

**Assessment of POU device for the
removal of chloroform and MTBE**

Prepared for:
Steve May

Puratap Pty Ltd
60 North Tce
Kent Town
South Australia 5067
Phone 133 502
Facsimile 08 8363 9811

Prepared by:

Australian Water Quality Centre
250 Victoria Square, Adelaide SA 5000,
Telephone: (08) 7424 1027
Fax: (08) 7003 1027

Contact: David Cook
E-mail: david.cook@sawater.com.au

Date: 17-03-10
Updated 03/03/11

Dear Steve,

Attached are results for the assessment of filter units for the removal of chloroform and MTBE. If you have any questions please give me a call or send an email.

Yours Sincerely,



David Cook
Scientific Officer
Water Treatment Laboratory
Australian Water Quality Centre



Australian
Water
Quality
Centre

Assessment of Puratap GI-2600 POU device for the removal of chloroform and MTBE

1.0 Introduction

Test filters, Puratap GI-2600 were assessed for removal chloroform and methyl tert-butyl ether (MTBE) spiked into mains (tap) water. The filter unit consisted of two filters enclosed in a sealed housing.

2.0 Test conditions

The test conditions used for the investigations are outlined below.

2.1 Chloroform removal

Test conditions were based on Muti-Pure Laboratory report for test request numbers 80797 and 80798. Test conditions are described in Table 1 with flow rate and total volume tested calculated from the test report described above using 1 gallon = 3.785 L. Prior to testing, the filter was flushed for 15 minutes at 2.0 L/min. Influent and effluent samples were taken at intervals of approximately every 400 L. The Puratap GI-2600 device was run for between 8 and 16 hours per day with a fresh feed stock prepared each day. The filter was operated as such that for every 30 minute time period the filter was on for 15 minutes and off for 15 minutes giving a 50% cycle time. Mains water was used for the tests and was filtered through a 0.45 µm cartridge filter to remove particulate material.

Test water was spiked with chloroform to achieve a concentration of approximately 300 µg/L including chloroform already present in the mains water.

Table 1 Test conditions for chloroform test

Parameter	Units	Value
Flow rate	L/min	1.5-2.0
Total volume	L	up to 3800
Cycle	%	50
Cycle time	min	30
Chloroform	µg/L	300
Test water	-	Mains water

2.2. MTBE removal

Test conditions were based on Muti-Pure Laboratory report for test request numbers 80774 and 80775. Test conditions are described in Table 2 with flow rate and total volume tested calculated from the test report described above using 1 gallon = 3.785 L. Prior to testing, the filter was flushed for 15 minutes at 1.5 L/min. Influent and effluent samples were taken at intervals of approximately every 400 L. The Puratap GI-2600 POU device was run for between 8 and 16 hours per day with a fresh feed stock prepared each day. The filter was operated as such that for every 30 minute time period the filter was on for 15 minutes and off for 15 minutes giving a 50% cycle time. Mains water was used for the tests and was filtered through a Matrikx 0.6 µm extruded carbon filter to remove chlorine and trihalomethanes.

Test water was spiked with MTBE to achieve a concentration of approximately 15 µg/L.

Table 2 Test conditions for MTBE test

Parameter	Units	Value
Flow rate	L/min	1.5
Total volume	L	up to 5600
Cycle	%	50
Cycle time	min	30
MTBE	µg/L	15
Test water	-	Mains water

3.0 Results

3.1 Mains Water Quality

Mains water quality is shown in Table 3. Filtration of mains water through the 0.6 µm filter extruded carbon filter resulted in the reduction of dissolved organic carbon (DOC) from 4.2 to between 0.4 and 1.1 mg/L during the MTBE removal study. The effluent DOC from the carbon filter increased as it becomes more saturated with DOC. The removal of trihalomethanes (THMs) was not impacted upon with total THM concentration reduced from 99 to <4 µg/L at the beginning of the study and from 117 to 5 µg/L at the end of the study. Total THMs refers to the sum of chloroform (CHCl₃), dichlorobromomethane (CHBrCl₂), dibromochloromethane (CHClBr₂), and bromoform (CHBr₃).

Table 3 Mains water quality

Analysis	Units	Result
DOC	mg/L	4.2
pH		7.8
Conductivity	µS/cm	664
Total Dissolved Solids	mg/L	360
Alkalinity	mg/L as CaCO ₃	52
Hardness		125
Calcium	mg/L	24.6
Magnesium	mg/L	15.5

3.2 Chloroform removal

Influent and product chloroform concentration as a function of volume treated is shown in Table 4. The flow rate was reduced from 2 to 1.5 L/minute after the treatment of 515 litres due to the difficulty in maintaining a flow rate of 2 L/minute and a feed pressure of 420 kPa. After the treatment of 2330 litres the build up of particles on the filter resulted in the need to increase feed pressure and after 2550 litres treated the test was ended as the feed pressure was approaching the limit of the pump used for the tests. Influent and product water temperature and pH are shown in Table 5.

At the flow rate and volumes of test water treated, no chloroform was detected in the product from the filter. Overall an average concentration of 270 µg/L of chloroform was reduced to <1 µg/L (reporting limit of analysis) which is > 99% removal after the treatment of 2330 litres of spiked mains water. Filter performance will vary with the amount of contaminant present and quality of water being treated such as DOC. In appendix A is a summary of the treatment conditions used and those volatile organic compounds that can be claimed to be reduced as given in the NSF 53 standard when using chloroform as a surrogate.

Table 4 Chloroform removal as a function of treated volume

Volume Treated (L)	Feed Pressure (kPa)	Flow rate (L/min)	CHCl ₃ (ug/L)	
			Influent	Product
0	420	2.00	310	<1
58	420	2.00		
196	440	2.02		
301	440	2.02		
390	425	1.98	254	<1
484	420	1.97		
515	550	1.98		
515	420	1.50		
760	420	1.49	242	<1
873	420	1.48		
1005	410	1.52		
1180	410	1.51	242	<1
1603	410	1.5	267	<1
1721	420	1.47		
1908	415	1.48	306	<1
2226	415	1.50		
2330	490	1.49	282	<1

Table 5 Temperature and pH of influent and product during chloroform removal test

Volume Treated (L)	Feed Pressure (kPa)	Flow rate (L/min)	Influent		Product	
			pH	Temp (°C)	pH	Temp (°C)
0	420	2.00	7.9	23.6	8.6	23.7
58	420	2.00				
196	440	2.02				
301	440	2.02				
390	425	1.98	7.5	23.5	7.7	23.6
484	420	1.97	7.5	23.4	7.7	23.6
515	550	1.98				
515	420	1.50	7.6	22.4	7.4	22.6
760	420	1.49	7.7	22.1	7.7	22.2
873	420	1.48	7.7	22.2	7.7	22.3
1005	410	1.52	7.4	23.8	7.4	24.2
1180	410	1.51	7.5	24.3	7.6	24.2
1603	410	1.50	7.5	22.9	7.4	23.1
1721	420	1.47	7.4	22.8	7.3	22.9
1908	415	1.48	7.5	23.6	7.6	23.7
2226	415	1.50				
2330	490	1.49				
2414	500	1.14				
2488	550	1.01	7.6	23.7	7.6	24.0
2526	510	0.74				

Quality
Centre

3.3 MTBE removal

Influent and product MTBE concentration as a function of volume treated is shown in Table 6. Influent and product water temperature and pH are shown in Table 7. At the flow rate and volumes of test water treated no MTBE was detected in the product from the filter. Overall an average concentration of 14 µg/L of MTBE was reduced to <1 µg/L (reporting limit of analysis) which is > 93% removal after the treatment of 3514 litres of spiked mains water. Filter performance will vary with the amount of contaminant present and quality of water being treated such as DOC. In appendix B is a summary of the treatment conditions and removal for MTBE.

Table 6 MTBE removal as a function of treated volume

Volume Treated (L)	Feed Pressure (kPa)	Flow rate (L/min)	MTBE (µg/L)	
			Influent	Product
0	410	1.50	10	<1
171	410	1.47	10	
322	410	1.5	10	<1
715	390	1.39	9	
757	415	1.52	16	
1075	410	1.51	15	<1
1474	410	1.52	13	<1
1494	415	1.49	18	
1791	390	1.30	13	<1
1829	410	1.53	15	<1
2061	405	1.48	15	<1
2492	390	1.41	12	<1
2588	420	1.52	17	
2832	420	1.49	15	<1
3215	420	1.50	13	<1
3238	420	1.52	15	
3514	450	1.55	15	<1

Table 7 Temperature and pH of influent and product during MTBE removal test

Volume Treated (L)	Feed Pressure (kPa)	Flow rate (L/min)	Influent		Product	
			pH	Temp (°C)	pH	Temp (°C)
0	410	1.50	7.7	23.8	8.9	23.8
171	410	1.47	7.8	23.7	8.0	23.6
322	410	1.5	7.8	23.5	7.9	23.1
715	390	1.39				
757	415	1.52	7.9	22.5	7.9	22.5
1075	410	1.51	7.7	23.5	7.7	23.1
1474	410	1.52	7.8	22.5	7.6	22.8
1494	415	1.49	7.8	24.1	7.7	24.3
1791	390	1.30				
1829	410	1.53	7.5	22.9	7.4	22.8
2061	405	1.48	7.5	22.9	7.5	22.9
2492	390	1.41	7.7	22.5	7.7	22.4
2588	420	1.52	7.6	24	7.6	24.0
2832	420	1.49	7.5	23.9	7.6	23.9
3215	420	1.50	7.7		7.7	
3238	420	1.52	7.7	22.9	7.7	22.9
3514	450	1.55	7.6	23.6	7.6	23.6

3.0 Conclusions

Based on test water quality and test conditions used the performance of Puratap GI-2600 was as follows:

An average concentration of 270 µg/L of chloroform was reduced to <1 µg/L (reporting limit of analysis) which is > 99% removal after the treatment of 2330 litres of spiked mains water.

An average concentration of 14 µg/L of MTBE was reduced to <1 µg/L (reporting limit of analysis) which is > 93% removal after the treatment of 3514 litres of spiked mains water.

4.0 References

NSF/ANSI 53 – 2009e Drinking water treatment units – health effects

5.0 Compliance to NS53 standard

Apart from the variations listed below, testing was completed as outlined in the NSF/ANSI 53 – 2009e standard.

Test system could not maintain test filter (Puratap GI-2600) under pressure during rest time, either during 15 minutes of time in cycle and 8 hr rest time overnight (NSF/ANSI 53 – 2009e standard, clause 7.2.1.6).

Temperature was slightly above 22.5 °C as specified in NSF/ANSI 53 – 2009e standard, clause 7.2.1.5.

Test inlet pressure was increased above (410 ± 20 kPa NSF/ANSI 53 – 2009e standard clause 7.2.1.7.1) after treatment of 3238 litres treated for MTBE.

For the first part of testing (up to 757L) the dissolved organic carbon concentration of the influent tap water was 0.4 mg/L which is below that specified (>1.0 mg/L as TOC) in NSF/ANSI 53 – 2009e standard, clause 7.2.1.5.

Scientific Officer

Dad CK

Date: 03/03/11

Australian
Water
Quality
Centre

Appendix A Summary of removal of volatile organic compounds using chloroform as a surrogate

Test Conditions	
Average Influent concentration (µg/L)	270
Average effluent concentration (µg/L)	< 1
Total Volume treated	2330
% removal after 2330 litres	>99%
Inlet pressure (kPa)	390-450
Flow rate (max) (L/min)	1.55
Compounds	
Alachlor*	Haloketones
Atrazine*	<ul style="list-style-type: none"> • 1,1-Dichloro-2-Propanone*
Benzene*	<ul style="list-style-type: none"> • 1,1,1-Trichloro-2-Propanone*
Carbofuran*	Heptachlor (H-34, Heptox)*
Carbon Tetrachloride*	Heptachlor Epoxide*
Chlorobenzene*	Hexachlorobutadiene*
Chloropicrin*	Hexachlorocyclopentadiene*
2,4-D*	Lindane*
Dibromochloropropane (DBCP)*	Methoxychlor*
O-Dichlorobenzene*	Pentachlorophenol*
P-Dichlorobenzene*	Simazine*
1,2-Dichloroethane*	Styrene*
1,1-Dichloroethylene*	1,1,2,2-Tetrachloroethane*
Cis-1,2-Dichloroethylene*	Tetrachloroethylene*
Trans-1,2-Dichloroethylene*	Toluene*
1,2-Dichloropropane*	2,4,5-TP (Silvex)*
Cis-1,3-Dichloropropylene*	1,2,4-Trichlorobenzene*
Dinoseb*	1,1,1-Trichloroethane*
Endrin*	1,1,2-Trichloroethane*
Ethylbenzene*	Trichloroethylene*
Ethylene Dibromide (EDB)*	Trihalomethanes (TTHM)
Haloacetonitriles (HAN) <ul style="list-style-type: none"> • Bromochloroacetonitrile* • Dibromoacetonitrile* • Dichloroacetonitrile* • Trichloroacetonitrile* 	<ul style="list-style-type: none"> • Bromodichloromethane* • Bromoform* • Chloroform* (surrogate chemical) • Chlorodibromomethane*
	Xylenes (Total)*

*Compounds tested using chloroform as a surrogate for volatile organic compounds as outlined in NSF standard 53.

Appendix B Summary of removal of MTBE

Test conditions	
Average Influent concentration (µg/L)	14
Average effluent concentration (µg/L)	< 1
Total Volume treated	3514
% removal after 3514 litres	>99%
Inlet pressure (kPa)	390-450
Flow rate (max) (L/min)	1.55
Compound	
MTBE	

Australian
Water
Quality
Centre