Short communication

A preliminary assessment of the chemical and microbial water quality of the Chunies River – Limpopo

W Germs, MS Coetzee, L van Rensburg* and MS Maboeta
School for Environmental Sciences and Development, North-West University, Potchefstroom Campus, Private Bag X6001, Potchefstroom 2520, South Africa

Abstract

The aim of this study was to do a preliminary assessment of the chemical and microbial surface water quality of the Chunies River. For this purpose sampling was undertaken on 25 and 26 May 2002, and a range of chemical (macro-elements, micro-elements and heavy metals) and microbial variables (HPC, total coliforms and faecal coliforms) were measured. The chemical water quality of the second section of the river, fed by base-flow, was poor and unacceptable for both domestic and agricultural use. The microbial water quality was unacceptable for domestic use throughout the course of the river due to faecal and coliform pollution. The most significant finding of this study was that the chemical water quality of the Chunies River, at the time the samples were taken, was acceptable and fit for agricultural and domestic use.

Keywords: chemical water quality; microbial water quality; Chunies River

Introduction

Being a semi-arid country, one of South Africa's most limited and precious resources is water. This is especially evident when considering that the average yearly rainfall in South Africa is about 497 mm, compared to the world average of 860 mm (Cowan, 1995). The situation is made worse by inefficiencies in use and the growing demands of the economy, which makes the optimum and sustainable use of South Africa's water resources one of the most pressing issues. The South African National Water Act (Act 36 of 1998) recognises that water should be used in an environmentally sustainable manner, and has the long-term protection and sustainable management of our water resources as one of its main objectives. The Chunies River in the Limpopo Province of South Africa is a subsidiary of the Olifants River primary catchment. It runs through commercial farmland and rural communities before its confluence with the Olifants River. No studies have, however, been done on the water quality with regard to its chemistry and microbial activity. This would be of importance, since platinum mine is being planned in the Chunies River catchment, and a platinum smelter is in the final stages of construction.

When interpreting chemical water quality, it is of great importance to understand the factors influencing water chemistry. Gibbs (1970) proposed that rock weathering, atmospheric precipitation, evaporation and crystallisation control the chemistry of surface water. When interpreting chemical water quality on a catchment scale, a more detailed explanation of the factors influencing the stream and river water chemistry would be useful. Since the catchment as a whole (including the catchment atmospheric and climate characteristics) provides input to the water chemistry of the streams and rivers draining the particular catchment, it follows that the factors influencing water chemistry can be discussed in terms of the characteristics of the catchment. The main catchment characteristics influencing water chemistry are geology, geomorphology, soils, climate, vegetation, land use and land cover, and pollution.

The influence of geology on chemical water quality is widely recognised (Gibbs, 1970; Langmuir, 1997; Lester and Birkett, 1999), as is the geochemistry, which has successfully been used as the basis of a model predicting stream-water chemistry (Smart et al, 2001). The influence of soils on water quality is very complex and can be ascribed to the processes controlling the exchange of chemicals between the soil and water, as well as the spatial heterogeneity of soils (Hesterberg, 1998). The most important soil properties influencing water chemistry, are the mineralogy (especially that of the clay fraction), organic matter, depth and drainage, pH and redox potential of the soil (Hesterberg, 1998). Land use and its associated land cover can therefore have a serious influence on water chemistry through modifying the geomorphology, soils, vegetation and hydrology of an area.

In terms of microbial water quality, a wide variety of viruses, bacteria and protozoa that can be transmitted via water are of concern. These micro-organisms have been associated with diseases such as gastroenteritis, cholera, hepatitis, typhoid fever, dysentery, salmonellosis, and eye, skin and nose infections (DWAF, 1996). The majority of the above disease-causing pathogens are transmitted by the faecal-oral route (DWAF, 1996), and the reservoirs for these micro-organisms could be animals, humans or the environment itself (Hurst et al., 1997). The faecal contamination of South Africa's water resources is becoming an increasing threat (DWAF, 2000). It is, however, technically and economically impractical to test for the full range of pathogenic micro-organisms due to the sheer numbers of pathogens that may be present in water (DWAF, 1996; Hurst et al., 1997). For these reasons indicator organisms are generally used to monitor the potential presence of micro-organisms, although no single indicator organism can be used with absolute confidence (DWAF, 1996). It is therefore recommended that combinations of indicators, each with their own

* To whom all correspondence should be addressed.
Fax:+2718 299-2503; e-mail: plblvr@puknet.puk.ac.za
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