Efficiency of the *Euroguard* domestic water treatment unit with regard to viruses, phages and bacteria

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Abstract

The reduction in numbers of human viruses as well as bacteria and phages in water treated by the commercial *Euroguard* water filter-cum-purifier for the domestic treatment of drinking water was evaluated. Drinking water seeded with laboratory strains of viruses, bacteria and phages which indicate faecal pollution, as well as sewage-contaminated river water and secondary treated waste water containing naturally occurring organisms, were passed through the unit which consists of a candle prefilter, activated carbon filter and ultraviolet irradiation compartment. At the prescribed flow rate of not more than 1 /-min-[1], numbers of poliovirus, hepatitis A virus, adenovirus types 40 and 41, rotavirus SA11, human rotavirus, coliphage MS2, somatic coliphages, *Escherichia coli*. *Streptococcus faecalis, Clostridiumperfringens,* total coliform bacteria, faecal streptococci and the heterotrophic plate count were reduced by more than 99.99% in all waters tested. In all test runs, including those on secondary waste water which was not intended to be used in the unit and represents a "worst-case" situation in practice, the quality of the treated water was well within microbiological limits of international specifications for drinking water.

Introduction

The *Euroguard* water filter-cum-purifier is manufactured and marketed by Eureka Forbes Ltd, Bombay, India. *Euroguard* is designed for the relatively inexpensive, convenient and reliable domestic on-line purification and decontamination of drinking water. The unit measures 360 x 300 x 100 mm, weighs 6 kg and is designed for mounting on an internal wall at a water supply. Treatment is based on a polypropylene candle prefilter for the removal of gross impurities, an activated carbon filter for the removal of organic compounds, and an ultraviolet light irradiation compartment for disinfection. *Euroguard* is intended for the treatment of freshwater from sources such as wells, springs, streams or lakes which are not abnormally polluted. The output is 1 l-min-[1]. Compared with the wide variety of other systems for similar purposes (Abbaszadegan et al. 1993), *Euroguard* has a number of safety devices to monitor and ensure fail-safe operation. These include a photoresistor which measures the ultraviolet light output. The resistor is connected to an automatic shut-off solenoid valve, green and red indicator lamps, and an audio indicator which plays a pleasant tune as long as treatment proceeds satisfactorily.

This study deals with an assessment of the efficiency of *Euroguard* with regard to human viruses, phages and bacterial indicators of faecal pollution selected on the basis of involvement in waterborne transmission of diseases, resistance to water treatment processes, and application in water quality specifications (Grabow et al., 1984a, 1984b, 1992,1993; IAWPRC Study Group on Health Related Water Microbiology, 1991). The evaluation of the unit was based on a guide standard and protocol for testing microbial water purifiers formulated by a multidisciplinary task force of the United States Environmental Protection Agency (Abbaszadegan et al., 1993).

Materials and methods

A *Euroguard* test unit was obtained from Eureka Forbes Ltd, Bombay, India, and operated strictly according to manufacturer's instructions.

Tests were carried out on thiosulphate-dechlorinated tap water (Grabow et al., 1984a) seeded with various combinations of laboratory strains of human viruses, phages and indicator bacteria, on river water polluted with secondary treated waste water, and also on secondary treated waste water. Test runs were carried out in the laboratory at an average temperature of 25°C. Two-litre volumes of water were used in each test.

The origins and methods of enumeration of laboratory test strains of human viruses by most probable number (MPN) assays using microtitre plates, have been described previously (Grabow et al, 1992). Micro-organisms used were: a vaccine strain of poliovirus type 1 and hepatitis A virus strain pHM-175 (Grabow et al., 1984a; Bosch et al., 1991a); simian rotavirus SA11 and human rotavirus strain HRV-3 (Sato et al., 1981; Grabow et al., 1984a; Bosch et al., 1991b); and adenovirus types 40 and 41 (Grabow et al., 1992). Male-specific coliphage MS2 and somatic coliphage VI were enumerated by plaque assays (Grabow et al., 1984b; 1993). *Escherichia coli, Streptococcus faecalis* and *Clostridium perfringens* were enumerated by membrane filter techniques (Grabow et al., 1984a). The same methods were used for the detection of viruses, phages and bacteria in test samples of river water (Apies River in Pretoria 500 m downstream of the Daspoort waste-water treatment plant discharge) and secondary treated waste water (Pretoria Daspoort waste-water treatment plant) (Grabow et al., 1984b). Methods for pour-plate standard (heterotrophic) plate counts and membrane filter counts of total coliform bacteria and faecal streptococci in river water and treated waste water have been described by Grabow (1990).

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