

An Assessment of Gravitational Water Filtration Systems for Export to Nepal

Melinda Drummond

Purpose of this Report

The purpose of this report is to summarize the potential for the Canadian product, Rainfresh® Bucket Gravity Filters, as an export to Nepal. This summary will include a description of the product, trade benefits to Canada, the issue in Nepal the product would address and the economic feasibility of trade of that product.

Part 1: Product Information

i. Product Description

The product selected for export to Nepal from Canada is the Rainfresh® Gravity Bucket Filter – Model MP4U, manufactured by Envirogard Products Limited. This water treatment system uses gravity as its sole form of power, meaning there are no electrical requirements for the system (Envirogard Product Ltd., 2013). The upper reservoir holds 25L of untreated water, which is cleaned at a rate of 2.6L/hr by gravity forcing the water through the ceramic filters (Envirogard Products Ltd., 2011 Mar). At a rate of 2.6L/hr, the water from 25L reservoir will complete treatment approximately every 10 hours. This means it requires filling only 2-3 times per day to generate ~60L of safe drinking water each day, more than half of which (35L) it is able to store (Envirogard Products, Ltd., 2011 Mar.).

There are four silver-impregnated ceramic filters mounted between the reservoirs for untreated and treated water (Envirogard Products, Ltd, 2011 Mar.) Envirogard Products Ltd. (2013) is very



Figure 1: Bucket Gravity Filter – Model MP4U, by Envirogard Products, Ltd.

proud to report that these filters are certified by the Canadian Standards Association (CSA) to remove microbes such as protozoan cysts and independently tested to verify the removal of *Escherichia coli* (*E.coli*), *Salmonella typhimurium*, *cryptosporidium* and *Giardia*. As the pores of the filters fill with water contaminants, the flow of treated water will slow; this can be managed with cleaning. A scrub pad is included with the product to clean the surface of the filters, which can then be returned to the system as many times as possible before they are smaller than the gauge (also included) (Envirogard Products, Ltd. 2011 Mar.).

The housing of this system are two separate plastic buckets of sturdy, food-grade quality (Envirogard Products Ltd, 2011 Mar.), shown in Figure 1. This was a purposeful divergence from the model with a stainless steel structure, to make the system lighter, allow a greater storage capacity, and make shipping more cost effective (Envirogard Products Ltd, 2013).

ii. Description of Manufacture

Envirogard Products Limited, the manufacturer of Rainfresh® products including the Bucket Gravity Filters – Model MP4U, is based in Richmond Hill, Ontario (Envirogard Products Ltd, 2011 Mar). Envirogard Products Ltd, employs 35 people across the company including administration, sales or trade and manufacturing (Innovation, Science and Economic Development Canada (IC), 2016, Oct.17). In 2015, they reported total sales between \$5-10 million (CAD), with \$500,000-\$1,000,000 (CAD) in exports to 22 different countries (IC, 2016, Oct.17).

iii. Cost of Required Machinery

The cost of the MP4U Model is \$205.40 (CAD) per unit with replacement filters costing \$35.90 (CAD), all Canadian taxes included (Envirogard Products Ltd, 2016, Nov.29). There is no

further equipment required for the operation of this unit, as the scrub pad and filter gauge are included with the unit.

iv. Health or nutritional information associated with the product

As previously stated, the filters used in these treatment systems have been certified by CSA to remove protozoan cysts, such as *Giardia* ($\geq 99.5\%$), and independently tested to verify the removal of *Escherichia coli* (*E.coli*), *Salmonella typhimurium*, *cryptosporidium* and *Shigella dysenteriae* ($>99.99999\%$) (Envirogard Products Ltd., n.d.). The Centers for Disease Control and Prevention (CDC) (2009, Apr 10) list these microbes in a travel water treatment guide due to their adverse health effects; each of these can cause gastrointestinal issues, including vomiting and diarrhea, while some have been associated with meningitis and hepatitis. The introduction of this threat to water is most often due to an infiltration of human and animal fecal waste to water ways (CDC, 2009, Apr 10).

v. Benefits to Canada

The benefits to Canada in exporting this product to Nepal, would be reflected most significantly in the local preservation or creation of jobs to support the production and shipment of this product. Pending the success of the product in Nepal, Envirogard Products may require additional manufacturing staff and the courier companies may need additional staff to support the additional shipments required.

Additional benefit to Canadian is in the diversification of trade partners and products minimizes the threat an economic down turn in a country or region poses to Canada's economy (Moeller, 2012).

Part 2

vi. Introduction to Nepal

Nepal is a landlocked country, situated between China and India with a range of elevation of 9000m across 200km (Central Intelligence Agency (CIA), 2016). The country is approximately 143,000 square kilometers with a population slightly more than 29 million people, which includes 125 castes or ethnic groups and almost as many languages (CIA, 2016).

The estimated median GDP per capita for 2015 was \$3350 (\$CAD) and a median fertility rate of 2.18 children born per woman and an average life expectancy of 71 years (CIA, 2016).

Approximately, 91% of the population has access to improved water sources however one of the more significant issues nationally is water-borne diseases (CIA, 2016).

vii. Cost analysis to achieve profitability

The cost to operate a Rainfresh® Bucket Gravity Filter system for a year has been summarized

Table 1: The cost of operating each of the North American systems at maximum capacity for a year. (Envirogard Products Ltd, 2011 Mar; Envirogard Products Ltd, 2010 Jan; DoultonUSA,2016; New Millennium Concepts Limited, 2016)

Company	Envirogard Products Ltd.		Doulton USA		New Millennium Concepts Ltd.
Brand	Rainfresh®				Berkey®
Model	Gravity Bucket Filter – Model MP4U	Gravity Water Filter – Model SM4U	HCA2-IMP	HCA2	Big Berkey®
Price (\$CAD)	\$205.40	\$228.00	\$197.41	\$151.45	\$352.42
Cost/L (\$CAD)	\$0.054/L	\$0.060/L	\$0.035/L	\$0.040/L	\$0.008/L
Days until Replacement (at max. flow)	60 days	54 days	75 days	100 days	71 days
Replacements/Year	6.1	6.8	4.9	3.7	5.1
Cost of Filter/Year (\$CAD)	\$875.96	\$976.48	\$655.42	\$324.86	\$1489.81

in Table 1, above. As reported in the description of Nepal the median income of a household is \$3350 CAD, the cost for the first year of operating the Rainfresh® Bucket Gravity Filter system would be \$937.76 CAD, before any transportation costs were included. This would represent 28% of their income, with the quality of life improvement being difficult to measure without a commercial use of the product. Ideally, these would be used in communities to wash produce, preventing the introduction of bacteria to the food supply, or in communities with tourist traffic that might pay for such security.

viii. Needs and benefits to the importing nation

The most common cause of death in children under five worldwide is water-borne disease, which is to say 43% (Global Ehsan Relief, 2016). This represents only death, not illness, and not for the rest of the population. The CIA Factbook (2016) reports 5 hospital beds in use for every 1000 of the population. Although reports also state that 91% of the population has access to improved water sources, this does not necessarily mean treated water; it could mean that there is a hand pump to assist the user with access to water. Diwakar, Yami and Prasai (2008) determined that 83% of the samples tested from public sources in Bhaktapur, including improved systems, tested positive for Total Coliforms, demonstrating the contamination of the water source with fecal matter. The cost benefit of water treatment systems would come from an improvement in the loss of productivity due to illness and a reduction in demand on the healthcare system.

ix. Key Contacts of Manufacturers

The Canadian company, Envirogard Products Limited, which manufactures the Rainfresh® products, including the Bucket Gravity Filter – Model MP4U, can be contacted by email,

info@rainfresh.ca. Lori Baldasaro is their Customer Service representative and very helpful. They can also be contacted by phone, toll-free at 1-800-667-8072.

x. Available Canadian or international grants available

There are a number of non-governmental organizations now working in Nepal, including WaterAid Nepal and Nepal Water for Health (NEWAH). They have similar goals, in water quality improvement, access and education with slightly different approaches; one through schools and the other through community-based initiatives.

While neither are using systems as small as the Bucket Gravity Filter system, both have funding sources and contacts that would be able to determine the best applications for the system in Nepal.

xi. Global and Regional Competition

Rainfresh® products have many competitors with many products with similar features and other with different features and abilities. One company, Zen Water Systems (2016) based in California, has multipart filtration systems that include zeolite, mineral sand and silver impregnated granulated activated carbon to remove impurities and unwanted tastes and odours. There is an optional ceramic filter to precede the aforementioned stages to remove dirt and bacteria.

The more comparable North American competition has been summarized in Table 2, below. These system have very similar components and capabilities, however they lack the storage capacity of the Bucket Gravity Filter system.

Table 2: Comparative summary of best known gravity water filtration systems marketed in North America. (Envirogard Products Ltd, 2011 Mar; Envirogard Products Ltd, 2010 Jan; Doulton USA, 2016; New Millennium Concepts Limited, 2016)

Company	Envirogard Products Ltd.		Doulton USA		New Millennium Concepts Ltd.
Brand	Rainfresh®				Berkey®
Model	Gravity Bucket Filter – Model MP4U	Gravity Water Filter – Model SM4U	HCA2-IMP	HCA2	Big Berkey®
Country	Canada		USA		USA
Housing Material	Food-grade plastic	Stainless steel	High density polypropylene		Stainless steel
Capacity (L)	35.00	8.50	5.03		8.52
Dimensions (cm)	Not recovered	29x49	19.05x 50.17		21.6x48.9
Number of Filters	4	4	2		4
Filters	7300G - silver impregnated ceramic	7500G – silver impregnated ceramic	CN-SSI(L) 2.75”x7” Imperial SuperSterasyl candle (made in England)	CN-SS 2x7(L) SuperSterasyl candle (made in England)	Black Berkey® purifiers
Flow Rate (Litres/day)	62.40	69.60	75.71	37.85	635.95
Replacement Time	3785L		5700L	3785L	45000L
Price (\$CAD)	\$205.40	\$228.00	\$197.41	\$151.45	\$352.42
Filter Replacement Cost (\$CAD)	\$35.90		\$66.88	\$43.90	\$73.03

There are distinct advantages to each of these products, the Doulton USA models have a moderately lower initial cost for a similar flow rate of treated water (across the two models), however the replacement cost of their filters is higher. The Big Berkey® has an impressive flow rate of approximately 10x the competitions, but it has a distinctly higher initial cost and a higher

filter replacement cost. The Rainfresh® models are average with in their rate of water treatment and initial cost, where these models exceed their competitors is in storage capacity. As discussed in Section i. Production Description, the Bucket Gravity filter can be filled 2-3 times per day and left un-manned, the other models have capacities of less than 10L meaning for continual production someone must transfer the clean water to another container for storage.

The competition in India and China is similar to that in North America, while the price of the initial unit is often a 1/3 of the cost of the Rainfresh® Bucket Gravity Filter system, it also often has 1/3 of the capacity (Amazon.com, Inc., 2016)

xii. Future Studies Required

As is common in developing nations such as Nepal, current and reliable statistics can be difficult to find. However, with more organizations with goals for water treatment and management and improved human health, hopefully more accurate, progressive and expansive data will become available.

Further studies might be completed on the feasibility of the Rainfresh® Bucket Gravity filter for use in remote mountain communities where infrastructure development in the near future is less likely, either for water or medical access. In this case, an additional study of disease rates and healthcare demands following the implementation of water treatment systems to determine any relationships.

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