TANK Enviro Systems

WATER > PROCESS > INNOVATION

REMOVING AMMONIA IN DRINKING WATER
WITH BRENTWOOD ACCUFAS

What is Ammonia?

Ammonia is a naturally occurring compound found in some chemical products, fertilizers, and as a byproduct of the degradation of organic materials such as manure and urine. Its high solubility means that it cannot be easily settled out of a freshwater source. Ammonia is not typically found in freshwater drinking sources, but a variety of events, including burning fossil fuels, fertilizing crops, ranching, and the leaching of sewage and septic tanks, may potentially produce ammonia. Additionally, areas with soils rich in humic substances or iron may contain higher natural contents.

Drinking water sources close to agricultural or animal confinement areas are especially prone to ammonia contamination, as the soluble ammonia from fertilizers or animal waste will seep into the groundwater via infiltration. Some surface water—lakes, rivers, and streams—can contain up to 12 mg/L of ammonia due to various runoff sources, according to the World Health Organization.

When deposited into freshwater sources in large concentrations, ammonia causes fish kills and harmful algae blooms. The United States has been regulating the discharge of ammonia in wastewater for over two decades for point source dischargers. Little to no regulation exists on non-point source dischargers like agriculture.

Ammonia itself has a relatively large threshold level before it poses a significant threat. Consequently, the Environmental Protection Agency does not currently regulate ammonia concentrations for drinking water; however, many European nations have instituted a drinking water standard of 0.5 mg/L or lower.

Effects of Ammonia on Disinfection

In municipal water distribution systems, large concentrations of ammonia result in higher dosages of chlorine disinfectant in order to maintain necessary free chlorine residuals. This leads to bad-tasting water and costly disinfection, as well as potential problems fully disinfecting drinking water. According to the World Health Organization, drinking water containing above 0.2 mg/L ammonia may use as much as 68% chlorine, rendering it unusable for disinfection.

Although ammonia is added to drinking water disinfection systems to limit the creation of carcinogenic disinfection byproducts, it is typically in low concentrations (0.4 mg/L) – not the relatively high concentrations found in impaired drinking water sources (2-5 mg/L).

Need

As the city grew, new strains were put on its existing water infrastructure. The city currently operates three water treatment plants. A major food processor within the city's service area creates high demand periods for brief intervals throughout the year, which increased the need for additional storage capacity. These required upgrades to create an ideal situation to optimize the disinfection practices used by the city. The city plans to use chlorine, both free and chloramines, for the foreseeable future. Unfortunately, the current water source contains 2.7 mg/L of ammonia on average, which leads to high required chlorine dosage and disinfection costs.

Pilot Details

Mostly used for wastewater treatment applications, Brentwood's pilot reactor was a great way to assess the nitrification capability of a submerged attached growth treatment system. Working together with the consultant engineering firm and the city, Brentwood ran a pilot for twelve weeks. A skid-mounted pilot unit consisting of Brentwood's patented biological treatment media was erected. Aeration was provided by a blower and diffused aeration system. A composite sampler collected influent and effluent data to the pilot unit.

The pilot demonstrated considerable nitrification efficacy. At flows of 1.5 and 2.5 gpm, 85-90% of the ammonia was removed. This translates to a loading rate of 780 and 468 SF/gpm respectively. This aligned with the city's goal of nitrifying ammonia to a point that would prevent formation of DBP's, but not impair disinfection.

It is apparent that a fixed-film bioreactor is a good fit for nitrification of potable water sources. However, many factors influence whether it should be implemented in different municipalities. By utilizing Brentwood's pilot reactor and design resources, a low-cost analysis can be performed for your municipality or client to achieve project goals.

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