Correspondence

Fluoride removal from rural spring water using wood ash

Sir, —We have investigated using wood ash as a cheap and effective means of removing excess fluoride from drinking water used by an impoverished rural community, with encouraging initial results.

More than 400 rural communities in South Africa depend on groundwater for domestic use.[1, 2] Technical problems with delivering piped water and the fact that water supply can become unreliable during periods of drought, result in both dependence on and a pressing need to explore the sustainable use of groundwater from aquifers. However, many groundwater sources in South Africa have undesirable solutes such as excessive fluoride.[1,3] This is evident at Luwini spring, Dididi village, some 10 km northeast of Thohoyandou in Limpopo province, where three-quarters of the population live in rural communities. Most of the inhabitants of Dididi village who use Luwini spring water suffer serious tooth damage as a result of excessive fluoride consumption.

Fluoride concentration of Luwini spring water is 4.6 mg/l, which is well above the South African guideline concentration of 0.75 mg/l (ref. 3) and the 1.5 mg/l maximum recommended by the WHO[4] for domestic use. The source of the high fluoride content of the water is uncertain, but the outcrops of the adjacent metamorphic granite and basalt rocks and the nearby sedimentary sandstone and shale formations might be the source of fluoride enrichment underground. Banks *et al*.[5] reported that fluoride is generally enhanced in groundwater of the bedrock aquifers of metamorphic rocks and alkaline granite or from fluoride minerals in the rocks and soil. Being aware of the anion-exchange potential of wood ash,[6] we investigated the ability of ash from local trees to reduce the fluoride content of the drinking water.

Luwini spring water was collected in January 2006 and analysed at the CSIR's Water Analysis and Treatment Laboratory. Four 1-litre beakers were filled with 500 ml of sample water (pH 9.37) and different amounts of wood ash as adsorbent (1 g, 1 g, 2 g and 5 g, respectively), from the combustion of local acacia species and *Dichrostachys cinerea*, were added with continuous stirring. Water samples were removed at regular intervals over an hour and filtered through Whatman No. 1 filter paper. A fluoride ion-specific meter (Hanna Instruments) was used to determine the corresponding fluoride concentrations. Tests for acidity, aluminium, calcium, magnesium, sulphate, iron(II) and pH were conducted using APHA standard methods.[7] The effect of alkalinity was determined by titrating the solution to pH 4.3 using 0.02 N hydrochloric acid.

The concentration of fluoride in the beaker water typically fell from 4.6 mg/l to about 2.6 mg/l in the first 2 minutes, levelled off for about 20 minutes, and then declined to about 0.3 mg/l by 60 minutes, in the presence of 1 g/l of wood ash at pH 10. We found, however, that pH had a minimal effect on fluoride removal.

This preliminary study has demonstrated that small amounts of wood ash, which is a cheap waste material and relatively plentiful in rural areas, proved effective in reducing fluoride contamination. Clearly, further work is necessary to turn these observations to practical benefit where they are needed by poor people in rural areas.

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R. Makhado[a]*, T. Bologo[a] and R. Knight[b]

[a]Natural Resources and the Environment, CSIR, P.O Box 395, Pretoria 0001, South Africa.

[b]Department of Biodiversity and Conservation Biology, University of the Western Cape, Private Bag X17, Bellville 7535.

*Author for correspondence.
E-mail: rmakhado@csir.co.za