Dechlorination

For years wastewater treatment plant effluents have been disinfected using chlorine. In some cases, excessive amounts of chlorine were used in an effort to kill fecal coliform bacteria. The addition of high concentrations of chlorine to the receiving water has proven to be hazardous to both plant life and fish. Systems are now required to dechlorinate the chlorinated effluent before it is discharged into a receiving stream or lake.

SULPHUR DIOXIDE GAS

The most common dechlorination process uses sulphur dioxide (SO_2) gas as a reducing agent. It reacts with the hypochlorite ion to break the bond between the oxygen and chlorine. This neutralizes the chlorine in much the same way that sodium thiosulphate neutralizes chlorine in a bacteriological sample.

Although they are chemically different, sulphur dioxide and chlorine have many of the same handling and safety considerations. They are both gases that are heavier than air and are stored as a compressed gas. They both have a pungent odor and are highly toxic if inhaled or if they come in contact with exposed tissues. They differ in that sulphur dioxide is a colorless gas. Because it is stored as a compressed gas, sulphur dioxide handling safety is almost identical to chlorine gas safety practices. Sulphur dioxide gas systems are called sulphonators. They operate under the same principle as a gas chlorinator. The only difference is that the maximum feed rate for a sulphonator is higher.

ALTERNATIVES

Alternatives to using sulphur dioxide include aeration and exposure to sunlight. Aeration is not very effective because it requires continuous aeration with a very long contact time. Sunlight utilizes ultraviolet radiation to breakdown the chlorine. There are other chemicals that can be used for dechlorination. One is ascorbic acid (Vitamin C) and the others are sodium bisulfite, sodium sulfite, and sodium bisulfate.

Powdered ascorbic acid is a weak acid that is reasonably easy to handle. It should be stored separate from other chemicals and kept in a cool, dry and well-ventilated room. Sodium bisulfite is a liquid that is highly reactive in the presence of acids and oxidizers (like bleach). It should be handled with a great deal of care using the proper PPE including respirators, face shields, goggles, chemical gloves and aprons. It should be stored separate from other chemicals. Always refer to the MSDS for both bleach and the dechlorination chemicals when performing these tasks.

Other disinfection processes that do not use chlorine are becoming more popular in many systems. Ozone (O_3) gas is more expensive than chlorine, but it takes much less of it to kill the fecal coliform. And ozone breaks down into dissolved oxygen, which is good for the receiving waters. Another option is the use of U-V radiation for disinfection. Ultraviolet light bulbs are placed in the effluent channel and as the water passes through the bank of lights, the U-V radiation kills the bacteria. This requires a very clear effluent and is most commonly used in systems that have tertiary filters. There is no chemical residual from U-V processes and they are capable of disinfection at a lower cost than chlorination/dechlorination.

ADVANCED STUDY QUESTIONS

1. Why is dechlorination necessary?

2. What are the alternatives to dechlorination with sulfur dioxide?

ADVANCED SAMPLE TEST QUESTIONS

1. The chemical most often use to dechlorination wastewater effluent is:

   A. Sodium Fluoride
   B. Sulphur dioxide
   C. Hydrogen sulphide
   D. Ammonia

2. A sulphonator operates on the same principle as a:

   A. Chlorinator
   B. Positive-displacement pump
   C. Lime feeder
   D. Flocculator