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PEOPLE AND SYSTEMS FOR WATER, SANITATION AND HEALTH

Moringa as an alternative to aluminium sulphate

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ABOUT 67% OF THE Zambian population have no access to clean drinking water. As a result, many people are prone to water borne diseases such as cholera, typhoid, dysentery and diarrhoea, which have claimed many lives in both rural and urban areas. The techniques used to treat water involve the use of chemicals and synthetic coagulants such as aluminium sulphate that are added to raw water. The coagulants are important, although very few water treatment agencies manage to import them, due to limited financial resources. The use of *Moringa oleifera* can offer an alternative option to these coagulants. *Moringa oleifera* is environmentally friendly and is important for the production of edible vegetable oils, improvement of soil fertility, used for wood fuel and the management of watershed and catchment areas. The promotion of *Moringa oleifera* among the poor rural population will contribute to improving the living standards of vulnerable groups through the provision of employment and clean drinking water.

This paper discusses *Moringa oleifera* as a potential alternative to aluminum sulphate for water treatment in rural and urban areas.

Acronyms and abbreviations used:

ICRAF	International Centre for Agroforestry.
MENR	Ministry of Environment and Natural Resources
NEAP	National Environmental Action Plan
NGO	Non Governmental Orgainization
NISIR	National Institute of Science and Industrial Research
WHO	World Health Organization
ZFAP	Zambia Forestry Action Program

Introduction

Zambia is endowed with abundant water resources. These resources are mainly in the form of surface and groundwater, both of which are greatly influenced by rainfall. Despite the abundance water, access to clean drinking water is the major problem in the country. The Institutions tasked to provide clean drinking water cannot manage because of various factors such as limited funds, poor infrastructure and a rapid population increase. According to the World Health Organization (WHO), an estimated 67% of Zambians use water that contains suspended matter such as solid materials, bacteria and other microorganisms. This water is the source of diseases such as cholera, typhoid, dysentery and diarrhoea, which have claimed many lives countrywide (Nyumbu, 1996).

The techniques for treating water involve the removal of the solid matter, generally done using coagulants that are added to the raw water. Aluminium sulphate (Alum) is generally used to treat water. However, aluminium sulphate treated water is restricted to urban areas and at times not all areas have access to this water due to high demand caused by increase in population. For rural poor populations, this water is out of reach.

The challenge facing the water sector today is how to give more people access to clean drinking water by cost effective means, especially the rural poor who can not afford any water treatment chemicals, without affecting the health of their environment. In recent years researchers have been examining appropriate alternatives to treat water by using natural coagulants of the *Moringa oleifera* seed. Such research has been going on in Sudan, Malawi, Zimbabwe and Zambia. Researchers are picking up where the local people left off when they used crushed *Moringa* seed to cause sedimentation in the their own water storage vessels in the home (Folkard and Sutherland, 1996).

Current Situation of n Clean Water Supply in the Country

Water is life and every human depends on water to survive. Actual accurate figures are not available, however, the estimated figure for total domestic water supply is between 200–400 litres per person per year in urban areas and 151 litres in rural areas (NEAP, 1994). According to NEAP (1994), around 3.5 million people received piped water by 1995. The current estimate is that 427 million cubic metres of piped water is required, of which 412 million cubic metres is for urban consumption. This requirement is not presently being met, creating predictable health and welfare problems. Only 33% of rural people have access to clean drinking water.

The main source of water is rivers, which are highly turbid particularly during the rainy season. River silt is churned into suspension and runoff from fields and surfaces carries solid materials, bacteria and other microorganisms into the rivers. It is important in any water treatment process to remove as much of the suspended matter as possible before the water reaches the disinfection stage. Removal of the solid matter is generally done using coagulants that are added to the raw water, usually chemicals such as aluminium sulphate are used. Aluminium sulphate is not locally produced, so is imported from outside the country, using limited foreign exchange. Quite

often District Councils cannot afford to purchase these chemicals due to budget constraints and for the rural population, the chemicals are out of reach. Apart from being expensive Alum is bought in bulk (50kg bags) and is labour intensive during the water treatment process (*personal communication*).

With the Government Policy of commercialization of water supply, most of the urban poor will fail to access this clean water, resulting in many of them experiencing high incidences of diarrhoeal disease outbreaks. During such outbreaks, many lives will and continue to be lost. Compounded by the increase in human population, it is very likely that a shortage of safe drinking water supply will continue and at the same time incidences of water borne diseases will continue to increase both in rural and urban areas. Thus the need to source alternatives to treat water should be given the priority it deserves if water borne diseases are to be reduced.

Moringa oleifera – potential alternative as a natural coagulant to treat water

Today in the Western World the keywords used when entering a supermarket are "We need natural products". As a "forester" I would like to introduce another natural product to the market for treating water. The natural product that can replace the expensive aluminium sulphate is *Moringa oleifera* seed. For several years researchers have been examining this tree and have found its seed to be suitable for water treatment. The tree has a lot of potential to replace Alum and other chemicals used in water treatment, especially for the rural poor population whose economic livelihood would depend on this tree.

Moringa oleifera is a native to Northern India and now can be easily and widely grown throughout the tropics. A natural coagulant from the seed of *Moringa oleifera* has been found to be an environmental friendly, cheap and viable alternative to expensive, conventional chemicals. It has traditionally been used for household water treatment in Sudan and Indonesia (Folkard and Sutherland, 1996). In Malawi it has successfully been used in place of conventional water treatment chemicals for colour, microorganisms and suspended solids removal in surface waters (NISIR, 1997).

According to literature from NISIR (1997) growing *M. oleifera* is very easy and it can even be grown on very poor soils through propagation of seeds or cuttings. In the Eastern Province of Zambia, ICRAF is growing the tree as an agroforestry species to improve soil fertility. It withstands long periods of drought and grows well in semi-arid and arid conditions. It is one of those hardy species that requires little silviculture attention and grows rapidly up to a height of 4 metres in one year. This makes the species appropriate to most parts of the country and neighbouring countries.

The process for preparing the seeds for water treatment is straightforward. The seedpods are allowed to dry naturally on the tree and afterwards the dried pods are harvested. The seeds are shelled and crushed and sieved using the same traditional techniques as to produce maize meal. According to preliminary research results from NISIR, the powder, when mixed with water, yields water soluble proteins with a net positive charge dosing solution (1-3% solutions) which acts as a natural cationic polyelectrolyte during treatment (Sutherland, al et. 1990, NISIR, 1997).

Promotion of *Moringa oleifera* species among the rural poor population will reduce the high incidence of water borne diseases and will also assist poor Councils in affording cheap water treatment materials.

Moringa oleifera is not only important for water treatment, but the tree has many uses. In areas where there is low woody biomass, cultivation of the tree would increase the fuelwood supply to the local community. The tree can be used as fuel wood after copping (cutting back the stem to encourage side shoots).

In watershed and catchment areas - most of which have been degraded - *Moringa oleifera* can be grown to reclaim the areas, as a conservation measure to protect the watershed and catchment areas from degradation. In addition, the plant is nitrogen fixing which add nutrients to the soils. It will therefore be likely to increase agricultural production in impoverished soils.

The *Moringa* seed contains 40% oil by weight and 75% oleic acid. The oil can be used as vegetable oil for cooking and in soap manufacture. The seed cake is useful as animal fodder and a fertilizer. By growing this tree, the local community will benefit from various uses and their livelihood will improve.

In hunger prone areas, *Moringa* green pods and leaves can be used as food (e.g. in the Gwembe valley in the Southern Province, locals have used *Moringa* leaves as vegetables). The flowers and roasted seeds are also used as a vegetable. These contain 27% protein and are rich in vitamin A and C, calcium, iron and phosphorous. Further, the leaves can be used as animal fodder (*personal communication*).

The promotion of *Moringa oleifera* not only provides alternative materials for treating water, but can also improve the living standards and welfare of the rural poor population in both rural and urban areas through provision of employment, extra income, food and clean water. It can also increase livestock production and fuel wood supply in deficit areas.

Discussion and conclusion

It is clear that *Moringa oleifera* can be a poor person's tree for both rural and urban areas. In this respect the challenge to us is how we make this tree contribute to a safe adequate water supply and poverty alleviation. Before I conclude my paper I wish to bring for discussion the need to intensify farm research, so that research findings can be disseminated to small-scale farmers and District Councils, who can then participate in examining this tree and the way it can easily be accepted. For this to be done there is need to

increase research funding so that it can move to the farm level.

The *Moringa oleifera* tree is not known by most small scale farmers and for it to be known there is a need to intensify extension services so that the local communities and water supply firms are sensitized about the importance and use of this tree. For this to happen there is need to strengthen the existing extension service wings in the country.

Promotion of *Moringa oleifera* will only be a reality if collaboration and networking is encouraged among key institutions, with researchers, District Councils, the private sector, NGOs, and Local Communities participating fully. There is need also to provide incentives to participating institutions for growing and using *Moringa oleifera* in water treatment.

There is no doubt that safe, adequate drinking water is the key to economic growth and in this respect all stakeholders in the water sector need to work together to promote growing the *Moringa oleifera*. This demands the introduction of an integrated approach in water resources management.

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