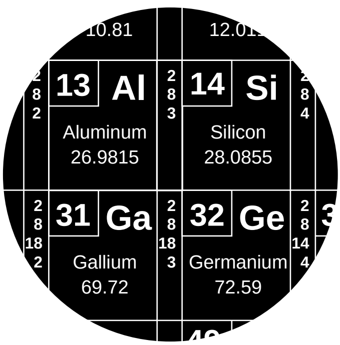
Midwest Laboratories, Inc.
13611 B Street
Omaha, Nebraska 68144-3693
Telephone: (402) 334-7770
Fax: (402) 334-9121

An evaluation of the Pure Water Midi D Model ECP Distillation System, and the Pure Water A-12 Distillation System for removing select contaminants from drinking water



Submitted to:

Pure Water, Inc.
3725 Touzalin Avenue
Lincoln, NE 68507

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Introduction . . .

Water is able to dissolve many substances to a greater or lesser degree and as such can become contaminated readily. As contaminants in the water supplies are frequently not visible to the naked eye, a consumer drinking water produced by a purification device needs to have the assurance the device will be effective in removing or significantly reducing a broad spectrum of contaminants.

Pure Water, Inc. manufactures and markets stainless steel devices with the expressed purpose of reducing contaminants from water and making the resulting water suitable for drinking.

The water distillation systems combine the process of distillation, where the feed-water is heated to boiling, the steam is collected, removed and cooled to form distilled water. Then water passes through carbon filtration to improve taste and to remove any residual organic carry over. The testing in this report was carried out on the complete distillation systems; a distiller in conjunction with the carbon filter.

Pure Water, Inc. engaged the services of Midwest Laboratories, Inc. to conduct a comprehensive evaluation of the ability of two popular distiller models to remove contaminants from water and to produce high purity drinking water.

Methodology Used . . .

The Pure Water Midi D Model ECP Distillation System and the Pure Water A-12 Distillation System were installed in accordance with manufacturers instructions in accordance with the respective Owners Manual. Tubing and fittings used were those supplied with the equipment, again in accordance with the Owners Manual.

Test contaminants were added to a pressurized tank containing city drinking water. All organic chemicals were certified reference materials obtained from ISO certified vendors.

The pollutants were added to the water at concentrations ten to twenty times the regulated level in the U.S.A. Upon addition to these chemicals, the tank was blanketed in Nitrogen and mixed by rocking back and forth. Samples of the contaminated water were taken from the tank and analyzed in duplicate. Following the collection of feed-water samples, a feed line pump was activated and raw contaminated water was fed to each of the water distillation systems under test. The distillers of each model were activated and permitted to operate for seven hours. At the end of this period, samples of water were drawn from the storage vessel for product water from the distillation system and analyzed in duplicate. The protocols used for the testing were United States Environmental Protection Agency (US EPA) and methods obtained from the Standard Methods for Examination of Water and Wastewater and results validated using a stringent quality control program. Results reported are the mean of two analyses.

The microbiological contaminant reduction utilized the widely accepted protocol detailed in the National Sanitation Foundation (NSF) Standard 62 Annex C.

***Note**: The contaminants listed in these tests are not necessarily present in the drinking water of the reader.*

Appendix of Units . . .

CFU/ML = Colony forming unit/milliliter (used for reporting bacteria results)
Mg/L = milligram/liter = ppm
ppm = parts per million = Mg/L
µg/L = microgram/liter = ppb
ppb = parts per billion = µg/L

Mg/L and µg/L are the units primarily used in reporting results for water analysis.

Results . . .

Removal of Microbiological Contaminants from Water

Microbiological contaminants are a group of living organisms which can be found in water supplies. Such contaminants can be the cause of illness in humans that consume drinking water containing these contaminants.

Table 1 indicates the results of removal of microbiological contaminants from feed-water.

TABLE 1

Reduction of Microbiological Contaminants Utilizing a Pure Water Midi D Model ECP and a Pure Water A-12 Distiller.

Organism	Raw Water Concentration	Product Water Concentration	Removal Efficiency	Action Level	Test Method
Bacillus subtilus	1 X 10^8 CFU/ML	None Detected	99.99%	10 CFU/ML	NSF Std 62 Annex C

Both the Pure Water Midi D Model ECP and the Pure Water A-12 Distillation Systems eliminated Bacillus. Bacillus subtilus is used as a surrogate indicator. The removal of the Bacillus subtilus spores is generally recognized as an indicator of the removal of the following biological contaminants from water: K. terrigena (bacteria), the Polio and Rota viruses, and Giardia and Cryptosporidia Protozoa.

Removal of Inorganic Contaminants & Metals from Water

Inorganic contaminants and metals are chemicals and compounds which do not incorporate a carbon atom in their molecular structure. While relatively few in number, some inorganic contaminants have a high toxicity and can be found in water supplies. The most toxic inorganic chemicals are regulated by the US EPA.

Table 2 lists the results of contaminant reduction for inorganic contaminants from a spiked feed-water sample.

TABLE 2

Reduction of Inorganic Contaminants in Water Utilizing a Pure Water Midi D Model ECP and a Pure Water A-12 Distiller.

		MIDI D ECP		A-12		
Inorganic	Feedwater Conc. Mg/L (ppm)	Product Water After Treatment Mg/L (ppm)	% Reduction	Product Water After Treatment Mg/L(ppm)	% Reduction	Test Method
aluminum	3.66	0	> 99.9%	0	>99.9%	EPA 200.9
antimony	35.6	0.02	> 99.9%	0.97	97.28%	EPA 200.9
arsenic	0.275	0	> 99.9%	0	>99.9%	EPA 200.7
barium	0.07	0	> 99.9%	0	>99.9%	EPA 200.7
boron	0.375	0	> 99.9%	0	>99.9%	EPA 200.7
cadmium	0.056	0	> 99.9%	0	>99.9%	EPA 200.7
calcium	41.45	0.165	99.60%	0.32	99.23%	EPA 200.7
chloride	87	4	95.40%	8	90.80%	EPA 300.0
chromium	0.17	0	> 99.9%	0	>99.9%	EPA 200.7
cobalt	0.16	0	> 99.9%	0	>99.9%	EPA 200.7
copper	0.22	0	> 99.9%	0	>99.9%	EPA 200.7
fluoride	2.55	0	> 99.9%	0	>99.9%	EPA 300.0
hardness	147	0.575	99.61%	1.25	99.15%	SM 2340B
iron	0.17	0.01	94.12%	0	>99.9%	EPA 200.7
lead	0.145	0	> 99.9%	0.001	99.31%	EPA 200.9
magnesium	10.6	0.04	> 99.9%	0.11	98.96%	EPA 200.7
manganese	0.16	0	> 99.9%	0	>99.9%	EPA 200.7
mercury	0.018	0	> 99.9%	0.0003	98.33%	EPA 245.1
nickel	0.16	0.01	93.75%	0	>99.9%	EPA 200.7
nitrate	11.3	0	> 99.9%	0	>99.9%	EPA 300.0
phosphorous	0.2	0	> 99.9%	0	>99.9%	EPA 200.7
potassium	15.2	0.135	99.11%	0.17	98.88%	EPA 200.7
selenium	0.14	0	> 99.9%	0	>99.9%	EPA 200.9
sodium	62.2	1.32	97.88%	0.65	98.95%	EPA 200.7
thallium	38.5	0.098	99.75%	0.386	99.00%	EPA 200.9
vanadium	0.17	0	> 99.9%	0	>99.9%	EPA 200.7
zinc	0.17	0.02	88.24%	0.02	88.24%	EPA 200.7

Both distillation systems effectively remove dissolved inorganic compounds from water and produced a drinking water essentially free of such contaminants. Some inorganic contaminants in this category, including lead, selenium, mercury and arsenic are regulated by the EPA since they can cause medical disorders. The combination of a distiller with its recommended post-filter effectively reduces a number of such contaminants.

Removal of Organic Contaminants from Water

Organic compounds contain a carbon atom in their chemical structure. This group consists of thousands of different entities, many derived from the petrochemical industry. Common organic contaminants include cleaners, herbicides, pesticides and industrial process wastes.

Tables 3 and 4 show the effect on organic and pesticide contaminants in water after treatment by the Pure Water Model ECP and the Pure Water A-12. A number of organic chemicals are regulated by the EPA.

TABLE 3

Reduction of Organic Contaminants in Water Utilizing a Pure Water Midi D Model ECP and a Pure Water A-12 Distiller.

		MIDI D ECP		A-12		
Organic Chemical	Feedwater Conc. µg/L (ppb)	Product Water After Treatment µg/L (ppb)	% Reduction	Product Water After Treatment Mg/L (ppm)	% Reduction	Test Method
phenol	28.1	0	> 99.9%	0	>99.9%	EPA 625
2,4-dichlorophenol	34.4	0	> 99.9%	0	>99.9%	EPA 625
2,4,6-trichlorophenol	36.2	0	> 99.9%	0	>99.9%	EPA 625
2,4-dinitrophenol	50.1	0	> 99.9%	0	>99.9%	EPA 625
pentachlorophenol	140.4	0	> 99.9%	0	>99.9%	EPA 625
bis (2-chloroethyl) ether	35.5	0	> 99.9%	0	>99.9%	EPA 625
nitrobenzene	39.8	0	> 99.9%	0	>99.9%	EPA 625
2,6-dinitrotoluene	33.2	0	> 99.9%	0	>99.9%	EPA 625
dimethylphthalate	31.8	0	> 99.9%	0	>99.9%	EPA 625
phenathrene	23	0	> 99.9%	0	>99.9%	EPA 625
fluroanthene	21.6	0	> 99.9%	0	>99.9%	EPA 625
naphthalene	23.8	0	> 99.9%	0	>99.9%	EPA 502.2
4-nitrophenol	38.6	0	> 99.9%	0	>99.9%	EPA 625
anthracene	21.4	0	> 99.9%	0	>99.9%	EPA 625
pyrene	21.9	0	> 99.9%	0	>99.9%	EPA 625
Benzene	7.5	0	> 99.9%	0	>99.9%	EPA 502.2
Bromobenzene	7	0	> 99.9%	0	>99.9%	EPA 502.2
Bromochloromethane	7.5	0	> 99.9%	0	>99.9%	EPA 502.2
Bromoform	9.5	0	> 99.9%	0	>99.9%	EPA 502.2
Carbon tetrachloride	5	0	> 99.9%	0	>99.9%	EPA 502.2
Chlorobenzene	7	0	> 99.9%	0	>99.9%	EPA 502.2
Chloroform	46	0.5	98.91%	0	>99.9%	EPA 502.2
2-Chlorotoluene	6.5	0	> 99.9%	0	>99.9%	EPA 502.2
Dibromomethane	8	0	> 99.9%	0	>99.9%	EPA 502.2
1,2-Dichlorobenzene	7	0	> 99.9%	0	>99.9%	EPA 502.2

1,3-dichlorobenzene	6	0	> 99.9%	0	>99.9%	EPA 502.2
1,2-Dichloroethane	9	0	> 99.9%	0	>99.9%	EPA 502.2
1,1-Dichloroethene	5	0	> 99.9%	0	>99.9%	EPA 502.2
1,2-Dichloropropane	7	0	> 99.9%	0	>99.9%	EPA 502.2
1,1-Dichloropropene	5	0	> 99.9%	0	>99.9%	EPA 502.2
Ethylbenzene	6.5	0	> 99.9%	0	>99.9%	EPA 502.2
Hexachlorobutadiene	5	0	> 99.9%	0	>99.9%	EPA 502.2
Naphthalene	7	0	> 99.9%	0	>99.9%	EPA 502.2
n-Propylbenzene	6	0	> 99.9%	0	>99.9%	EPA 502.2
Styrene	6	0	> 99.9%	0	>99.9%	EPA 502.2
Tetrachloroethene	6	0	> 99.9%	0	>99.9%	EPA 502.2
Toluene	7.5	0	> 99.9%	0	>99.9%	EPA 502.2
Trichloroethene	6	0	> 99.9%	0	>99.9%	EPA 502.2
o-Xylene	20.5	0	> 99.9%	0	>99.9%	EPA 502.2

Most city water supplies do not contain measurable levels of volatile or semi-volatile chemicals. However, private wells can become contaminated from a variety of causes. The above data indicates that both units are effective at removing a large number of organic contaminants. Some of the contaminants are found in gasoline fuels, paint thinner, cleaning agents, and residues from a wide assortment of manufacturing processes.

TABLE 4

Reduction of Herbicide and Pesticide Contaminants in Water Utilizing a Pure Water Midi D Model ECP and a Pure Water A-12 Distillers.

		MIDI D ECP		A-12		
Organic Chemical	**Feedwater Conc. µg/L (ppb)**	**Product Water After Treatment µg/L (ppb)**	**% Reduction**	**Product Water After Treatment Mg/L (ppm)**	**% Reduction**	**Test Method**
acetachlor	1.85	0	> 99.9%	0	>99.9%	EPA 507 Mod
alachlor	1.75	0	> 99.9%	0	>99.9%	EPA 507 Mod
ametryn	1.55	0	> 99.9%	0	>99.9%	EPA 507 Mod
atrazine	2.2	0	> 99.9%	0	>99.9%	EPA 507 Mod
butylate	2.3	0	> 99.9%	0	>99.9%	EPA 507 Mod
cyanazine	2	0	> 99.9%	0	>99.9%	EPA 507 Mod
deethylatrazine	1.4	0	> 99.9%	0	>99.9%	EPA 507 Mod
deisopropylatrazine	1.95	0	> 99.9%	0	>99.9%	EPA 507 Mod
EPTC	1.6	0	> 99.9%	0	>99.9%	EPA 507 Mod
ethalfluralin	1.2	0	> 99.9%	0	>99.9%	EPA 507 Mod
metolachlor	1.7	0	> 99.9%	0	>99.9%	EPA 507 Mod
propachlor	2.1	0	> 99.9%	0	>99.9%	EPA 507 Mod

prometon	1.7	0	> 99.9%	0	>99.9%	EPA 507 Mod
propazine	1.4	0	> 99.9%	0	>99.9%	EPA 507 Mod
simazine	1.8	0	> 99.9%	0	>99.9%	EPA 507 Mod
triallate	1.45	0	> 99.9%	0	>99.9%	EPA 507 Mod
trifluralin	1.2	0	> 99.9%	0	>99.9%	EPA 507 Mod
2,4-D	38	0	> 99.9%	0	>99.9%	MDA-AEP
2,4-DB	37.5	0	> 99.9%	0	>99.9%	MDA-AEP
2,4,5-T	40	0	> 99.9%	0	>99.9%	MDA-AEP
pentachlorophenol	60.5	0	> 99.9%	0	>99.9%	EPA-625
MCPA	35	0	> 99.9%	0	>99.9%	MDA-AEP
MCPB	40	0	> 99.9%	0	>99.9%	MDA-AEP
MCPP	34.5	0	> 99.9%	0	>99.9%	MDA-AEP
picloram	40.5	0	> 99.9%	0	>99.9%	MDA-AEP
chlorneb	0.25	0	> 99.9%	0.007	97.20%	EPA-508
chlorobenzilate	0.35	0	> 99.9%	0.01	97.14%	EPA-508
chlorothalanil	0.475	0	> 99.9%	0.012	97.47%	EPA-508
methoxychlor	0.15	0	> 99.9%	0	>99.9%	EPA 507 Mod
propachlor	2.85	0	> 99.9%	0.095	96.67%	EPA 507
treflan	0.95	0	> 99.9%	0.025	97.37%	EPA 507

Pesticides are commonly used by the agriculture industries, homeowners, golf-courses and a variety of other applications. Levels of pesticides have been detected in ground water in many parts of the U.S.A. and throughout the world. A diverse number of commonly used herbicides and pesticides were tested, with most contaminants removed in excess of 99%. The diverse types of pesticides removed demonstrates the effectiveness of the units in any part of the United States and abroad.

Conclusion . . .

Both the Pure Water Midi D Model ECP and the Pure Water A-12 distillation systems offered to the public by Pure Water, Inc. are designed and manufactured to effectively remove a variety of contaminants both chemical and biological. The scientific basis of distillation has long been a standard method of purifying water in chemical laboratories. With periodic cleaning and maintenance either the Pure Water Midi D Model ECP or the Pure Water A-12 should provide years of dependable service and gallons of clean water from a wide variety of source water.

Laboratory testing shows both units produce drinking water of much higher quality than the standards established by the U.S. Environmental Protection Agency. These test results are available for review by contacting Pure Water, Inc., 3725 Touzalin Avenue, Lincoln, NE 68507 USA.

References . . .

- Pure Water Midi D Model ECP Owners Manual (Pure Water)
- Pure Water A-12 Owners Manual (Pure Water)
- Distillation Study Guide (Water Quality Association)
- Standard Methods for The Examination of Water and Wastewater. (American Public Health Association. American Water Works Association. Pollution Control Federation)
- Drinking Water Distillation Systems. Standard 62. American National Standard/NSF International Standard (National Sanitation Foundation)

EPA 200.7	Determination of metals and trace elements in water and wastes by (ICP) inductively coupled plasma - atomic emission spectrometry.
EPA 300.0	Determination of inorganic anions by Ion chromatography.
EPA 245.1	Determination of mercury in water by cold vapor atomic absorption spectrometry.
EPA 200.9	Determination of trace elements by stabilized temperature graphite furnace atomic absorption.
EPA 625	Determination of semivolatile organics (base /neutral and acids) by liquid/liquid extraction and gas chromatography/mass spectrometer detector (GC/MS).
EPA 502.2	Volatile organic compounds in water by purge and trap capillary column gas chromatography with photoionization and electrolytic conductivity detectors in series.
EPA 507	Determination of nitrogen and phosphorous containing pesticides in water by gas chromatography with a nitrogen-phosphorus detector.
MDA-AEP	Determination of chlorinated herbicides in water by gas chromatography with an electrolytic conductivity detector. Minnesota Department of Agriculture - acid extractable pesticides.
EPA 508	Determination of chlorinated pesticides in water by gas chromatography with an electron capture detector.

Respectfully submitted,

Dr. Jerome King
Quality Assurance/Quality Control Director
Midwest Laboratories, Inc.