

Drinking Water Treatment - pH Adjustment

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About pH

pH is an indicator of the acid or alkaline condition of water. The pH scale ranges from 0-14; 7 indicates the neutral point. The normal pH range of drinking water is 6 - 8.5. The pH is mostly a result of natural geological conditions at the site and the type of minerals found in the local rock. The pH can also be affected by acid rain. Water with a pH value less than 7 is acidic and tends to be corrosive. Acidic water (low pH) can leach metals from plumbing systems, which can cause pipes to leak. Metals that leach from the pipes (lead from lead pipes or copper from copper pipes) may also cause health problems. Water with a value greater than 7 indicates alkalinity and tends to affect the taste of the water. Alkaline drinking water may take on a "soda" taste. Corrosion problems also can occur in plumbing. The three types of pH adjustment devices are discussed below.

Neutralizing filters

How neutralizing filters work

A neutralizing filter is used if drinking water is acidic (low pH). It is a simple treatment device that raises the pH of water by adding a neutralizing material. However, it should be noted that the neutralization process may increase [water hardness](#).

Neutralizing filters are point-of-entry devices that raise water pH to neutral levels (around 7) which reduces or eliminates plumbing corrosion problems. Calcium carbonate treats water with a pH greater than 6 and synthetic magnesium oxide will treat water with a pH below 6.

Untreated water flows through the filter, which is filled with calcium carbonate (limestone) or a synthetic magnesium oxide medium. This material dissolves in the water and raises its pH level.

Capacity

The neutralization process takes time and in general the flow rate should not exceed 3.0 gallons per minute per square foot of filter bed area. A bed depth of 32 to 36 inches is necessary to provide adequate contact time; shallower beds will not provide sufficient neutralization.

Maintenance

All treatment systems require regular maintenance. The material used in a neutralizing filter needs to be refilled and the filter needs to be backwashed regularly.

Installing a [cartridge filter](#) prior to the neutralizing filter will remove solid particles from the water and can help to prolong the life of the neutralizing filter.

Special considerations

The biggest drawback to neutralizing filters is that they may increase or cause water hardness if calcium and magnesium are used in the filter. If hard water becomes a nuisance, the neutralizing filter should be followed by a [water softener](#). If water hardness is treated with sodium, it may be unsuitable for people on a low-sodium diet.

In addition to water hardness, neutralizing filters may also cause water pressure loss due to the fact that the water needs to flow through finely ground neutralizing material.

Neutralizing filters are typically installed after the pressure tank, so neither the pressure tank nor the well pump will be protected from corrosion. If the flow rate is high, a liquid injection system (see below) may be better than a

neutralizing filter, as it is installed before the pressure tank and thus provides corrosion protection to the tank and the plumbing system.

Soda ash/sodium hydroxide injection

How soda ash/sodium hydroxide injection works

This treatment method is used if water is acidic (low pH). Soda ash (sodium carbonate) and sodium hydroxide raise the pH of water to near neutral when injected into a water system. Unlike neutralizing filters, they do not cause hardness problems in treated water.

Injection systems are a point-of-entry system. A corrosion-resistant chemical feed pump injects soda ash or sodium hydroxide solution into the water to raise the pH. The solution should be fed directly into the well to protect the well casing and pump from corrosion.

If the water needs to be [disinfected](#) as well as neutralized, dual treatment is possible within the injection system by adding a chlorine solution (sodium hypochlorite) along with the neutralizing chemical.

Injection systems can treat water with a pH as low as 4.

Maintenance

As with all chemical feed systems, the chemical feed pump must be maintained and the chemical storage tanks refilled. Soda ash, the preferred chemical, is safer to handle than sodium hydroxide. Screens and filters should be periodically checked and cleaned.

Special considerations

Use caution if using sodium hydroxide. If adding it manually, maintain good ventilation to avoid breathing vapors. Add the chemical slowly to the water and ensure complete mixing. Be sure to wear protective gloves, goggles and clothing to avoid skin and eye contact with the chemical. Store sodium hydroxide in a cool, dry place away from flammable materials.

Individuals on a low sodium diet should consult a doctor before installing an injection system. Use manufacturer specifications to compare sodium levels in the treated water to levels consumed from other sources in the diet. Potassium hydroxide may be used as a substitute for sodium hydroxide but may cost more.

Acid injection

How acid injection works

Acid injection treats water with a high pH by lowering the pH of water to around 7, which eliminates the soda taste and can improve the effectiveness of chlorination. This method also reduces the potential of pipe corrosion as water with a pH above 9 can corrode metals such as brass, copper, zinc, aluminum and iron.

Acid injection is a point-of-entry system. A chemical feed pump made from corrosion-resistant materials injects a solution of acetic acid (white vinegar) into high pH water. Citric acid and alum can be used instead, although they are more expensive. Weak solutions of hydrochloric acid or sulfuric acid also lower pH but these are more hazardous and require special handling. They are recommended, however, if the pH of untreated water is 11 or higher. After adding the acid solution, the feed rate should be adjusted until tap water reaches a pH around 7.

Maintenance

As with all injection systems, the pump must be maintained and the chemicals refilled. Wear goggles, gloves, and protective clothing when handling acid solution.

Special considerations

Chemicals used in acid injection systems should be handled carefully and stored in clearly marked containers, out of the reach of children. When diluting acid solutions it is important to always add acid to water slowly, never add water to acid. Be sure to thoroughly examine manufacturers' recommendations before purchasing an acid injection system or necessary chemicals.

Questions to ask before you buy

Before purchasing a water treatment device, have your water tested at a [state certified laboratory](#) to determine the contaminants present. This will help you determine if pH adjustment is an effective treatment method for your situation. See [Questions to Ask Before You Buy A Water Treatment System](#) for more information.

Adapted from: Wagenet, L., K. Mancl, and M. Sailus. (1995). *Home Water Treatment*. Northeast Regional Agricultural Engineering Service, Cooperative Extension. NRAES-48. Ithaca, NY.