

Microbiological assessment of food crops irrigated with domestic greywater

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Abstract

Two of the challenges facing Africa in the 21st century are effective use of restricted water resources and ensuring food security. The eThekweni Municipality is not exempt from these challenges and is investigating ways in which they can be addressed in the local context. One of the aims of national government has been to ensure the supply of clean drinking water and suitable sanitation to every household. As part of its efforts in this regard, eThekweni Municipality has introduced a multi-tiered water supply programme ranging from full-pressure water systems and flush toilets to stand pipes and dry toilets. In the dry sanitation systems, there is no real provision for the disposal of domestic greywater and, bearing in mind that South Africa is a water scarce country, the municipality is investigating ways of using this water as a resource rather than viewing it as a waste. A preliminary trial was set up in 2003 using this water to irrigate vegetables to be used for home consumption. The microbiological safety of this practice needed to be examined to ensure that it would indeed help to uplift communities by the provision of healthy food as well as provide an ecologically sound use and reuse of available water.

The initial proposal was to investigate total coliforms, *E. coli* and *Enterococcus* as the normal faecal indicators for health purposes as well as *Staphylococcus* as a human skin surface micro-organism and coliphage as a viral indicator. The first controlled field trial was put in at the test site at the University of KwaZulu-Natal in 2005 using several crop types and three irrigation regimes. The vegetable samples were examined both internally and externally for the selected micro-organisms. It was found that very few *E. coli* were detected and in later crops the micro-organism list was expanded and further identification of the total coliform organisms detected is being addressed. This paper presents the results from the analyses to date.

Keywords: greywater, irrigation, health risk, domestic crops

Introduction

A previous Minister of Water Affairs and Forestry expressed the wish for water in South Africa that there would be 'Some for all, forever'. As the Southern African region is recognised as a water scarce area, action needs to be taken to ensure that this wish is fulfilled. As a leader in the water supply arena in this country, the eThekweni Municipality was the first to implement the concept of 6 kl of free water per household per month. At the earliest stages of implementation of community upliftment, the feeling in the communities was that one of their highest priorities was to receive potable water; the aspect of sanitation came much further down on the list. This led to the situation where communities were receiving water but had no formal means of disposing of it after use. In many instances, water was thrown outside the door of the residence resulting in pooling and unsanitary conditions including the breeding of mosquitoes. In any sanitary intervention the Bellagio Principles (Hurst, 2002) need to be kept in mind to ensure acceptability and sustainability of the intervention. In addition, KwaZulu-Natal has the highest HIV positive rate in the country and the eThekweni area is certainly not exempt. In many cases, the family bread winner is either dead or dying, households are headed by children or aged grandparents and finances are

at a sub-economic level. As a result, the nutritional status of the household can be extremely poor which results in increased susceptibility to disease and a further drain on resources. An opportunity was seen for the re-use of greywater which could result in an improvement in the living conditions of these families. In 2003, a preliminary trial was set up using greywater to irrigate above-ground vegetables to be used for home consumption. The crops produced appeared to be excellent and the community involved wanted to expand operations. There was some doubt, however, about the hygiene of crops grown under such conditions and whether there needed to be some restriction in the type of crop grown. A joint project between eThekweni Water and Sanitation and the University of KwaZulu-Natal was initiated to investigate these issues.

Experimental design

A semi-field trial plot was established at the University of KwaZulu-Natal in which it was originally planned that four crops would be planted. During the course of the year additional vegetables were added and the final selection was: spinach, green peppers, madumbis, potatoes, onions, beetroot and carrots. These were grown in plastic bags filled with sterile, low nutrient Berea red sand and drip-irrigated through a plastic bottle with either normal municipal tap water, greywater or a hydroponics solution.

Irrigation through plastic bottles pierced at the bottom was to prevent splash back contamination of above surface growth as far as possible. The vegetables were watered daily with 500 ml of the relevant solution and harvested at maturity, after approximately three to four months. A rep-

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