Q&A

21Q5: Could you advise me on applicability of chlorine dioxide for disinfection?

Recently, new product was introduced, that is Chlorine dioxide, ClO_2 (CLO_2 Dioxid-S). Our company has used Cl_2 gas for disinfection and we are not familiar with ClO_2. But ClO_2 has so many advantages such as: 100% safe, not corrosive (can clean pipe, biofilm, fouling, and algae.), 100% disinfection, easy to apply, no big investment needed, 10 times more effective as a disinfectant than chlorine, easy to transport and store, etc. Based on your knowledge and experiences, could you give me some advises? Which one (chlorine or chlorine dioxid-s) is more applicable for our company? (Mr. M.N.R, Cambodia)

A1: A big waterworks bureau and a manufacturer once carried a practical study on CLO_2 about ten years ago. At that time, CLO_2 production equipment was a type of chemical mixing at site. Therefore, it had several problems such as difficulty of adjustment of mixing ratio, toxicity of chlorite and chlorate which is created as a by-product, and high explosive nature of some reagents used; only putting it on the desk in the dry conditions (only a little vibration) caused explosion.
Because of these factors, CLO_2 has not been introduced positively for water supply in Japan.
After that, the study on toxicity of chlorate which is a final by-product has progressed. Based on the study, chlorate was introduced. And the opinion that CLO_2 should be used as disinfection for water supply became weaker and weaker. Especially in high temperature countries, changing speed from CLO_2 to chlorite and chlorate must be very fast and CLO_2 is easily volatilized. Therefore, in my opinion, the control of CLO_2 is difficult. I also confirmed this point to a person who has used the facility of producing CLO_2.

There is a similar product, “Stabilized CLO_2”, but I cannot clarify its principle from the points of supply of chemicals, stability and pH control. And also I am worried about whether you can use it in the country far from production factory.

Using chlorine gas has also reduced in Japan because of worker security and countermeasure of earthquake. Now we use sodium hypochlorite (80% of total disinfection), on-site generation of hypochlorite (10%) in Japan. The U.S. also tends to change from liquid chlorine and chlorine gas to hypochlorite from the point of safety of workers. In the case of use of hypochlorite produced by electrolysis, it is important to select salt as raw material and equipment.

You said that CLO_2 is 100% safe, but I can say that there are no any 100% safe disinfectant chemicals.

I cannot define the best method under the Cambodian conditions at this moment, but if there are supply system and capability of product quality control, using sodium hypochlorite is practically better. If not, producing hypochlorite by electrolysis might be the better way. I am not familiar with your situation, so I would like to know other's comments for selection of disinfectant.
Chlorine dioxide is not used in Japan because the by-products can be generated, and the control is also difficult.
(Answerer: Dr. ASAMI Mari, National institute of public health, Ministry of health, labor and welfare, 2010)

A2:
1. Advantage of chlorine dioxide
- Production of trihalomethanes is less than production by chlorine or hypochlorite.
- Stronger oxidizing agent than chlorine, and decompose organic matter better.
- It is said that CT value to inactivate bacteria is one tenth of CT value by chlorine.
2. Disadvantage of chlorine dioxide
- Decomposed by light easily.
- After decomposed, chlorite is produced.
- Chlorite is harmful to human health and difficult to reduce.
- Stored chlorine dioxide should be free from light.
- Chlorine dioxide generator might be suitable to use for drinking water treatment.
- Formaldehyde and acetaldehyde production is same as chlorine.
3. Recommendation
For the case that trihalomethane production is very high by chlorination, usage of chlorine dioxide is considered although ozonation is also a solution for the problem.

To introduce safer disinfection method than chlorine gas, sodium hypochlorite is easier to handle. Of course, actual use is considered with their costs.

（Answerer: Mr. SASAYAMA Hiroshi, Yokohama Waterworks Bureau, 2010）