucleatum	Staphylococcus Aureus	Feline Parvovirus	Bluetongue Virus
Sarcinae Lutae	Staphylococcus epidermia	Mouse Flu	Mouse Hepatitis Virus (MHV)
Streptococcus Pyrogenes	Streptococcus Faecalis	Minute Virus of Mice (MVM)	Mouse Encephalomyelitis
Strep 1, 2, 3.	Mycobacteroi Bovis	New Castle Disease Virus	Mouse Polio Virus (MEV)
Mycobacterium Smegmatis	Mycobacterium kansaaii	Iridovirus	Pertiviries – Togaviridae
		KHV, VHS, ISA	Hepatitis, Cholera, Typhoid
OTHER			
Vidrio Cholerae	Culex Quinquifasiatus		
Mycoplasma			

### 4. Cost Comparison

GO<sub>2</sub> is extremely cost competitive when compared by volume with other disinfectants. However, GO<sub>2</sub> delivers significant additional benefits which must be taken into account. These include:

- ▶ Elimination of expensive chlorine gas delivered by cylinders.
- ▶ Elimination of chlorine dioxide gas generators, plus the costs of ownership, maintenance, certification & re-certification.
- ▶ Security measures & risk and liability insurance policy.
- ▶ Training, certification and re-certification of qualified personnel.
- ▶ Environmental, explosion, health & safety factors.
- ▶ Hazardous materials transportation and storage costs.
- ▶ Corrosion to water distribution and storage systems, equipment, pumps, pipes and filters.
- ▶ Use of additional chemicals e.g. pH level stabilizers.
- ▶ The penalties of NOT delivering the required biocidal results.
- ▶ No adverse environmental or ecological effects.
- ▶ Precise dosage management.
- ▶ No investment required in infrastructure or equipment.
- ▶ No risk of explosions.
- ▶ Easy to use, transport and store.
- ▶ Long shelf life (5 years).
- ▶ Higher product concentration.

### 5. GO<sub>2</sub> in Shrimp Culture

Since 1993, when shrimp epidemics affected all breeding ponds across Southeast Asia, shrimp culture has suffered gross economic loss. Research conducted worldwide concluded that conditional diseases, such as viral and bacterial diseases, mainly induced epidemics. Deterioration and pollution of the ecological environment of aquaria are the main causes of shrimp diseases.

GO<sub>2</sub> has broad-spectrum capacity to kill microbes such as bacterium, sporangium, fungi, algae, spore formers, molds, viruses, epiphytes and larval stages of fish parasites. GO<sub>2</sub> has no effect upon superior species, such as shellfish and fish. Microbes develop resistance to GO<sub>2</sub> as the CLO<sub>2</sub> penetrates the cell wall and destroys the cell's RNA. As a strong oxidizing agent, GO<sub>2</sub> will decompose almost all reductive organic materials in water. This includes residual feed and excrement, resulting in an improved environment in breeding aquaria and



## GO<sub>2</sub><sup>TM</sup> APPLICATION BRIEF



ponds. GO<sub>2</sub> also increases the concentration of dissolved oxygen. The net effect is to prevent epidemics in fish and shellfish farming.

Multiple studies have demonstrated the high efficiency of GO<sub>2</sub> in killing microbes and viruses.

GO<sub>2</sub> is applied to pond water via a solution dispensed from a boat, oxygenating fountain or foam raft.

For complete disinfection of a feeding pond, after removal of dirty mud at the bottom of the pond and before the pond has been re-filled, simply spray concentrated GO<sub>2</sub> onto the pond bottom and walls. Disinfection of feeding water is essential during fish

breeding and growth. Residual feed and excrement contamination significantly deteriorates the water body, leading to the rapid propagation of pathogenic microbes, causing disease and high mortality in fish and shellfish stocks.

GO<sub>2</sub> decomposes polypeptides and breaks the bond in microbial proteins, RNA and DNA to kill all microbes and viruses. GO<sub>2</sub> reacts with amines and sulfides in breeding water, air and on the surface of fish, shellfish and materials, eliminating odor and providing clean water and air.

To use GO<sub>2</sub>, first determine the volume of the target water. Dose GO<sub>2</sub> at a rate of 0.05 to 0.1 PPM into a pond with a water depth of 1 meter. The dosage may be adjusted according to the quality of the water. Efficiency is enhanced if 20kg/Mu of calx is additionally dosed into the pond within 24 hours.

For disinfection and sterilization of pregnant shrimp during the 2 week period before a pregnant shrimp lays eggs, dose 0.1 to 0.2 ppm of GO<sub>2</sub> into the pond per 7days, until the eggs are laid. This disinfection improves the health of pregnant shrimp and of the offspring.

For disinfection of the environment and surfaces in a hatching room, mist 1.6 liters to 2.4 liters of GO<sub>2</sub> per 100 cubic meters of space to decontaminate the room.

### Disease prevention at all stages during the growth of shrimp

GO<sub>2</sub> may be applied at 4 stages, starting from fertilized eggs to the breeding stage, as follows:

- ▶ At the first fertilized egg stage, apply GO<sub>2</sub><sup>®</sup> to the water body at a dosage rate of 0.02 ppm.
- ▶ At the second stage, apply GO<sub>2</sub><sup>®</sup> into breeding water at a dosage rate of 0.02 to 0.05 ppm.
- ▶ At the third stage, continuously dose at a rate of 0.05 to 0.1 ppm.
- ▶ At the fourth stage, continuously dose at a rate of 0.05 to 0.15 ppm.

To eliminate shrimp viruses and bacterial diseases, dose daily with 0.15 ppm into breeding water with a depth of 1m. Repeat for 3 to 5 days. This process will prevent viral and bacterial diseases and demonstrate high efficiency in defending against epiphyte diseases.

Disinfection of facilities in shrimp culture, equipment, tools, utensils, boots, gloves and everything that comes into contact with shrimp and breeding water should be dipped or sprayed with concentrated GO<sub>2</sub> so as to prevent infection, disease propagation and reoccurrence.

GO<sub>2</sub> 4,000 ppm concentrate can treat the following amounts of water at 5 pre-set concentrations:

4,000 ppm kit for	1.0 ppm	0.5 ppm	0.3 ppm	0.2 ppm	0.1 ppm
264 Gal	1,058,201	2,116,402	3,527,337	5,291,005	10,582,011
1,000 Liters	4,000,000	8,000,000	13,333,333	20,000,000	40,000,000

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