7-19-2006

Evaluation of Purification Processes of Water Vending Machine Company in Ciudad Juarez

Maria Theresa Escobedo Portillo et al.
Universidad Autonoma de Ciudad Juarez

Abstracts of presentations given on Wednesday, 19 July 2006, in session 20 of the UCOWR Conference.

EVALUATION OF PURIFICATION PROCESSES OF WATER VENDING MACHINE COMPANY IN CIUDAD JUAREZ

Ma. Teresa Escobedo P.[1], Jorge A. Salas Plata M.[1], Griego E. Muñoz M.[1]
[1]Universidad Autónoma de Ciudad Juárez (UACJ)

ABSTRACT

The objective of the present study is to evaluate the purification processes of a public water vending machine company in Ciudad Juarez. A revision of the Osmonics Manual of Pure Water was carried out, as well as other bibliographical sources on line, in order to summarize the water purification methods and other information related to the topic. Information on water quality from the public distribution network in a site of the northern part of the city was obtained. This network is the water source for the drinking water machines. The information was obtained from the Environmental Laboratory of the Institute of Engineering and Technology (IIT) at the UACJ, in the period 2002-2004. Based on the processes required for water purification, a comparison with the technology utilized by the company was done and the evaluation was obtained. The results show that there is compatibility among the purification processes applied and the water quality supplied. Nevertheless, it is observed in the historic analysis of the water quality from the public distribution network that some parameters do not correspond with the standards (Phenols, Chlorides, Aluminum, Sodium and Mercury). Besides, the total dissolved solids of this water source (900 ppm) is above the standard in comparison with the one required for an optimum operation (650 ppm), according to Osmonics Co. It is concluded that the water quality provided by the company is good. It is recommended to carry out a study of water quality based on samplings of all the water machines of the company.

1. INTRODUCCION

The water contamination reduction is carried out by purification technologies, whose processes require to be evaluated. The insecurity and/or ignorance regarding the drinking water quality of the water utilities in Ciudad Juarez, force the people to buy purified water. Water contaminants may be gases from the atmosphere, minerals, organic matter and all kinds of materials. An important purification process is Inverse Osmosis.

1.1 Inverse Osmosis (IO)

Inverse osmosis was invented in 1959 and is one of the most important water purification methods in which dissolve organic and inorganic material are removed, using a different mechanism such as ionic exchange or activated carbon. OI removes most of the organic compounds and even 99% of all ions. Also, it eliminates 99.9% of virus, bacteria and pyrogens. To understand the IO process, one should recall natural osmosis as a nutrients transfer mechanism of living organisms through the cell membranes. If there are, in contact, two solutions of different concentrations of a solute (e.g. salts), a solvent (e.g. water) is moved itself from the most diluted solution to the most concentrated one. If salty water and distilled water are put in contact, through a membrane, it will be obtained equilibrium between both liquids because of the natural mechanism before mentioned. Water that crosses the membrane is "pushed" by the

osmotic pressure of the saltiest solution and the equilibrium of the process is reached when the hydrostatic column balance the osmotic pressure.

It is deduced that if the interest is to obtain a more diluted water flow, the phenomenon should be inverted. For it, one must overcome the natural osmotic pressure through the application of a greater pressure in the opposite direction the physical phenomenon is reverted through the OI process which simultaneously produces two kinds of water flows.

1. The one that crosses the membrane and remains free of dissolved solids (mineral, organic matter, etc.) and microorganisms (virus, bacteria, etc.) called product or permeated water.
2. The other has dissolved solids and microorganisms; it is called the concentrated water.

The OI process which utilizes a semi-permeable membrane to separate and remove dissolved solids, organic matter, pyrogens, colloidal matter (<1 micron), virus and bacteria from the water. OI is able to remove 95%-99% of total dissolved solids (TDS) and 99% of all bacteria, providing a pure and safety water. The membrane of IO has a microspore area that rejects impurities without impeding the water flow. The membrane also retains 85%-95% of inorganic solids. The "polyvalent" ions are rejected more easily than the "monovalent" ions. The organic solids with a molecular weight over 300 are retained by the membrane, but the gases are able to cross through it. The water purity produced depends on the water purity of the source.

2. OBJECTIVE

The objective of the present study is the evaluation of purification processes of water vendor machines in Ciudad Juarez, México. The water purification company sells its product to a considerably low price (almost 50% of savings with regard to the other companies), causing thus a little doubt on the quality that can offer to the consumers. This business has expanded its services for the entire city placing water supply centers in diverse areas of the city.

3. METHODOLOGY

A revision of the Osmonics Manual of Potable Water was carried out, as well as other bibliographical sources on line, in order to summarize the water purification methods and other information related to the topic. Information on water quality in a site of the northern part of the city was obtained. This water is supplied by the public distribution network and is the water source for the drinking water machines. This information was obtained from the Environmental Laboratory of the Institute of Engineering and Technology (IIT) of the UACJ, in the period 2002-2004. Based on the processes required for water purification, a comparison with the technology utilized by the company was carried out and the evaluation was obtained. The water purification process of the vendor machine is the following:

The water of the public network is placed in a tank

- A hydroneumatic system injects pressurized water to initiate the process.
- The purification process involves polishing filters, softeners, activated carbon, filters to eliminate sand, salts, odors, flavors, chlorine and other particles.
- An IO system finishes the purification process.

- Once water it purified, it is stored in a hermetically closed tank.
- Before the water bottle filling, purified water passes through an ultraviolet sterilized system.
- During the water filling, process water does not touch the machine's mouthpiece.

Figures 1,2,3,4,5, and 6 show different sites of the vendor machine in the city

Figure 1. Santa Teresa
Fuente: Muñoz, 2005

Figure 2. Acequias
Fuente: Muñoz, 2005

Figure 3. Pradera Dorada
Fuente: Muñoz, 2005

Figure 4. Infonavit Casas Grandes
Fuente: Muñoz, 2005

4. CONCLUSIONS AND RECOMMENDATIONS

There is compatibility among the purification process applied and the water quality supplied. According to the data, phenols and chlorides, as well as the cadmium, mercury and sodium are exceeded state standards. Based on the information obtained, the observation in situ of the purification machine as well as the technology utilized, it is considered that water sold by

this company is of good quality and price; machines receive a daily maintenance, according to the company. The purification processes corresponds to the one suggested by Osmonics. It is recommended to carry out water quality analysis on a regular basis, to assure that biological safety water is being offered since some of the parameters of the water supply source of the public network are exceeded state standards.

5. REFERENCES

1. Osmonics 1997. *Pure water handbook*. Minetonka, MN: Osmonics, Inc.

2. House Water 2005. Personal communication.

4. Quality Water International. 2005. Available at http://www.qualitywater.com.ve/QUIENES%20SOMOS.htm

5. Instapura 2005. Available at http://morelosweb.com/instapura/

6. Agua-Tec 2006. Available at www.aguatec.com.mx

7. El acuarista 2006. Available at http://www.elacuarista.com/secciones/filtrado7.htm

8. Sociedad española de microfiltración 2005. Available at http://www.sefiltra.com/sefiltra_productos_equipos_ultravioleta.htm

9. Excel water technologies Inc. 2005. Available at http://www.excelwater.com/spa/b2c/water_tech_5.php?WL_Session=69dd76ef13132dce48974dbd3084121f

Author contact information:

M.C. Ma. Teresa Escobedo P., assistant professor and researcher
Instituto de Ingeniería y Tecnología (IIT-UACJ)
Av. del Charro 610 Nte.
Ciudad Juárez, Chihuahua, México
CP 32310
(656) 6-88-48-00