
ABSTRACT

The contribution of detergent phosphorus to eutrophication and the economic and water quality consequences of eliminating detergent phosphorus were assessed in the Umgeni catchment, in KwaZulu-Natal, South Africa.

The following computations and investigations formed part of the assessment:

- calculation of the phosphorus loading arising from urban and rural detergent consumptions,
- quantification of phosphorus loadings on the four major impoundments in the Umgeni catchment and the contribution made by detergent phosphorus,
- development of a predictive equation relating phosphorus loading to algal production in the impoundment and using it to determine the impact of detergent phosphorus elimination on algal production,
- investigation of the fate of phosphorus compounds in an impoundment, using the MINTEQA2 geochemical equilibrium speciation model,
- a cost-benefit assessment of detergent reformulation.

The results indicated that detergents contributed significantly to the environmental phosphorus loading, with rural inputs (46 %) being slightly less than urban inputs (54 %).

The phosphorus loading on the Inanda impoundment was found to be significantly greater than that on the other impoundments, primarily due to the large urban and rural populations residing in the catchment area. Three scenarios for obtaining the catchment loading showed detergents to comprise between 26 and 53 % of the loading on the impoundment.

A phosphorus-loading/algal-production model was successfully developed for the Inanda impoundment and was used to assess the impact of the reduced loading corresponding to detergent phosphorus elimination. For the most probable reduction scenario of 53 %, the algal count was predicted to reduce by 75 %.

Examination of the phosphorus species distribution using the MINTEQA2 model showed that precipitation and adsorption processes dominate over soluble complex formation and leave only a small amount of phosphorus in solution for algal uptake.

An investigation of the costs and benefits of eliminating detergent phosphorus indicated that the costs associated with proscribing detergent phosphorus outweighed the benefits.