Technical note

Evaluation of the impact of household treatment procedures on the quality of groundwater supplies in the rural community of the Victoria district, Eastern Cape

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Abstract

The rural community in the Victoria district, Eastern Cape, uses groundwater from boreholes for drinking and other domestic purposes. The brackish taste of the water has been the major complaint from this community. In this study, the physicochemical and microbiological quality of the groundwater supplied to the community as well as the household treatment procedures which can be easily used to improve water quality standards were evaluated. For the physicochemical quality, salinity was the sole parameter of concern. The indicator bacteria were analysed using the membrane filtration technique. The bacteria detected were heterotrophic, total coliform, faecal coliform, and faecal streptococci. Total coliform counts were high in general and faecal coliforms were often detected and confirmed to be *Escherichia coli* by the indole test. The overall microbiological quality of the water was either poor or unacceptable according to South African standards. Both boiling and household bleaching succeeded in achieving the microbiological drinking water quality standards without much improvement on salinity or total hardness. Five minutes boiling could be recommended compared to household bleaching since, in addition to significantly improving the microbiological quality, it also slightly changed the salinity and total hardness by the precipitation of calcium carbonate.

Introduction

Many developing regions suffer from either chronic shortages of freshwater or the readily accessible water resources are heavily polluted. According to the World Health Organisation (WHO), a large portion of the population in developing countries live in rural and suburban areas where conventionally treated drinking water is generally unavailable (WHO, 1993). South Africa, like most developing countries, is experiencing rapid population growth. Accelerated population growth coupled with impoverished socio-economic development with limited water resources and poor sanitation, leads to an increase in diseases associated with poor living conditions among which water-related and water-borne diseases play a major role.

In the Eastern Cape, especially in the Victoria district, the majority of the rural community get their drinking water supply from groundwater sources. The water is drawn from the boreholes and distributed to the community without any prior treatment. People from this rural community often complain that the water tastes brackish which is normally an indication of poor quality, especially of high salinity.

Background

Groundwater

Groundwater supplies have some advantages over surface water. Groundwater is generally of a more uniform character and relatively free from harmful bacteria. Moreover, a groundwater supply can be easily developed at a small capital cost (Raghunath, 1982). Groundwater can, however, be contaminated as a result of poor solid, liquid and sanitary waste practices. Defective well construction and failure to seal abandoned wells as well as poor groundwater production management are also responsible for pollution. Contaminated groundwater can still appear clear and yet contain pathogenic organisms; visual evaluation should therefore be avoided. Bacteria in the liquid effluents from the septic tanks and cesspools, to name a few, are likely to contaminate shallow groundwater aquifers if poorly constructed or located with respect to the production borehole. Furthermore, the presence of a shallow or perched aquifer increases the risk of contamination (Pontius, 1990).

Physical chemistry

There are many physicochemical parameters of interest for water quality assessment. Some of the easily determined ones include temperature, pH, turbidity, salinity, hardness, nitrates, phosphates and certain trace elements. Temperature has a marked influence on the chemical and biochemical reactions that occur in the water body. High temperature, for instance, increases the toxicity of many substances such as heavy metals and pesticides. It also increases the sensitivity of living organisms to toxic substances (Dojlido and Best, 1993). Hydrogen ion concentration (pH) in water has an important influence on living organisms and the surrounding environment of the water. Low pH, for example, accelerates the corrosion of metals as indicated by the corrosion index. The permissible pH range varies between 6.5 and 8.5 for the WHO and between 6 and 9 for South Africa. Turbidity in water is caused by the presence of suspended matter which scatters and absorbs the incoming light. The variety of sources, character and size of suspended solids means that the measurement of turbidity gives only an indication of the extent of pollution. The WHO and

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