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Distillation for Home Water Treatment

Michigan State University Cooperative Extension Service

Water Quality Extension Publications

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**Distillation** is one of the oldest methods of water treatment and is still in use today, though not commonly as a home treatment method. It can effectively remove many contaminants from drinking water, including bacteria, inorganic and many organic compounds.

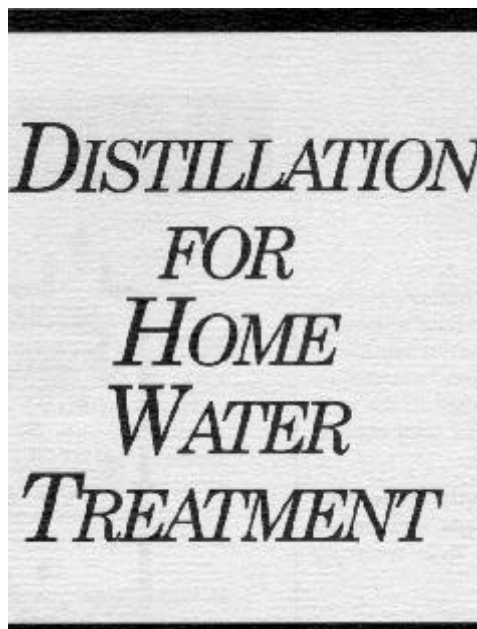
The first step toward solving a suspected water quality problem is having your water analyzed by your local health department or a reputable laboratory. A water analysis will not only verify whether a water quality problem exists, but is also essential to determine the most appropriate solution to the problem.

State or local health officials can interpret water analysis results. Some laboratories may also provide this service.

Note that home water treatment is considered only a temporary solution. The best solutions to a contaminated drinking water problem are to either end the practices causing the contamination or change water sources.

## DISTILLATION

**DISTILLATION IS A PROCESS** that relies on evaporation to purify water. Contaminated water is heated to form steam. Inorganic compounds and large non-volatile organic molecules do not evaporate with the water and are left behind. The steam then cools and condenses to form purified water.



Distillation is most effective in removing inorganic compounds such as metals (iron and lead) and nitrate; hardness (calcium and magnesium); and particulates from a contaminated water supply. The boiling process also kills microorganisms such as bacteria and some viruses. The effectiveness of distillation in removing organic compounds varies, depending on such chemical characteristics of the organic compound as solubility and boiling point. Organic compounds that boil at temperatures greater than the boiling point of water (some pesticides) can be effectively removed from the water.

Organic compounds that boil at temperatures lower than the boiling point of water (ex., benzene and toluene) will be vaporized along with the water. If these harmful compounds are not removed prior to condensation, they will re-contaminate the purified product.

## DISTILLATION UNITS

**DISTILLATION UNITS OR STILLS** generally consist of a boiling chamber, where the water enters, is heated and vaporized; condensing coils or chamber, where the water is cooled and converted back to liquid water; and a storage tank for purified water. Fig. 1 shows the components and process of a distiller.

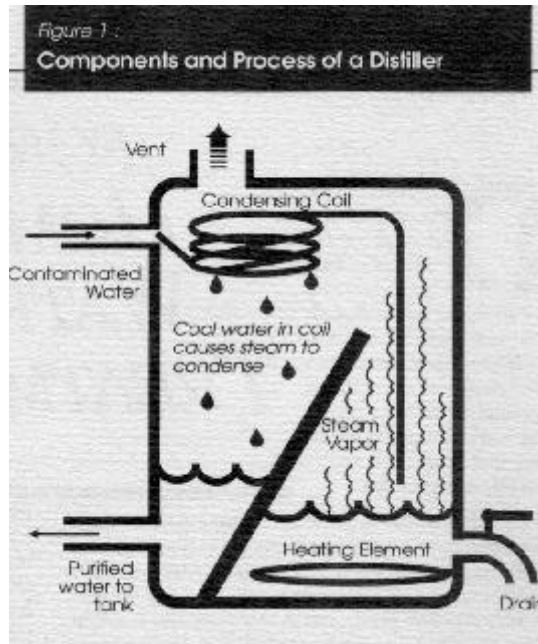
Distillation units are usually installed as point-of-use (POU) systems. They are generally placed at the kitchen faucet and used to purify water intended for drinking

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and cooking purposes only. Stills vary in size, depending on the amount of purified water they produce. The production rate varies from 3 to 11 gallons per day. Home stills can be located on the counter or floor, or attached to the wall. Models can be fully or partially automated, or manual.

Some stills have columns or volatile gas vents to eliminate organic chemicals with boiling points lower than water, thus ensuring uncontaminated water.

## OPERATION, MAINTENANCE AND COST

AS WITH ALL HOME WATER treatment systems, stills require some level of regular maintenance to keep the unit operating properly. Unevaporated pollutants remaining in the boiling chamber need to be regularly flushed to the

septic or sewer system. Even with regular removal of the residual water that contains unevaporated pollutants, a calcium and magnesium scale will collect at the bottom of the boiling chamber. This scale eventually needs to be removed, usually by hand scrubbing or by an application of acid.

Heating water to form steam requires energy. This means that operating costs for distillation units are generally higher than those of other forms of home water treatment. The production of heat from home stills can be an advantage in winter, but a disadvantage in summer. The distillation process also removes oxygen and some trace metals from water. Some people claim this leaves the water tasting flat.

Distillation units are generally expensive, ranging from \$300 to \$1200. Portable units can be purchased for less than \$200.

*(Note: Dollar values are provided as a rough guide to compare costs of different systems. Current prices are likely to be higher than those quoted.)*

## CERTIFICATION AND VALIDATION

CERTIFICATION OF TREATMENT PRODUCTS is available from independent testing laboratories, such as the National Sanitation Foundation (NSF). Results from NSF tests provide good measures of the effectiveness of devices designed to treat water for both aesthetic and health reasons. The Water Quality Association (WQA), a self-governing body of manufacturers and distributors, offers voluntary validation programs to its members. Validation is less stringent than certification. Note that certification or validation will not ensure effective treatment; all systems must be designed for each particular situation and maintained properly.

## SUMMARY

PURIFYING DRINKING WATER by using home distillation units is one option available for people with a water quality problem. Distillation is an effective method to remove inorganic compounds, bacteria, particulates and some organic contaminants. However, other treatment methods may be better for these contaminants and more cost-effective as well. Distillation is not a very common method for home water treatment.

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FOR general water quality information and referrals, contact.

Your county Cooperative Extension Service office (listed under "County Government" in the white pages of your phone book).

**Center for Environmental Toxicology**  
Michigan State University  
East Lansing, Michigan 48824  
(517) 353-6469

**Institute of Water Research**  
Michigan State University  
East Lansing, Michigan 48824  
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FOR questions about water testing, test interpretation and treatment systems, contact

Your local health department (listed under city or county in the phone book).

**Michigan Department of Public Health**  
Division of Water Supply  
3423 North Logan Street  
P.O. Box 30195  
Lansing, Michigan 48909  
(517) 335-9216

FOR further information on water quality and home water treatment, consult the following Publications, available from your county Extension office:

E-2016, "Testing for Contaminants: A Guide for the Home and Farm"

WQ 02, "Guidelines for Testing of Private Wells"

WQ 19, "Nitrate - A Drinking Water Concern"

WQ 2 1, "A Guide to Home Water Treatment"

WQ 23, "Home Water Treatment Using Activated Carbon"

WQ 24, "Reverse Osmosis for Home Treatment of Drinking Water"

