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Hydrogen Sulfide in Household Water

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Introduction

Hydrogen sulfide gas is a nuisance that is not usually a health risk at concentrations present in household water. Water containing hydrogen sulfide, commonly called sulfur water, has a distinctive "rotten egg" odor, which may be especially noticeable when running hot water. Such water can discolor coffee, tea and other beverages, and alter the appearance and taste of cooked foods.

Hydrogen sulfide dissolved in water can also corrode plumbing metals, such as iron, steel, copper and brass and exposed metal parts in washing machines and other water-using appliances. The corrosion of iron and steel from hydrogen sulfide forms ferrous sulfide or "black water" which can darken silverware and discolor copper and brass utensils. Hydrogen sulfide can also interfere with the effectiveness of water softeners.

A concentration as low as 0.1 milligrams hydrogen sulfide per liter of water (mg/l) is detectable by smell by most people. However, characteristic hydrogen sulfide taste can be detected in water with a hydrogen sulfide concentration as low as 0.05 mg/1.

Sources of Hydrogen Sulfide

Hydrogen sulfide gas is formed from decomposing underground deposits of organic matter, such as decaying plant material. This gas occurs in deep or shallow wells and can also enter surface water through springs. Hydrogen sulfide from sewage pollution can occur in some surface water, in poorly constructed wells or in shallow wells close to sewer lines or septic systems. Wells drilled in shale or sandstone, or near coal or oil fields often have hydrogen sulfide present in the water.

The presence of hydrogen sulfide may be seasonal and frequently occurs in well water which also contains appreciable levels of iron and/or manganese, or that has a low pH.

Testing for Hydrogen Sulfide

To determine an appropriate treatment method, it is necessary to find out how much hydrogen sulfide is present in the water supply. Since hydrogen sulfide is a gas that is dissolved in water and can readily escape from it, determining the concentration of hydrogen sulfide requires that the water sample be tested at the site or be immediately stabilized for laboratory analysis. Sample bottles with stabilizing chemical should be obtained from the laboratory that does the analysis. These stabilized watersamples cannotbeanalyzed forothercontaminants. When sewage pollution is a suspected source of hydrogen sulfide, the water should be tested for coliform bacteria

Treatment of Hydrogen Sulfide Problems

The recommended treatment for reducing hydrogen sulfide varies with its concentration in household water. Select the treatment appropriate for the amount of hydrogen sulfide present in the water supply from the following treatment options: (Where ranges for hydrogen sulfide concentrations given below overlap one another, more than one treatment method may be suitable.)

- **Trace amounts of hydrogen sulfide (up to a few tenths mg/1)**
  At this level, activated carbon filtration will reduce the unpleasant taste associated with hydrogen sulfide but has a very

limited capacity for odor absorption. Hydrogen sulfide gas is adsorbed onto the carbon surface. In this method, the filter, when exhausted, must be replaced, not recharged.

- **Less than 2 mg/1 hydrogen sulfide**
  Aeration (adding air to the water) is an appropriate treatment method. In any aeration system, the water must be protected from bacterial contamination and freezing, and there are large space requirements. Another limitation of this method is that the aeration process produces a strong hydrogen sulfide odor near the aerator which may be unpleasant if near the household living area Furthermore, this process, by itself, may not always reduce the hydrogen sulfide to non-detectable levels. However, the addition of a carbon filter may remove some of the remaining trace amounts of hydrogen sulfide.
- **1-10 mg/1 hydrogen sulfide**
  The use of an iron-removal filter containing manganese greensand is suggested. Manganese greensand filters must be recharged with a solution of potassium permanganate when the oxygen is depleted. This process is similar to regenerating a water softener and usually must be implemented at intervals from one to four weeks depending on the condition of the water, size of the unit, and amount of water consumption. Water with a pH below 6.7 may need to be treated with an acid water neutralizer before iron removal filtration will be effective.
- **More than 6 mg/1 hydrogen sulfide**
  Constant chlorination using an automatic chemical feed pump is the most common treatment method. The recomrnended dosage is 2 mg/1 chlorine for 1 mg/1 hydrogen sulfide. The chlorine should be added ahead of the mixing tank and sufficient storage must be provided to maintain 20 minutes of contact time between the water and the chemical. This process may produce objectionable taste in the water. Depending upon the amount of chlorine added, an activated carbon filter may be used to obtain chlorine-free water for cooking and drinking. The sarne carbon filter can also reduce any remaining hydrogen sulfide. Maintenance and replacement of filter systems should be considered since sulfur, iron, manganese and other suspended materials in the water can quickly clog the filter.

Sulfur Bacteria

It is possible to have the characteristic "rotten egg" odor in water even when laboratory tests show the absence of hydrogen sulfide. In this case, the odor is caused by harmless bacteria that chemically change sulfate in the water to hydrogen sulfide. These bacteria live on the hot water side of the home water distribution system.

Shock chlorination of the entire water system, including storage, hot water tanks, and distribution lines, kills the bacteria. This process introduces very high concentrations of chlorine into the water system. Chlorine should remain in the system for several hours, preferably overnight. If the situation persists, continuous chlorination may be required.

Summary

Hydrogen sulfide in drinking water is a common nuisance contarminant. Although it is not hazardous to health, the offensive odor and corrosivity of household water containing hydrogen sulfide make treatment desirable. Although there are various treatment alternatives, chlorination is the most commonly used and effective. Often, the treatment for hydrogen sulfide is the same as for iron and manganese, allowing removal of all three contaminants in one process.

For more information about reducing hydrogen sulfide in household water, contact your local Virginia Cooperative Extension office. The authors wish to thank the following individuals who reviewed this publication:
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