

Performance evaluation of the household ultraviolet water purifier

Syed Hussain Shah

College of E&ME, National University of Sciences and Technology (NUST) Peshawar Road Rawalpindi, Pakistan
Tel. +92 051 9278050; Fax +92 051 9278048; email: syed_hussain_shah@hotmail.com

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ABSTRACT

In this study water disinfection capability of three household ultraviolet water purifiers was studied. The first two purifiers were composed of three housings, namely, for polypropylene yarn cartridge, for granular activated carbon cartridge and for 4-pin ultraviolet lamp. The third purifier was a horizontal water flow system containing a bi-pin ultraviolet lamp labeled as UV water Sterilizer. This study focused on the performance of the cylindrical UV disinfection reactor. Eleven ultraviolet lamps were labeled and placed in the UV sets turn wise. 100 ml of water samples collected from various sites were studied for coliform colonies growth before UV irradiation and after the process. To study the affect of the bio-dose on the efficiency of UV lamps, one/two ml of sewage was injected in 25 l of tube well water. The performance of various lamps was studied after 24 h incubation. The lamps were efficient for low bio-dose but none of the lamps was found efficient against high bio-dose. The public health services require that UV lamp should have a minimum UV dose of 16,000- $\mu\text{w s/cm}^2$. Spectroscopic studies revealed that all the UV lamps irradiate a beam of 253.7 nm. These lamps differed in the emitted UV dose and the arc length only. Quartz sleeves surround UV lamps in the disinfection reactor. Four quartz sleeves were spectroscopically studied for UV transmittance. It was found that the green sleeve was pure silicate glass having zero percent transmittance for UVC, while the other three were good quality quartz sleeves. The hydraulic contact time of water film with UV lamp, and its optimum length was calculated from the analysis. As UV lamp of the optimum length and UV dose was not available, in order to achieve the required results the stainless steel jacket surrounding the sleeved lamp was replaced by a highly UV reflecting metallic jacket, or UV photo reflector. The improved design produced encouraging results.

Keywords: Ultraviolet water purifier; Quartz sleeves; Leachate; Germicidal lamps; Ultraviolet photo-reflector
