1989

Bottled Water

Joseph L. Taraba
University of Kentucky

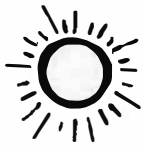
UNIVERSITY OF KENTUCKY
COLLEGE OF AGRICULTURE
Lexington, Kentucky 40546

COOPERATIVE EXTENSION SERVICE

Agricultural Engineering Update


Structures & Environment


Soil & Water


Energy


Safety


Crop Processing


Power & Machinery

AEU-40

BOTTLED WATER

Joseph L. Taraba
Associate Extension Professor and
Extension Specialist for Agricultural Engineering

Bottled water is an option for families who have a water problem, whether their water is unsafe or has an "off" taste or odor. It is best used as a temporary measure or in small quantities for drinking water. At a cost of 65 cents to $1.15 per gallon (Lexington, KY; July 1988) bottled water could become an expensive item for a large family using it for drinking and cooking.

At 80 cents per gallon, an 8-ounce glass costs 5 cents. Why would people pay for bottled water when tap water is virtually free (a fraction of a cent for several glasses)? For many families, bottled water may be better-tasting than their own water supply. Others may question the safety of their water. Bottled water could be a good temporary measure. (Note: People often get water from friends or relatives when they have a problem with their own water supply; users should check the quality of drinking water, especially from unregulated sources.)

Is bottled water in fact better than tap water? That depends on the source and treatment for the water. Tap water and bottled water are both subject to the same regulations, the Environmental Protection Agency primary and secondary drinking water standards (see Appendix A), so there is little reason to expect great differences. One big difference, however, is that public systems are exempt from secondary standards when no alternative is available; bottled water must meet both standards.

Bottled water is commonly treated with ozone for disinfection. Ozone is a high-strength oxygen that quickly reverts to normal oxygen. It is a strong oxidant, like chlorine, but does not add taste as chlorine does. How long chlorine and ozone remain active in the water depends on many factors, including temperature. This residual usually provides disinfection throughout the public water distribution system. Ozone also can provide a residual disinfection for a limited time. However, bottled water may be in distribution for several weeks and storage conditions, especially temperature, are important for maintaining quality. Shelf life dating of containers is not required. A musty and/or plastic taste may result from poor or long storage conditions. In terms of bacteria content, bottled water may be no better than most municipal tap water.

Bottled water often is purchased for its good taste. However, good taste is not an indicator of safe water. Many harmful substances such as pathogens (disease-causing organisms), nitrates, trace heavy metals (such as lead and mercury), pesticides, and some organic materials have no taste. Water naturally contains varying amounts of carbon dioxide, calcium, iron compounds, sodium, fluoride, and other minerals and mineral salts -- all substances that affect taste. Differences in the amounts explain why the taste of tap water varies from one area to another.

Bottled water processed from city water systems, wells and springs may range in mineral content, from low to high in "mineral" waters. Sometimes minerals are added in processing to improve the flavor of water.

Types of Bottled Water

There are four basic types of bottled water that offer varying degrees of treatment or purity. The typical treatment processes are shown in Figure 1.

Distilled water or demineralized water has been treated to remove nearly all of the minerals that occur naturally in water. Through a process or combination of distillation, reverse osmosis, or deionization, the water contains less than 10 parts per million (ppm) or 10 milligrams per liter (mg/l) of total dissolved solids. Virtually all sodium is removed by these processes. The resulting water has the highest degree of purity and is excellent for use in steam irons or watering plants but may be considered rather flat and tasteless for drinking because of the lack of minerals.

Drinking water may come from municipal water systems, wells, or springs. It often is treated by reverse osmosis to remove minerals and organic chemicals, a process that also removes bacteria and other pathogens and most pesticides. The resulting water is purified but still contains some dissolved solids. Distillation, deionization, or a combination of processes also may be used to remove contaminants. Distillation produces a purer water than reverse osmosis because it removes more of the dissolved solids. Deionization removes minerals but not necessarily organic chemicals, pesticides, and other contaminants unless other processes also are used. Water bottlers often add back certain minerals (but usually not sodium) to improve taste.

Natural water comes from a protected well or spring and is bottled without extensive treatment. This water typically is free of the trace chemical additives found in many public water supplies. However, it contains most of the mineral contaminants commonly picked up by water as it moves through the

air, soil, and rock materials. Because this is almost exclusively groundwater, it usually contains a wide range of minerals and is therefore quite flavorful. Spring water is really no different from groundwater except that it is forced to the surface from deeper layers or reaches the surface as it flows through the aquifier.

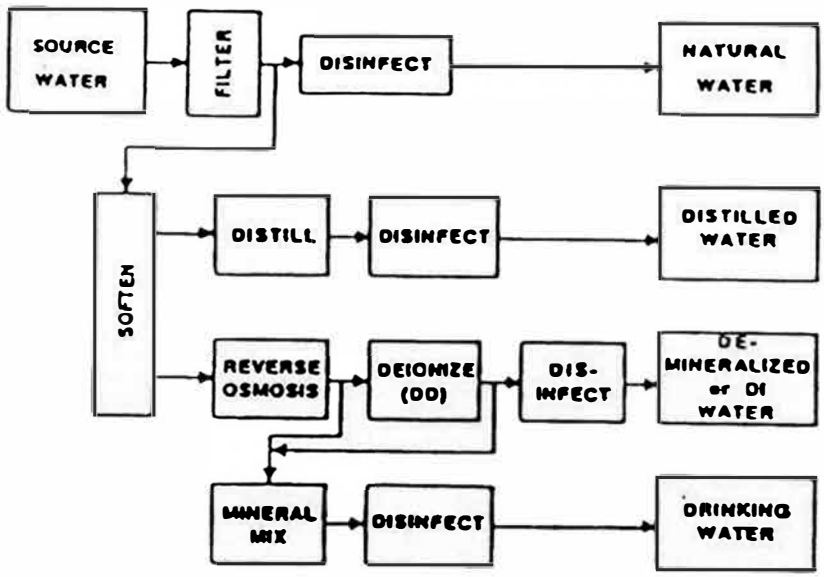
Natural waters from Kentucky range from a high degree to a medium degree of hardness resulting from the wide range of minerals that occur naturally in groundwater. Natural waters also may contain other undesirable contaminants such as pesticides or organic chemicals if these substances occur in the area contributing to the supply well or spring. Since natural water may not receive treatment other than disinfection, it may contain some undesirable contaminants. Bottled natural water must meet EPA primary and secondary drinking water standards, but this does not address most of the thousands of industrial chemicals.

Mineral water is obtained from a natural spring or underground source. The mineral content is not modified by the manufacturer and may contain from 1,000 to 3,000 ppm total dissolved solids. It may be still or sparkling, a version that is currently in demand as a cocktail substitute. The carbon dioxide that causes carbonization may be natural or added during bottling.

Both domestic and imported mineral waters are subject to federal standards for safety and purity under the guidelines for soda waters.

Labeling of bottled water is inconsistent as to the water source and the treatment techniques. The most informative labels indicate the exact water source, identify the water treatment processes, and the processor name and address; while the least informative only indicate that it is a natural water source along with the processor name and address.

FIGURE 1. WATER TREATMENT PROCESSES



(Filter: Mechanical and/or Activated Carbon)

Bottled Water Quality

The Food and Drug Administration (FDA), the federal agency responsible for regulating bottled water, requires regular sampling and inspects facilities for cleanliness and quality control. Additionally, Kentucky has an inspection program for bottled water (see Appendix B). The industry trade group, the International Bottled Water Association (IBWA), also inspects facilities of its members to assure quality control. The National Sanitation Foundation (NSF) also operates a certification program. Manufacturers who belong to IBWA or have NSF certification usually indicate this quality assurance on their product labels. Consumers who have questions about bottled water should contact the bottler, IBWA, or NSF for information.

Recommended References

FDA Consumer, May 1983
Consumer Reports, Sept. 1980, Jan. 1987
Consumer Research, Dec. 1985, May 1983
Rodale's Practical Homeowner, Jan. 1987
Which?, July 1982

APPENDIX A

Drinking Water
Maximum Contaminant Levels
(July 1988)

Coliform Bacteria	1 colony per 100 milliliters as monthly average
Turbidity	1.0 nephelometric turbidity unit as monthly average

Inorganic Chemicals	Milligrams Per Liter
Arsenic	0.05
Barium	1.0
Cadmium	0.01
Chromium	0.05
Lead	0.05
Mercury	0.002
Nitrate	10.0
Selenium	0.01
Silver	0.05

Organic Chemicals	Milligrams Per Liter
Endrin	0.0002
Lindane	0.004
Methoxychlor	0.1
Toxaphene	0.005
2,4-D	0.1
2,4,5-TP Silvex	0.01

Total Trihalomethanes	0.1 milligrams per liter as annual average

Secondary Contaminants	
Chloride	250.0 mg/l
Copper	1.0 mb/l
Color	15 units
Total Dissolved Solids	500.00 mg/l
Hydrogen Sulfide	0.05 mg/l
Iron	0.3 mg/l
Manganese	0.05 mg/l
Odor	3 Threshold Number
Phenols	0.001 mg/l
Sulfate	250.0 mg/l
Zinc	5.0 mg/l

Radionuclides	Picocuries Per Liter
Gross Alpha Particles	15
Radium	5
Gross Beta Particles	50
Strontium 90	8
Tritium	20,000
Iodine 131	3

Sodium	20.0 milligrams per liter as an optimum level

Volatile Synthetic Organic Chemicals	Milligrams Per Liter as Annual Average
Benzene	0.005
Carbon Tetrachloride	0.005
1,2-Dichloroethane	0.005
Trichloroethylene	0.005
para-Dichlorobenzene	0.075
1,1-Dichloroethylene	0.007
1,1,1-Trichoroethane	0.2
Vinyl Chloride	0.002

APPENDIX B

Bottled Water Producers in Kentucky
June 21, 1988

(Source: public records; Kentucky Natural Resources and Environmental Protection Cabinet, Department for Environmental Protection, Division of Water, Drinking Water Branch.)

Trauth Dairy
56 East Eleventh Street
Newport, Kentucky 41071
(606) 431-7553

Source: Highbridge Springs

Comment:

This system was originally approved with Newport Water Works as its source. Purchasing water systems are not required to monitor for chemical contaminants. Therefore, no chemical analysis results are available. This system recently began operation, however, using water hauled from Highbridge Springs rather than Newport Water Works. Action is being taken to rectify the deficiencies due to the change in source. All bacteriological analysis results are negative during 1988.

Dawson Springs Mineral Water
317 South Main Street
P.O. Box 504
Dawson Springs, Kentucky 42408
(502) 797-8750

Source: Cash well

Comment:

This differs from all other bottled water supplies in that mineral water is the product. In order to meet the industry definition of mineral water, certain minimum contaminant levels must be satisfied rather than maximum contaminant levels. The raw water chemical analysis results indicate very high level of the "secondary contaminants", which often affect the water aesthetically rather than in terms of health effects. Finished water chemical analysis results are to be submitted. All bacteriological analysis results are negative during 1988.

Crystal Clear Water Company
3899 Produce Road
Louisville, Kentucky 40218
(502) 969-7000

Source: Louisville Water Company

Comment:

This system purchases water from the Louisville Water Company. Purchasing systems are not required to monitor for chemical contaminants Therefore, no chemical analysis results are available. All other bacteriological analysis results are negative for 1988.

Kentucky Bubbling Spring, Inc.
7713 Old Westport Road
Louisville, Kentucky 40222
(502) 893-3668

Source: Spring

Comment:
No bacteriological analysis results submitted during 1988. System operates only periodically.

Highbridge Spring Water Company
Route 1, Box 48
Wilmore, Kentucky 40390
(606) 858-4407

Source: Highbridge Springs

Comment:
All bacteriological analysis results are negative for 1988. Chemical analysis results are below maximum contaminant levels for both primary and secondary standards.

Iceberg Pure Water
1006 D. Park Central Avenue
Nicholasville, Kentucky 40356
(606) 885-9501
P.O. Box 12527
Lexington, Kentucky 40583

Source: Jessamine Co. Water District

Comment:
This system purchases water from Jessamine County Water District. Purchasing systems are not required to monitor for chemical contaminants. Therefore, no chemical analysis results are available. All bacteriological analysis results are negative for 1988.

Iceburg Spring Water
1006 D. Park Central Avenue
Nicholasville, Kentucky 40356
(606) 885-9501
P.O. Box 12527
Lexington, Kentucky 40583

Source: Spring

Comment:
Chemical analysis results are below maximum contaminant levels for both primary and secondary standards. All bacteriological analysis results are negative for 1988.

Samuel Springs Water Company Source: Spring
P.O. Box 8
Deatsville, Kentucky 40016
(502) 348-0172
(502) 968-6355

Comment:
This system recently began operation. Raw water chemical analysis results are below the maximum contaminant levels for both primary and secondary standards. Finished water chemical analysis results are to be submitted. All bacteriological analysis results are negative for 1988.

Mother Nature Spring Water Source: Spring
P.O. Box 95
Ashcamp, Kentucky 41512
(606) 754-5756

Comment:
No chemical analysis results are available. Only two water samples were submitted during 1988 for bacteriological analysis, both of which are negative. This system is currently subject of enforcement action.

Three other bottled water companies have had treatment plans approved, but have not begun production:

Elkhorn Valley Spring Water Source: Well
3001 Bryan Station Pike
Lexington, Kentucky 40516
(606) 299-4066

Living Waters Mountain Home Source: Spring
Good Neighbor Road (Loyall)
P.O. Box 844
Harlan, Kentucky 40831
(606) 573-3587

Mountain Crystal Water Company Source: Spring
P.O. Box 718
Hazard, Kentucky 41701
(606) 436-2534
(606) 623-2628
(606) 436-2637

(This publication has been adapted in part for Kentucky from "Bottled Water" by G.M. Powell and M.E. Tucker, Kansas Extension Publication #MF-881, Aug. 1987.)

75-7/88
250-8/88
500-3/89