[redacted] **WATER PURIFIER SYSTEM**

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DISCLOSURE

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EXECUTIVE SUMMARY

Introduction

[redacted] is the top consumer and household electronics company in Korea since 1989, and was introduced to the Malaysian market in 2006. The company has extended its product line-up from water filtration appliances to air purifiers, bidets, water softeners and food waste disposers. [redacted] water purifier system is claimed to be the most advanced water purifier in the market using modern technology and excellent designs. It uses a reverse osmosis (RO) filtration technology with 0.0001 micron purified, ensure clean and healthy water.

Objective/Aim

The objective of this technology review was to assess the safety, effectiveness and cost-effectiveness of [redacted] water purifier system for drinking water in Ministry of Health facilities.

Results and Conclusions

There was no retrievable information on US FDA approval or CE mark for [redacted] water purifier system for drinking water. However, the company claimed that their products had approval from SIRIM and Suruhanjaya Tenaga (Energy Commission) but no certificate was included. There was also no retrievable evidence on the adverse events related to the use of this product from the available scientific databases. There was no retrievable evidence on the effectiveness and cost-effectiveness of [redacted] water purifier system for drinking water although it used RO filtration technology. The company claimed that the cost for [redacted] water purifier system is approximately between RM [redacted] to RM [redacted] depending on product range.

Methods

Electronic databases were searched, which included Medline, PubMed, EBM Reviews-Cochrane Database of Systematic Review, EBM-Reviews-Cochrane Central Register of Controlled Trials, EBM Reviews-Health Technology Assessment, EBM Reviews-Cochrane Methodology Register, EBM Reviews-NHS Economic Evaluation Database, Database of Abstracts of Reviews of Effects (DARE), Horizon scanning databases - Centre, Birmingham, Australia and New Zealand Horizon scanning (ANZHSN), US FDA website, MHRA website and from non scientific database - Google search engine. In addition, a cross-referencing of the articles retrieved was also carried out accordingly to the topic. Relevant articles were critically appraised and evidence graded using US / Canadian Preventive Services Task Force.

[redacted] WATER PURIFIER SYSTEM

1.0 INTRODUCTION

Water purification is the process of removing undesirable chemicals, materials, and biological contaminants from contaminated water. The goal is to produce water fit for a specific purpose. Most water is purified for human consumption (drinking water) but water purification may also be designed for a variety of other purposes, including meeting the requirements of medical, pharmacology, chemical and industrial applications. In general the methods used include physical processes such as filtration and sedimentation, biological processes such as slow sand filters or activated sludge, chemical processes such as flocculation and chlorination and the use of electromagnetic radiation such as ultraviolet light.[1]

[redacted] is the top consumer and household electronics company in Korea since 1989, and was introduced to the Malaysian market in 2006. The company has extended its product line-up from water filtration appliances to air purifiers, bidets, water softeners and food waste disposers. [redacted] water purifier system is claimed to be the most advanced water purifier in the market using modern technology and excellent designs. It uses a reverse osmosis (RO) filtration technology with 0.0001 micron purified, ensure clean and healthy water.[2]

This technology review was conducted based on a request from the Director of Disease Control Division, Ministry of Health Malaysia, who received a proposal from a company to promote the usage of [redacted] water purifier system for drinking water in Ministry of Health facilities.

2.0 OBJECTIVE /AIM

The objective of this technology review was to assess the safety, effectiveness and cost-effectiveness of [redacted] water purifier system for drinking water in Ministry of Health facilities.

3.0 TECHNICAL FEATURES

Around the world, household drinking water purification systems, including a RO step, are commonly used for improving water for drinking and cooking. Such systems typically include a number of steps such as sediment filter, activated carbon filter, RO filter, and ultraviolet (UV) lamp. Similarly, it is claimed that [redacted] water purifier system is comprised of a six step filtration flow process which perform the ultimate solution in assured purity (Table 1).[2]

Figure 1: [redacted] water purifier system

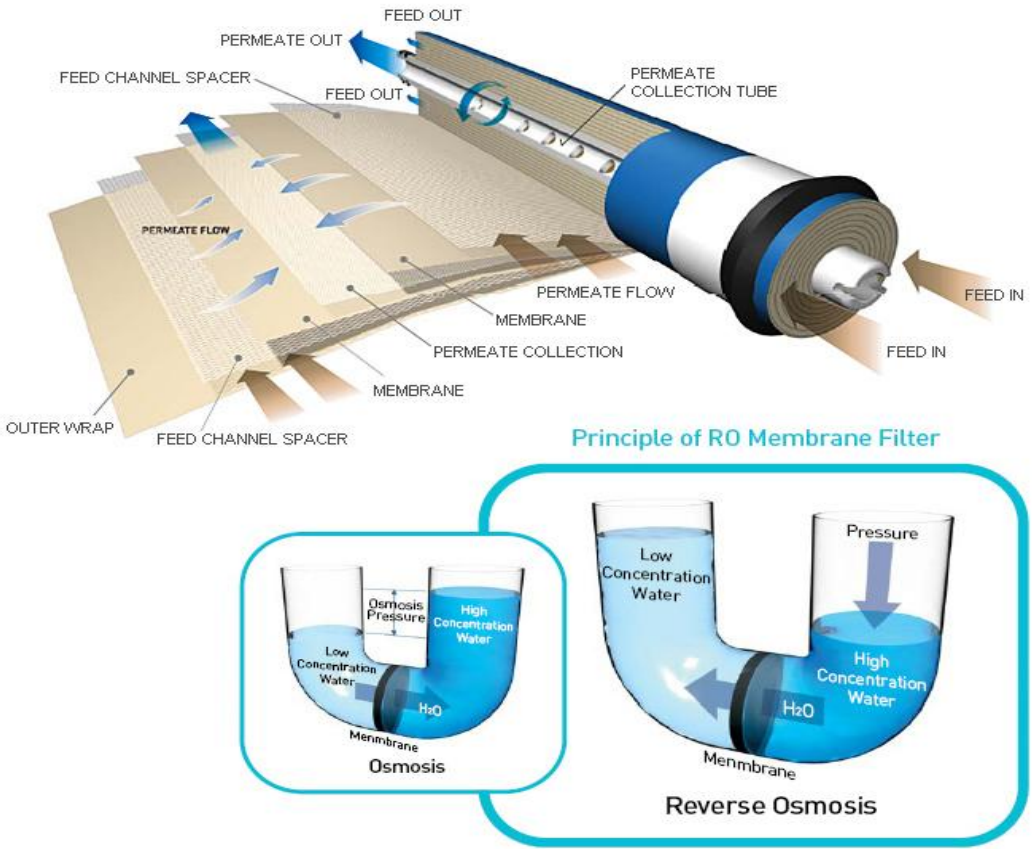

Figure 2: [redacted] RO filtration system

Table 1: [redacted] filtering stage

Step 1	*Sediment filter* to reduce infusible particles

Step 2	*Pre-carbon filter* to reduce aesthetic chlorine, odour, and volatile organic compounds (VOC's)
Step 3	*RO membrane filter* to reduce water contaminants such as pentavalent arsenic, barium, cadmium, selenium, radium 226/228, trivalent chromium, hexavalent chromium, lead, nitrate/nitrite
Step 4	*Fine post-carbon filter* to reduce smell induction material, aesthetic chlorine, and VOC's, and improves taste of Water
Step 5	*Fine dust filter* to reduce fine particles
Step 6	*Ceramic filter* to maintain filtered water and prevents from bacteria growth

RO is a filtration method that removes many types of large molecules and ions from solutions by applying pressure to the solution when it is on one side of a selective membrane. The result is that the solute is retained on the pressurized side of the membrane and the pure solvent is allowed to pass to the other side. To be "selective," this membrane should not allow large molecules or ions through the pores (holes), but should allow smaller components of the solution (such as the solvent) to pass freely.[3]

In the normal osmosis process the solvent naturally moves from an area of low solute concentration, through a membrane, to an area of high solute concentration. The movement of a pure solvent to equalize solute concentrations on each side of a membrane generates a pressure and this is the "osmotic pressure." Applying an external pressure to reverse the natural flow of pure solvent, thus, is reverse osmosis. The process is similar to membrane filtration (Figure 2).[3]

The [redacted] water purifier system also has several features such as below: [2]

Micom Control System	To monitor the whole water purification process at all times
Air-tight Tank	Separated air-tight structure perfectly prevents the secondary contamination to be caused by foreign materials such as dust, bug, and etc
Integrated Overflow Sensor	Detect abnormal status of the system such as “Main Tank Overflow”, “Leakage from Filters and Tube”, and leakages from other wetted parts as well as block the inflow of the water
Hot Water Safety Faucet	To prevent burns caused by hot water
Advanced Micro-dust Filtering System	By adopting micro-dust filter right in front of the water tank, the amount of micro-dust flows into the tank is minimized which can ensure all time clean and fresh water.
Two-way Overflow Prevention	A safety block function using twin air bladders prevents overflow
Automatic Over Cooling/Over Heating Temperature Control	The cooling systems work only when the water contains enough water. Micom controller monitors the water level and controls the cooling and heating mechanism to protect the system from the damage caused by overcooling

	and overheating
Easy Operation with Changeover Faucet	Cold or ambient water is delivered by a simple rotation of the selection knob

4.0 METHODOLOGY

4.1. Searching

Scientific databases such as Medline, PubMed, EBM Reviews-Cochrane Database of Systematic Review, EBM-Reviews-Cochrane Central Register of Controlled Trials, EBM Reviews-Health Technology Assessment, EBM Reviews-Cochrane Methodology Register, EBM Reviews-NHS Economic Evaluation Database, Database of Abstracts of Reviews of Effects (DARE), Horizon scanning databases - Centre, Birmingham, Australia and New Zealand Horizon scanning (ANZHSN), USFDA website, MHRA website and from non scientific database - Google search engine were searched for evidence of safety, effectiveness and cost-effectiveness of [redacted] water purifier system for drinking water.

The following keywords were used either singly or in combinations: [redacted] water purifier system, reverse osmosis filtration, safety, adverse events, effectiveness, cost-effectiveness.

4.2. Selection

All published articles related to safety, effectiveness and cost-effectiveness of [redacted] water purifier system for drinking water were included. Relevant articles were critically appraised using Critical Appraisal Skills Programme (CASP) and evidence was graded according to US/Canadian Preventive Services Task Force (Appendix 1).

5.0 RESULTS AND DISCUSSION

No relevant articles were retrieved on [redacted] water purifier system for drinking water from the scientific databases. There was no retrievable evidence on the safety, effectiveness and cost-effectiveness of this technology.

5.1 Safety

There was no retrievable information on US FDA approval or CE mark for [redacted] water purifier system for drinking water. However, the company claimed that their products had approval from SIRIM and Suruhanjaya Tenaga (Energy Commission) but no certificate was included. There was also no retrievable evidence on the adverse events related to the use of this product from the available scientific databases.

5.2. Effectiveness

There was no retrievable evidence from scientific databases on the effectiveness of [redacted] water purifier system for drinking water although it used RO filtration technology. Based on National Drinking Water Quality Standards, Ministry of Health Malaysia, drinking water must be clear, and does not have objectionable taste, colour and

odour. It must be pleasant to drink and free from all harmful organisms, chemical substances and radionuclides in amounts, which could constitute a hazard to the health of the consumer. The quality of drinking water is measured in terms of its microbiological, physical, chemical and radioactivity characteristics. Table 2 lists some of these characteristics and constituents with their recommended standards, which shall not be exceeded for maximum protection of the consumer.[4]

5.3. Cost-Effectiveness

There was no retrievable evidence on the cost-effectiveness of [redacted] water purifier system for drinking water. However, the company claimed that the cost for [redacted] water purifier system is approximately between [redacted] to RM [redacted] depending on product range.

6.0 CONCLUSION

There was no retrievable evidence on the safety, effectiveness and cost-effectiveness of [redacted] water purifier system although it used RO filtration technology. The company claimed that the cost for [redacted] water purifier system is approximately between RM [redacted] to RM [redacted] depending on product range.

7.0 REFERENCES

1. Water Purification from Wikipedia. Available at http://en.wikipedia.org/wiki/Water_purification

2. [redacted] (M) Sdn. Bhd. Available at http://www.[redacted].com.my/Home.aspx

3. Reverse Osmosis from Wikipedia. Available at http://en.wikipedia.org/wiki/Reverse_osmosis

4. National Drinking Water Quality Standards. Manual Program Kawalan Mutu Air Minum (KMAM). Engineering Services Division, Ministry of Health Malaysia. 2004.

8.0 APPENDIX

8.1 Appendix 1

DESIGNATION OF LEVELS OF EVIDENCE

I Evidence obtained from at least one properly designed randomized controlled trial.

II-I Evidence obtained from well-designed controlled trials without randomization.

II-2 Evidence obtained from well-designed cohort or case-control analytic studies, preferably from more than one centre or research group.

II-3 Evidence obtained from multiple time series with or without the intervention. Dramatic results in uncontrolled experiments (such as the results of the introduction of penicillin treatment in the 1940s) could also be regarded as this type of evidence.

III Opinions or respected authorities, based on clinical experience; descriptive studies and case reports; or reports of expert committees.

SOURCE: US/CANADIAN PREVENTIVE SERVICES TASK FORCE (Harris 2001)

DRINKING WATER QUALITY STANDARDS AND FREQUENCY OF MONITORING

NO.	PARAMETERS	COLUMN I	COLUMN II				COLUMN III
		MAXIMUM ACCEPTABLE VALUE	FREQUENCY TO BE MONITORED				SOURCE OF REFERENCE
		mg/l (unless otherwise stated)	WATER TREATMENT PLANT OUTLET	SERVICE RESERVOIR OUTLET	DISTRIBUTION SYSTEM	WELL/ SPRING	
	GROUP I						
	MICROBIOLOGICAL:						
1	TOTAL COLIFORM	MPN METHOD/MEMBRANE FILTRATION METHOD: MUST NOT BE DETECTED IN ANY 100ml SAMPLE	W	W	M	2Y	MAL
2	*E. coli* OR THERMOTOLERANT	ABSENT IN 100ml SAMPLE	W	W	M	2Y	WHO2
3	COLIFORM BACTERIA						
4	FAECAL STREPTOCOCCI	MEMBRANE FILTER METHOD: ABSENT IN 100ml SAMPLE MPN METHOD: < 1 IN 100ml SAMPLE	WN	WN	WN	WN	EEC
5	CLOSTRIDIUM PERFRINGENS	ABSENT	WN	WN	WN	WN	MAL 1990
6	VIRUSES	ABSENT IN 100ml	WN	WN	WN	WN	NZ
7	PROTOZOA	ABSENT IN 100ml	WN	WN	WN	WN	NZ
8	HELMINTHS	ABSENT IN 100ml	WN	WN	WN	WN	NZ
	PHYSICAL:						
9	TURBIDITY	5 NTU	W	W	M	2Y	WHO2
10	COLOUR	15 TCU	W	W	M	2Y	WHO2
11	pH	6.5 – 9.0	W	W	M	2Y	MAL
12	FREE RESIDUAL CHLORINE	0.2 – 5.0	W	W	M	2Y	WHO1
13	COMBINED RESIDUAL CHLORINE	NOT LESS THAN 1.0	W	W	M	2Y	MAL1990
14	MONOCHLORAMINE	3	WN	WN	WN	WN	WHO2
	GROUP II						
	INORGANIC:						
1	TOTAL DISSOLVED SOLIDS	1000	M	M	Y/2	2Y	WHO2
2	CHLORIDE	250	M	M	Y/2	2Y	WHO2
3	AMMONIA (as N)	1.5	M	M	Y/2	2Y	WHO2
4	NITRATE (as N)	10	M	M	Y/2	2Y	WHO1
5	IRON	0.3	M	M	Y/2	2Y	WHO2
6	FLUORIDE	0.4 – 0.6	M	M	Y/2	2Y	MAL
7	HARDNESS	500	M	M	Y/2	2Y	WHO1
8	ALUMINIUM	0.2	M	M	Y/2	2Y	WHO2
9	MANGANESE	0.1	M	M	Y/2	2Y	WHO2
	GROUP III						
1	MERCURY (TOTAL)	0.001	Y/4	Y/2	Y	2Y	WHO2
2	CADMIUM	0.003	Y/4	Y/2	Y	2Y	WHO2
3	ARSENIC	0.01	Y/4	Y/2	Y	2Y	WHO2
4	CYANIDE	0.07	Y/4	Y/2	Y	2Y	WHO2
5	LEAD	0.01	Y/4	Y/2	Y	2Y	WHO2
6	CHROMIUM	0.05	Y/4	Y/2	Y	2Y	WHO2
7	COPPER	1	Y/4	Y/2	Y	2Y	WHO1
8	ZINC	3	Y/4	Y/2	Y	2Y	WHO2
9	SODIUM	200	Y/4	Y/2	Y	2Y	WHO2
10	SULPHATE	250	Y/4	Y/2	Y	2Y	WHO2