Assessment of the chemical removal capacity of the HOMEedge water treatment system.

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Healthy Water Technologies

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1.0 Introduction

This work has been designed to provide a preliminary assessment of the chemical and biological removal capacity of the HOMEedge water treatment system. The Australian standard stating chemical removal requirements for domestic treatment devices is AS/NZS 4348:1995 Water supply – Domestic type water treatment appliances – Performance requirements. For full compliance testing the standard requires two treatment devices tested in parallel to achieve 66% or greater removal of a chemical from a challenge solution at five different points through the life of the treatment device (measured in the number of litres of potable water filtered through the device). Similarly, the standard outlines the requirements for free chlorine removal and odour control.

Table 1: *Requirements for chlorine removal classification stipulated in AS/NZS 4348: 1995 Section 5.2*

Class	Chlorine removal
I	75% or greater
II	50% - 75%
III	25% - 50%

To provide a preliminary measure of compliance of the HOMEedge system, chemical and free chlorine challenge solutions were treated using the system and the removal efficiency of the device was assessed. Full compliance testing according to the standard requires multiple tests on replicate treatment systems to be performed at various stages in the working life of device. Though not fully compliant to the standard, the testing protocol used for this study provides an indication of the removal capacities of a new HOMEedge system and validation of the manufacturers claims.

2.0 Methodology

A single HOMEedge water treatment system was used in all the testing. The test set-up consisted used a primary liquid holding container, from which the contents were pumped through the HOMEedge unit using a peristaltic pump at a flow rate of 3 L/min. The HOMEedge system was initially flushed by passing 10L of ultrapure type 1 water (resistivity ≤18.2 mΩ cm^{-1}) through the unit. The system was then treated with 1L of challenge solution, containing all the analytes to be tested mixed in ultrapure water. Samples of the challenge solution were collected before and after treatment and analysed using the methods outlined in Table 2.

Table 2: *Analysis methods used in the study.*

Analysis	Method Reference	Description
pH	APHA 4500 H+	Direct measurement using pH probe.
Chlorine Free	GCCC 3.2.4	Colourmetric determination using spectrophotometry.
Fluoride (Total)	GCCC 6.11	Direct measurement using fluoride specific probe
Metals	GCCC 6.9	Quantification using ICP-OES

3.0 Results

The data reported here is only a preliminary assessment for control and removal capacity for odour and chemicals of the HOMEedge water treatment system. Full removal capacity testing throughout the life of the filter **WAS NOT** performed in accordance to AS/NZS 4348: 1995 therefore these results **DO NOT** indicate the HOMEedge water purifier is compliant to the standard.

3.1 Physicochemical analysis: Table 3a displays the results for the physicochemical testing. No change was observed in pH and a minor (8.1%) reduction was observed in the reduction-oxidation (redox) potential.

3.2 Free Chlorine and Odour Control: Table 1 is annotated directly from AS/NZS 4348: 1995 Section 5.2 and outlines the classifications for different grades of free chlorine removal. The results for the chemical removal capacity in Table 3 c.

Treatment with the HOMEedge system removed 99.2% of the free chlorine in the challenge solution, putting it in the Class 1 category for free chlorine removal.

3.3 Chemical Removal Capacity: The results of the chemical analysis are displayed in Table 3b. The guidelines in ASNZS 4348: 1995 (Section 3.2) for chemical removal require at least 66% removal after treatment.

Some reduction (29.7%) in Fluoride was observed post treatment with the HOMEedge system, though the system displayed limited capacity to remove the metals tested.

Table 3a: *Physicochemical Testing Results.*

Parameter	Pre-Filtration	Post-Filtration	Percent change	Units	Limit of Reporting
pH	7.2	7.2	0%	N/A	0.03
Reduction-Oxidation Potential (Redox)	704	647	8.1%	mV	1

Table 3b: *Chemical Testing Results.*

Parameter	Pre-treatment	Post-treatment	Compliant Removal Concentration	Percent removal	Units	Limits of Reporting
Halides						
Free Chlorine	3.8	0.32	0.95	99.2%	mg/L	0.05
Fluoride (Total)	108	76	35.9	29.7%	mg/L	0.1
Metals						
Aluminium (Total)	4.2	4.1	1.4	2.4%	mg/L	0.005
Copper (Total)	3.3	3.3	1.1	0%	mg/L	0.005
Silicon	8.4	7.9	2.8	6%	mg/L	0.1
Iron (Total)	3.0	3.0	1	0%	mg/L	0.01
Zinc (Total)	43	40	14.3	7%	mg/L	0.01
Lead (Total)	3.2	3.2	1.1	0%	mg/L	0.005
Calcium (Total)	34	35	11.3	0%	mg/L	1
Potassium (Total)	36	35	12	2.8%	mg/L	0.5
Magnesium (Total)	33	35	11	0%	mg/L	0.5
Sodium (Total)	1.6	2.0	0.5	0%	mg/L	0.5

Colour Coding Key	
Passes removal requirements under ASNZS 4348 according to preliminary testing.	
Fails removal requirements under ASNZS 4348 according to preliminary testing.	

4.0 Conclusions

The HOMEedge system did effectively remove the level of free chlorine, and to a more limited extent, fluoride. Interestingly, this did not correspond to a marked decrease in the reduction-oxidation potential. As chlorine is an oxidative disinfectant, neutralisation of the free chlorine should result in a decrease in the redox potential.

A likely reason for this is the turbulation of the water as it passes through the HOMEedge is releasing dissolved oxygen from the water which is interacting with the free chlorine (Cl_2) to form chlorite (ClO_2) and chlorate (ClO_3), both of which will contribute to the oxidative potential. A similar mechanism could explain the reduction in fluoride observed.

5.0 References

ASNZS 4348: 1995 Water supply – Domestic type water treatment appliances – Performance requirements.

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