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Processes for Removal of Hydrogen Sulfide Found in Florida Ground Water Sources

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ABSTRACT: *Hydrogen Sulfide is a very soluble and odorous gas that is frequently found in Florida ground waters used as water sources for community supplies. There are many treatment methods that can be employed to successfully remove Hydrogen Sulfide. This paper examines the most common systems, and their major benefits and considerations, for small and medium water treatment systems.*

Keywords- ***water treatment systems, odorous, Florida ground waters.***

1.INTRODUCTION

Sulfur occurs may occur in several oxidative states, these include, Hydrogen Sulfide, elemental sulfur and sulfate.Sulfate is typically the form of sulfur found in the aquifer. Sulfate is the most reduced state of sulfur and the primary reason for sulfate is that bacteria have oxidized the other forms of sulfur to the sulfate state. Sulfate has no odor and is highly soluble in water in various sulfate compounds.

Sulfur reducing bacteria can reduce sulfate converting it into hydrogen sulfide in an environment devoid of oxygen. Since drinking water aquifers contains no oxygen, when a carbon source is introduced to a ground water containing sulfate, sulfide conversion can be produced by biological activity. The higher in the aquifer from which the water is withdrawn, the more prevalent will be the organic and biological sources necessary for this conversion. The chemical equation for sulfide conversion from sulfate is shown below:

$$SO_4^{-2} + 2C_{\text{organic}} + 2H_20 + \text{microbial activity} \rightarrow H_2S + 2HCO^{-3}$$

Hydrogen Sulfide can occur in the aqueous phase in two forms, as Hydrogen Sulfide or H_2S and the bisulfide ion or HS^-. The form that Hydrogen Sulfide will take is dependant on the pH of the liquid.

Hydrogen Sulfide (H_2S) and its conjugate base the bisulfide ion (HS^-), are referred to as total sulfide and occur together naturally at the pH ranges found in Florida ground water. As can be

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seen in the figure below, between the pH of 6 to 9, Hydrogen Sulfide can be present as Hydrogen Sulfide (H_2S).

Hydrogen Sulfide is a very volatile dissolved gas and readily escapes as a gas into the air causing unpleasant odors. At pH of 7 both forms of Sulfide are present in equal concentrations. Downwardly adjusting pH to around 6 will result in converting all of the bisulfide ion, to the volatile form. Conversely, raising the pH to above 9, will convert the bisulfide ion to the sulfide ion.The four possible forms of Hydrogen Sulfide are given below.

- Hydrogen Sulfide (Gaseous)
- Hydrogen Sulfide (Aqueous)
- Bisulfide Ion (HS-)
- Sulfide Ion (S=)

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2.SCOPE OF WORK

Hydrogen Sulfide Water Quality Problems:
Under the pH conditions found in Florida source waters, sulfide if present, will include the Hydrogen Sulfide dissolved gaseous form. Aqueous Hydrogen Sulfide is a very noticeable odorous gas that readily dissipates when water containing it is agitated or exposed to the atmosphere. Hydrogen Sulfide is easily detected in the air at concentrations as low as 0.5 ppb. This concentration would generally equate to a Hydrogen Sulfide concentration near 0.5 mg/l in the water. Sulfides at this level will have a musty odor. Sulfides that exceed 1 mg/l in the water will generate the very noticeable and objectionable rotten egg odor.

Since ambient air contains negligible amounts of hydrogen sulfide, mixing of ground water containing with air will tend to degass Hydrogen Sulfide into the air from the water. Thus when a faucet is turned on by a homeowner with water containing Hydrogen Sulfide, degassing will occur with the classic “rotten egg” odor noticeable.

Hydrogen Sulfide is less soluble in warm water than cold. Thus concentrations in the water above 0.1 mg/L will cause a significant odor problem, especially in showers where the hot water is turned on.

Hydrogen sulfide concentrations above 0.05 mg/L will also affect taste and appearance of beverages such as coffee and tea made with the water.

Besides the odor complaints, hydrogen sulfide will produce yellow or black stains on kitchen and bathroom plumbing fixtures

3.TREATMENT OF HYDROGEN SULPHIDE

There are a significant number of methods that can be employed to remove Hydrogen Sulfide. The treatment option will be dependant on the concentration of Hydrogen Sulfide in the water and the pH. .

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Conventional Degassification: Conventional aerators consist of towers with trays in them. The water enters the top and cascades down to the bottom over a series of trays. As the water moves down the cascading trays, water molecules are brought in direct contact with the air. Since Hydrogen Sulfide is very volatile and is virtually negligible in ambient air, bringing the volatile sulfide compound in contact with the air forces the concentrations in the water to equalize with that in the air, effectively removing the gas. However, the volatilized Hydrogen Sulfide will result in a very noticeable rotten egg odor which will generate complaints.

This process is only partially effective at removing Hydrogen Sulfide because frequently all the Hydrogen Sulfide in the water is not in the removable volatile form. To convert the maximum amount of Hydrogen Sulfide to a volatile form, downward pH adjustment (acid) is often required. Since most of the State's ground waters will have a pH 7 or above, chemical addition to lower the pH will be necessary to achieve effective removal. As mentioned previously, the finished water will then need chemical adjustment of pH or use of chemical sequestering agents that binds to metal pipes to prevent corrosion problems from occurring in the distribution system and in service connections.

Forced Draft Degassification: Conventional aeration systems frequently do not provide enough air needed for completer degasification to occur. Therefore an external source such as a blower to increase the amount of air that can be forced into the water must be used. Forced draft aerators normally consist of a cylindrical shell containing trays and sometimes are fitted with support plates for including packing material. The blower forces air up thorough the layered material.

Packing material is typically a plastic media that provides significant air-to-water interface. Water enters at the top of the tower and air is forced up through the bottom. This method is much more effective at degassing than tray aeration or forced air aeration because of the significant increase in air to water contact provided by the media. When forced air blowers are used in this configuration they are referred to as packed towers.

LITERATURE REVIEW-

Vladmir Zivica (April 2003) studied the causes for corrosion on reinforcement are studied where the action carbonation and chloride attack are given preliminary importance.

Ted R. Mortan (December 1973) in this paper talks about fiber glass reinforced plastics used in many applications; from boats to missiles. The article is mainly concerned with the use of fiber glass reinforced plastics for corrosion resistant applications.

Anees U. Malik (March 2001) the paper deals with studies carried out on the corrosion and mechanical behaviour of fusion bonded epoxy (FBE) coating on steel in aqueous media which include product water, distilled water and saline water. The mechanical testing's on coating include adhesion, bending and Cathodic disbondment testing.

4.CONCLUSION

It is important to maintain adequate residuals in the water distribution system to prevent the growth of sulfate bacteria. Chlorine depletion is exacerbated by stagnant water found in dead-end lines. These conditions lead to additional corrosion which provide electrons needed for sulfur bacteria to grow. Bacterial activity can be controlled in several ways depending on where the problem occurs. Corrective actions include the following: 1.) Maintaining higher chlorine residuals within the distribution system to eliminate sulfur reducing bacteria, 2.) flushing low flow distribution lines to prevent bacterial growth, 3.) killing the bacteria in the hot water tank by periodically raising the temperature to above 140 ^{o}F, 4.) replacing the Magnesium anode in the water tank with a Zinc or Aluminum anode, and 5) Removing the anode entirely (this action will decrease the life of the unit).

The process should proceed as follows: 1. If the smell is only noticeable from the hot water tap, the source is likely the hot water tank, 2. If the smell is noticeable from the hot water tap and cold water tap but only from that treated by a water softener, the problem is in the softener, 3.) If the smell is noticeable most when the water is first turned on and then diminishes, it is likely from the well or distribution system, and 4.) If the smell is the smell is noticeable when the water is turned on and stays fairly constant the problem is likely from the well.

REFERENCES

1. Sulfide Oxidation Using Hydrogen Peroxide, Industrial Wastewater Reference Library, 2007
2. Public Service Commission State of Florida, Aloha Termination Request, April 2004
3. Feasibility of Aerating Water for Sulfide Oxidation without Causing Odor Problems, Heather Fitzpatrick, Journal of Undergraduate Research, June, 2002
4. Elemental Odor Control, New Trends in Activated Carbon, James Graham, Water Environment Federation, 2006
5. Common Customer Complaints, My Hot Water Stinks, David J Hack, Missouri Department of Natural Resources, AWWA, 2007
6. Sulfide in Well Water, John Mann, Environmental Health Scientist, Polk County Tennessee, 2007
7. Sulfates and Sulfide, Varner, Shipton, Jasa and Dvorak, Nebraska Extension Service, August 2004
8. Sources of Sulfate and Hydrogen Sulfide in Drinking Water, Brian Oram, Environmental Engineering and Earth Sciences Dep., Wilkes Univerity, 2007
9. Hydrogen Sulfide and Sulfur Bacteria in Well Water, Minnesota Division of Environmental Health, November 1998

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