

Hydrogen Sulfide in the Pond or Aquatic Garden

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Hydrogen sulfide (H₂S) is a gas that can form in aquatic gardens and ponds, when certain bacteria feed on organic debris in areas of the pond that are low or depleted in oxygen. The most common way to detect H₂S is by a rotten egg odor that may bubble out of the water when bottom sediment is stirred-up while seining fish, planting, or conducting general maintenance. In well water that has a high iron content, H₂S can react with iron to form iron sulfide that appears as a black film or sludge on the pond bottom. H₂S may be more prevalent in ponds and aquatic gardens that have been established for several years and have been heavily stocked with aquatic plants and animals. This is because organic debris accumulates on the bottom sediment surface, preventing oxygen to diffuse into the pond bottom.

Because H₂S forms in anaerobic zones, where no oxygen is present, it is usually found only at the bottom, or near the soil-water interface in a pond. When mud and water from the bottom is stirred-up by wind action, or seining, or even activity of bottom-feeding fish, then there is a much greater possibility that H₂S will come in contact with fish. This is a big concern because even a very low concentration of H₂S can kill fish. According to the Environmental Protection Agency, a maximum acceptable level of H₂S for fish and aquatic life is 0.002 ppm.

Hydrogen sulfide is affected by pH, temperature, and dissolved oxygen. H₂S is most toxic at a pH lower than 6.5. Most fishponds and aquatic gardens are maintained with pH ranges from 7.0 to 9.0. However, pH fluctuates and can decrease significantly during early summer mornings because of plant and animal respiration allowing H₂S levels in the pond to become lethal.

In contrast to pH, at increased temperatures very low levels of H₂S can be toxic. In July and August, sulfide concentrations, which are relatively harmless during the winter, can cause significant damage and mortalities of fish within a few minutes. Dissolved oxygen also plays a role in the harmful effects of H₂S. As H₂S toxicity increases at higher temperatures, oxygen converts it to a nontoxic form.

When ponds are well oxygenated, H₂S will not escape from sediments unless they are disturbed as during planting, seining, or pond maintenance.

Hydrogen sulfide can be exasperated in warm months, as rapid organic decomposition occurs during periods with low dissolved oxygen levels, higher water temperatures, and large pH fluctuations.

The main health concern caused by H₂S is gill damage marked by increased opercula movement and respiratory arrest. Fish may seek areas under waterfalls or near aerators in order to obtain more oxygen. Fish exposed to near lethal levels of H₂S over prolonged periods show other signs of disease. Symptoms include poor feeding and an increased susceptibility to common diseases and parasites.

After long-term exposure to H₂S, fish become thin and sickly. Fish experience outbreaks with other common diseases and parasites because of gill damage and stress from initial exposure to H₂S. Often several fish in the same pond will be sick, yet on diagnostic scrapes several fish may appear to be infected with different parasites.

The best treatment is learning how to prevent this problem from occurring. This can be accomplished by providing

adequate aeration and by designing ponds and gardens in order to decrease dead or stagnant areas. Frequent water changes are also beneficial. H₂S can be diluted by flushing old water, preferably from the bottom of the pond, and then replacing with an equal volume of new water. Keeping ponds aerated will help decrease H₂S levels. Some well water contains high levels of H₂S and stagnant pipe water can create favorable conditions for sulfate reducing bacteria. In this case, aerate the water as it flows into the pond, this can be easily achieved by allowing the water to flow over several baffles from the faucet. If well water stands and aerates for several days before adding it to your pond or aquatic garden, H₂S generally evaporates. H₂S can be removed from pond water using potassium permanganate, but this is only a temporary solution and not recommended. Potassium permanganate can also be caustic to fish and cause gill damage itself.

In rare cases, a rotten egg smell may emanate from hot water lines or water heating units. When a rotten egg smell is detected from warm or hot water, sulfate-reducing bacteria are often the culprits. The magnesium anode used in many water-heating units offers the bacteria a great home. To correct this problem, the water heater and hot water lines should be disconnected from the pond or aquatic garden and the unit and lines should be flushed with chlorinated water and then rinsed with fresh water. If possible, remove the magnesium anode and install a polyphosphate feeder on the cold water or chiller line entering the heating unit to prevent corrosion. Make sure all the cold water and chiller lines are free from leaks and the polyphosphate does not enter system water or system lines.