Introduction

Chlorine is used in many water supply systems and home swimming pools to keep algae and other microorganisms from growing. Chlorine is also used for cleaning and maintaining irrigation systems. Proper injection methods and amounts of chemicals must be used to provide an effective water treatment program without damaging any part of the irrigation system or the crop being produced.

Irrigation systems can become partially or completely clogged from biological growths of bacteria, fungi, or algae. Bacteria, fungi, and algae are present in surface and ground water sources and use chemical elements such as nitrogen, phosphorus, sulfur, or iron as nutrient sources. Generally, filtration alone cannot effectively remove these microorganisms. Chlorination can be used to minimize the growth of microorganisms within the pipes and other components of irrigation systems. Without proper water treatment, clogging of pipes, fittings, and emission devices (sprinklers, drippers, spray jets, etc.) can occur, resulting in decreased growth and development of the irrigated crop because of reduced water application amounts, uniformity, and efficiency. This publication provides information on the sources of chlorine and the amounts required for treating irrigation water and systems to control the growth of microorganisms.

Sources Of Chlorine

Chlorine is available in gas, liquid, and solid (granular or tablet) forms. However, only the liquid form (liquid sodium hypochlorite) is labeled for use in irrigation systems in Florida.

Each of the three different chlorine forms reacts differently with the irrigation water, depending on the other chemicals or elements in the water. Reactions may be an alteration of the pH of the water, or may involve precipitation of some element that could result in clogging of microirrigation components.

Chlorine Gas

Chlorine gas (Cl_2) is commonly used in municipal water treatment systems. As chlorine gas reacts with water, hypochlorous acid (HOCl), hydrogen (H^+), and chloride (Cl^-) are formed. This reaction lowers the pH of the irrigation water. The change in pH depends on how much chlorine gas is injected and on the buffering capacity of the water.

Chlorine gas is used in municipal water treatment systems because it provides chlorine in the most concentrated and economical form. Basically, 1 pound of chlorine gas will provide a 1 part per million (ppm) concentration of Cl_2 to 1,000,000 gallons of water. Similarly, an injection of 1 pound of chlorine gas per hour will provide a 1 ppm concentration of Cl_2 to a water supply with a flow rate of 2000 gallons per minute (gpm).

Chlorine gas is a respiratory irritant and affects the mucous membranes. It can be detected as an odor at a concentration of 3.5 ppm and can be **fatal** after a few breaths at 1000 ppm. Therefore, the user of chlorine gas must exercise extreme caution and safety. Maximum air concentrations should not exceed 1 ppm for prolonged exposure. This form of chlorine is limited to water treatment systems or other applications by licensed users.

Solid Chlorine

Granular (powdered or tabular) forms of chlorine are commonly used to chlorinate swimming pools. Calcium hypochlorite is the form that is typically used and found at local pool supply stores. Dissolving calcium hypochlorite in water will result in the formation of hypochlorous acid (HOCl) and hydroxyl ions (OH^-), a reaction that raises the pH of the water. The calcium hypochlorite form may react with other elements in the irrigation water to form precipitates that could clog microirrigation emitters and thus counteract the purpose for chlorination.

Calcium hypochlorite is used to treat swimming pool water because the solid chlorine form is inexpensive, easy to store, and easy to use. It generally has 65 to 70 percent of available chlorine. Thus, approximately 1.5 pounds of calcium hypochlorite will treat 1,000,000 gallons of water with a 1 ppm concentration of Cl_2.

Liquid Chlorine

Liquid sodium hypochlorite is most commonly used as laundry bleach. However, it is also labeled for use in irrigation systems. Mixing liquid sodium hypochlorite in water results in the formation of hypochlorous acid (HOCl) and hydroxyl ions (OH^-), a reaction that raises the pH of the water. Unlike the calcium added in the solid chlorine form, the sodium added in this liquid form does not contribute to clogging problems. Neither the sodium nor the chlorine added to the water should be detrimental to crops or soils at the typical concentrations used.