The Chemical Composition of the Upper Hennops River and its Implications on the Water Quality of Rietvlei Dam

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Abstract

A chemical investigation of the upper Hennops River between 1973 and 1975 revealed that the Kempton Park sewage works, situated in the headwaters of the river, is a major contributor to mineral loading and water flow. Concentrations of most dissolved constituents in the river decreased with distance from the sewage works, although magnesium levels increased as a result of dolomitic influences in the catchment. Reduction in the levels of dissolved phosphorus and nitrogen compounds was more pronounced after the river had passed through vlei systems, suggesting a potential of these systems for the removal of nutrients. Despite the pollution of the upper Hennops River with secondary treated sewage effluents, chemical quality conformed to prescribed potable water standards. On the basis of the 1973/74 dissolved phosphorus and nitrogen surface loading rates (13,05 g m a-^{1} phosphate as P and 8,54 g m~^{2} a-^{1} nitrogen as N, respectively), Rietvlei Dam may be considered a eutrophic im poundment, in which algal growth is nitrogen limited.

Introduction

Rietvlei Dam, situated at 25,87°S and 28,26°E on the Hennops River, has been a source of water supply to the city of Pretoria since 1933. Secondary treated sewage effluents from Kempton Park are discharged into the upper Hennops River (also known as the Swartspruit) some 25 km upstream from Rietvlei Dam. On the basis of the annual effluent volumes discharged from the Kempton Park sewage works and the annual inflow into the impoundment, Walmsley, Toerien and Steyn (1978) estimated that up to 73 per cent of the annual inflow into Rietvlei Dam may consist of discharged secondary treated sewage effluents.

Rietvlei Dam has been ranked (according to phosphate availability) as the most eutrophic of 98 impoundments studied by means of algal bioassays (Toerien, Hyman and Bruwer, 1975). Algal bioassays have also shown that the waters of this impoundment are nitrogen growth-limiting (Steÿn, Scott, Toerien and Visser, 1975; Walmsley and Ashton, 1977) and show a high potential for the growth of nitrogen-fixing blue-green algae (Walmsley and Ashton, 1977). As a result of nitrogen fixation in the impoundment, nuisance blooms of algae develop (Ashton, 1976) and when present, increase the treatment costs for potable water production at the Rietvlei water works (Toerien, 1975).

Walmsley *et al.* (1978) have discussed the eutrophication of Rietvlei Darn and compared it with that of other impoundments. This paper deals with the general chemical composition of the waters of the upper Hennops River, which is the major inflow to the impoundment.

Description of Study Area

The catchment of Rietvlei Dam is 492 km^{2} in area and contains the industrial town of Kempton Park. The geology consists mainly of dolomites as well as shales, quartzites and conglomerates of the Pretoria Series. Shales of the Dwyka and Ecca Series also occur in isolated areas of the catchment (Du Toit, 1954). Bond (1946) classified the underground waters of the area as being of the temporary hard carbonate type. The Hennops River is the main stream draining the catchment, but is joined by smaller non-perennial tributaries (Figure 1). The river rises in a marshy area (vlei) a few kilometres east of Kempton Park and passes through a swamp before receiving the discharge of the Kempton Park sewage treatment plant. During the course of its flow to

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