



WATER QUALITY
in KENTUCKY



Hard Water—To Soften or Not to Soften

Minerals that cause hard water have a wide impact on households. Hard water interferes with almost every cleaning task from laundering and dishwashing to bathing and personal grooming. Clothes laundered in hard water may look dingy and feel harsh and scratchy. Dishes and glasses washed in hard water may become spotted as they dry. Hard water may cause a film on glass shower doors, shower walls, and bathtubs. Hair washed in hard water may feel sticky and look dull.

Hard water also affects the performance of household appliances. Researchers at New Mexico State University studied the effects of water quality on the performance of residential gas and electric water heaters. The one-year study measured the energy consumption of six residential gas and electric water heaters in use for five to 15 years in Las Cruces, New Mexico.

Half of each group exclusively used the area's untreated hard water. The other half exclusively used softened water. Results of the study showed that water heaters using only hard water consumed more energy than those using only softened water.

The researchers removed and weighed the sediment and scale accumulated in each of the water heaters. The water heaters using softened water contained scale buildup weighing from 1.09 lb to 4.27 lb. The group using hard water contained scale buildup weighing from 3.86 lb to almost 40 lb.

Accumulated scale is a poor conductor of heat. In water heaters, accumulated scale insulates the water from the heat source. The New Mexico study demonstrated that water heaters with scale buildup used more energy to deliver a given amount of hot water than heaters without scale buildup.

Another study conducted at Ohio State University showed that using softened water in certain household tasks lessened the time necessary to complete the tasks, allowed for easier cleaning, and contributed to savings in the amount of household cleaning products used. If these items are important to you, consider softening water in your household.

Measure of Hardness

Calcium and magnesium ions present as sulfates, chlorides, carbonates, and bicarbonates cause water to be hard. Water chemists measure water impurities in parts per million (ppm), but water hardness is often expressed in grains of hardness per gallon of water (gpg). The two systems can be converted mathematically. Table 1 gives common classifications for hard water with values listed in both parts per million and grains per gallon. One grain of hardness is the amount of calcium and magnesium equal in weight to a kernel of wheat.

Figure 1. Generalized hardness (in grains/gallon) of Kentucky's groundwater.

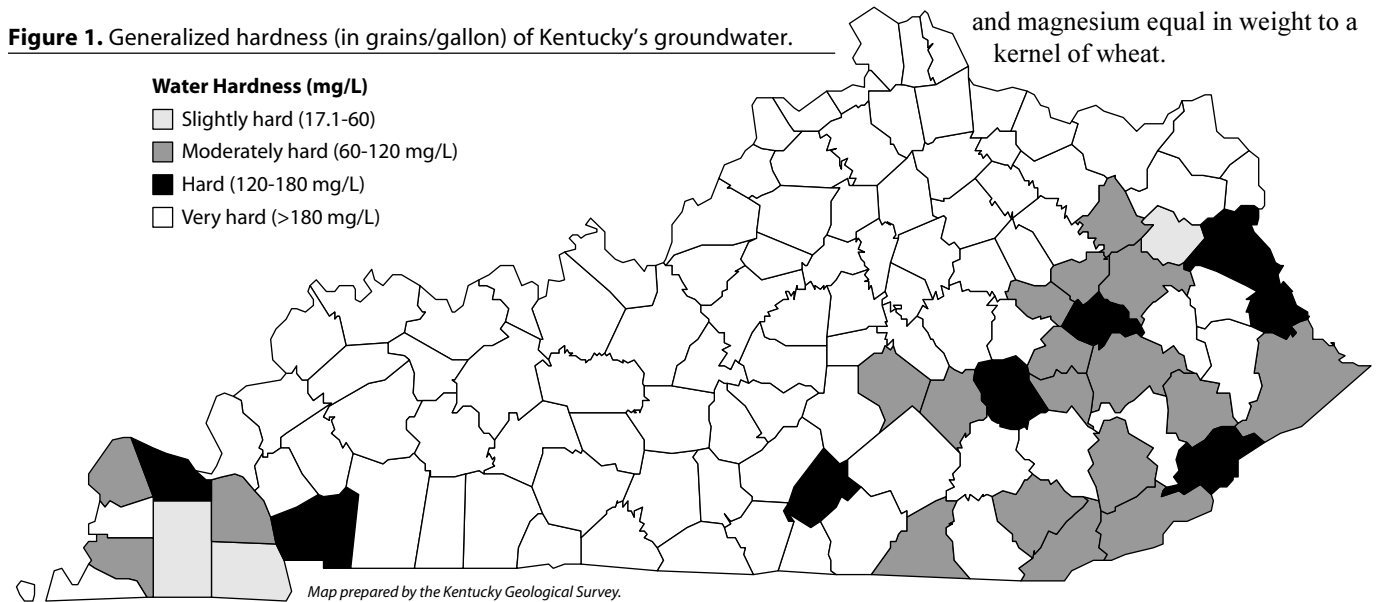


Table 1. Hard Water Classifications.

Classifications	ppm	grains/gallon
Soft	0 - 17	0 - 1
Slightly hard	17 - 60	1 - 3.5
Moderately hard	60 - 120	3.5 - 7.0
Hard	120 - 180	7.0 - 10.5
Very hard	Above 180	Above 10.5

Water supply companies and local health departments can give you an indication of how hard the water is in your area. Figure 1 gives a general indication of water hardness across the state.

How to Reduce Hardness

You can reduce water hardness by buying or renting a water softening tank and connecting it to your water supply line. Softening hard water typically involves the use of an ion exchange water softener. In this process, the water passes through a bed of softening material, usually sulfonated polystyrene beads, which are micro-porous. The beads are supersaturated with sodium to cover both their exterior and interior surfaces, thus having the ability to take on or give up electrical charges.

The ion exchange process takes place as the hard water passes through the softening material. The calcium and magnesium attach themselves to the resin beads while the sodium in the resin beads is released into the water. The process occurs billions of times during softening. Eventually, so much hardness collects on the softening material that the unit can no longer soften the water, and recharging is necessary. The softening material is washed automatically with a brine solution to replace the sodium and enable the ion exchange process to continue.

Types of Water Softeners

Water softeners are classified in four different categories:

1. **Manual.** The owner starts and stops all steps in recharging the unit.
2. **Semi-automatic.** The owner starts the steps manually except for the automatic termination of the rinse

and the return to service.

3. **Automatic.** The owner stops the unit when recharging is necessary. All subsequent steps in recharging follow automatically.
4. **Fully automatic.** The unit operates with a timer, and all operations are activated automatically. The system has enough softening material for multiple regenerations, but more must be added periodically as required.

Selecting a Water Softener

Buying a water softener requires comparison shopping and investigation. Here are some hints to help as you shop:

- A typical household water softener costs around \$1,000 to \$1,800. Monthly operating expenses range from \$2 to \$8 if sodium is used and from \$3 to \$15 if potassium is used.
- Buy only from a reputable dealer. Be wary of door-to-door sales offers.
- Decide on a system only after you have considered the cost of the equipment and its installation and have obtained an approximation of operating costs. Expensive units are sometimes called “water treatment” systems but may be only glorified softeners.
- Check the warranty. Be sure you understand it. Warranties may be for only one year or a lifetime. Again, avoid both extremes. A dependable warranty could be for 10 years on the tank and five years on the control valves.
- If installation fees are included in the price, be sure that there are no further charges for bypassing lawn and garden water systems, replenishing swimming pools, etc.
- Be certain that you understand the method and cost of recharging the system.
- Ask dealers for names of customers. Check with these customers to learn if they are satisfied with the equipment and service. Ask friends who have invested in water softening equipment for advice.
- When purchasing any type of water treatment equipment, including

water softeners, look for equipment that carries the seal from the Water Quality Association (WQA), National Sanitation Foundation (NSF), or Underwriters Laboratories, Inc. (UL). A seal from any of these organizations indicates that the equipment has been independently tested to industry performance standards.

Questions and Answers about Water Softening

Should everyone use softened water?

People who have heart or circulatory problems or who are on low sodium diets may not want to soften their water, or they may want to soften only their hot water. The latter option defeats the purpose of a water softener because the dishwasher is the only household appliance in which hot water alone is used. People with heart or circulatory problems should discuss this question with a physician. Three alternative methods are available to reduce sodium in softened water: reverse osmosis, distillation, and deionization.

In addition to the sodium, is softened water harmful in other ways?

Water contains trace elements of vital minerals found only in minute quantities in the human body. These tiny amounts have a profound effect on human health. Researchers have found conflicting results relating the mineral content of water to the risk of cardiovascular disease. The risk appears lowest when the drinking water contains lots of minerals and highest when the water is soft. Consumers may want to consider installing a bypass to the kitchen water supply for cooking and drinking.

Softened water increases the potential for leaching heavy metal from pipes, solder, and plumbing fixtures. Increased levels of copper, lead, zinc, and cadmium are found in soft water, particularly when it stands overnight in the plumbing system. Heavy metal concentrations can exceed Environmen-

tal Protection Agency (EPA) primary drinking water standards, particularly for water standing overnight in brass plumbing fixtures and faucets.

Is softened water harmful to plants, lawns, and gardens?

Softened water is not recommended for watering plants, lawns, and gardens due to its sodium content. Care must also be taken that water used in recharging a water softener be disposed of through a storm drain or sewer because of its damaging effects. If you are on a septic tank, the logical method of disposal is to discharge the brine into the septic tank and soil absorption field where some leaching of sodium salts will occur. Other alternatives include a separate holding tank, which could be emptied by a vacuum truck, a separate disposal field, or discharge point that does not affect neighbors' property.

Can water softeners be rented?

Renting water softening equipment may be an option only in urban areas. For a monthly fee, the company installs a softening unit and replaces it periodically with a freshly charged unit. This option may be the optimum type of service for households with moderate water usage or those seeking the least possible maintenance of equipment.

Can softened water be used in a steam iron?

Always read and follow the manufacturer's recommendations for best results. Generally, the best choice of water for steam irons is distilled water, particularly for use over a long period. Softened water contains minerals, which may clog steam irons.

Conclusion

Using softened water has many advantages. You can expect cleaner, softer-feeling clothes, use a lesser amount of household cleaning products such as detergents, save on personal cleanliness products such as shampoo, and have easier maintenance and upkeep of your home. You can also expect longer life for appliances, including washing machines, dishwashers, and water heaters.

Softening household water supplies is not a decision to be made lightly. Factors to consider are family composition, stage in the family life cycle, lifestyle, health, maintenance of the equipment, and cost.

For additional information about water quality, please contact your county Cooperative Extension Service.

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