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The Role of Bacteria as A Cure for Polluted Rivers in Africa

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Most urban rivers are polluted due to the indiscriminate human and industrial activities. As more rural people migrate to urban cities for a greener livelihood, it is expected that river pollution would continue to be one of the core issues regarding attention by governments and all civil society organisations in many African countries. Apart from the public health dangers of river pollution, aquatic life e.g. fish is heavily affected also. Bacterial technology has been implemented in parts of China for river quality remediation. The paper explores the possibility of adopting such a technology in Africa. The paper also presents concept notes on how the use of such a technology can be integrated to the mainstream sustainable water resources management scheme in Africa. The paper anticipates contributing in part towards government and civil society organisations' effort towards safe health, hunger eradication and poverty alleviation in Africa.

Key words: Bacterial technology, public health, river quality remediation, China.

The United Nation's Millennium Development Goals (MDGs) has echoed the need to eradicate poverty and hunger in developing countries including Africa. Part of this reason has been to safeguard the precious lives that are lost annually in Africa as a result of ill-health emanating from water-related diseases, poor sanitation, poor dietary needs and harsh weather conditions. The last decade has seen, in most parts of Africa, a significant growth in the infrastructure development and socio-economic development usually concentrated in the cities. As a result, cities become the main source of providing the so-called better jobs to most citizens in Africa. Due to the globalised economic markets, activities such as agriculture which used to be viable some years ago are no longer attracting the needed economic value and benefits. In view of this, majority of the rural settlers who depend on agriculture become more pressured for a better life because of the unfair economic trade that has rendered their job-task less important. Consequently, there has been a large flux of people from rural communities into cities. This phenomenon is typical of most developing countries around the world. For instance, it is estimated that cities would provide habitat to about half of the global population and next three decades would see about 2 billion increase in population[1].

The pollution of rivers is very significant in most parts of Africa. One of the challenge has been for most cities in Africa is the haphazard siting of industries such as cement production, electronic factories, textile industries, paint manufacturing, open and deep mining activities etc. In most cases, these are located near to cities. The absence also of centralised treatment of sewage from households becomes another challenge for most cities in Africa. The resultant effect is that, untreated waste and chemicals of all forms are washed directly into the rivers. Quite unfortunately, the millions of rural communities with no access to potable water end up relying on river sources. This poses serious health risks to such communities, apart from the bad aesthetics. In most cities, restaurants sometimes are sited closed to polluted rivers and streams. The pollution of rivers in Africa is

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complicated as unequal balance of educated people with commitment to out-dated cultural practices continues to be one of root causes. Aside these challenges, river sources are limited but continuous pollution imply that governments would have to spend huge budgets for their treatment. Africa which is already heavily challenged by high rates of unemployment and poverty may not be in the position to consider spending large budgets for river quality remediation.

The trend in socio-economic development in Africa showcases one that will be urban driven. Rapid city growth in Africa and other developing countries also affect the potential of basic services such as sanitation to meet the demands of the citizens[2]. It has been found that centralized wastewater treatment systems would be an added burden to developing countries[3-5]. This simply means that Africa may not be prepared to adopt advanced systems for preventing pollution control for rivers due to the mixed social needs and demands as in health, education, poverty, employment and political stability.

For most rivers in Africa to survive pollution and safe water-related diseases from spreading, there has to be new paradigm in handling the issue. This thinking must provide economical and yet easily adoptable scheme that can be implemented in any part of Africa. In view of this, this short communication presents the bacterial technology that has been successfully implemented in parts of China for river quality remediation. The rivers in the urban areas in China, like most parts in Africa, are heavily polluted. The paper presents concept notes that indicate the importance of adopting such a technology and suggests ways to integrate this into the framework of water resources management in Africa.

Overview of bacterial technology

Experimental Setup

The patented origin-microorganism bacterial product on treatment of treatment of polluted rivers is used. Generally it contains bacilli, denitrifying bacteria, lactic acid bacteria, anaerobic bacteria and brown-rot-spindle bacteria. Depending on the source pollution level, different mixing ratios are used. The mixing ratio for the bacteria, mixed medium and water is typically in the order of 4: 3: 3 [6]. The Nature Liquid (NL) made is of multiple enzymes, trace elements, amino acids, vitamins and humic acid. The composition of each of these is done according to professional judgment. This provides nutrients to the bacteria as well as restrains any harmful microbial growth. The cultured bacteria are used as the treating medium for the river in question.

Treatment of polluted rivers in China

The paper makes an overview of related works of bacterial technology implementation for river quality remediation in China. These rivers are heavily polluted as a result of indiscriminate waste disposal and untreated effluents from industries. The reports from the China's Ministry of Environmental Protection in 2009 on surface water quality showed that 42.7% lies within Grade IV and V[7]. This grade range represents poor water quality status and such rivers cannot support aquatic life neither are they suitable for potable purposes. Related works, however, have proven that the use of bacterial technology provides an efficient and affordable way to treat such heavily polluted river systems[8]. For instance, the technology was implemented in the Meishanyuan district of China for septic thanks. This was to reduce the level of contaminants which subsequently ends up in rivers. It was realized that septic tank removal rates for chemical oxygen demand, total phosphorus and total nitrogen were 88.8%, 74.5% and 67.3% respectively[6]. The concept notes of this paper are drawn from these success stories of bacterial technology for river quality remediation in China.

Potential benefits for African Polluted Rivers

Benefits of Bacterial Technology

The presentation of the benefits of the bacterial technology for environmental pollution remediation were examined by Kabo-Bah[9]. According to this work, the technology is Simple, Affordable, Adaptable, Scalable and Eco-friendly (SAASE). The expected benefits for implementing the bacterial technology for the river quality remediation in Africa are explained below:

Simple

Most imported technology to Africa has often failed partly because of the sophisticated nature. In the Africa system, where majority of the people may not have benefited from high-level education, technologies that can be home-grown become the best choice. The technology generally involves the lead expert who cultures the specific

bacteria required for the treatment purpose. Labourers now help the lead expert with the implementation of the cultured bacteria into the river systems using ordinary boats. Apart from the lead expert who with little training on how to culture bacteria for the specific pollutants in the river system, implementation does not require any other complex technology for implementation.

Affordable

Technology transfer to Africa does not always render the needed benefits due to the cost implications[10-12]. Cost implications usually do not allow the possible replication of such technology in Africa. The bacterial technology can save between 56%-99.8% of the costs associated with the treatment of polluted rivers[9]. The reason is that the technology does not require the importation of large and complicated equipment, software and skilled human resources from other countries. The technology can be driven locally. This means that city authorities across Africa can be able to implement this technology using home-grown knowledge and techniques.

Adaptable

Heavily polluted rivers in Africa are dredged to improve their quality[13-15]. However, river dredging usually result in the loss of aquatic organisms and changes the natural flow regime of rivers. The use of bacterial technology does not affect the loss of important aquatic organisms such as fishes and is applicable to any polluted river under consideration. Based on the needs, this is easily adaptable for rivers in urban communities in Africa. Therefore, without physical modification in polluted rivers, rivers can be treated.

Scalable

Technologies that are simple and can easily be duplicated, allow for scaling up. Depending on the specific pollutant levels of the river, requisite volumes of cultured bacteria are also used. This makes the system scalable for small, medium and large scale river quality remediation campaigns.

Eco-friendly

The bacterial technology has the ability to purify the dirty organic matter in the polluted river rather than toxifying it. The technology also follows current discussion on climate change and the push from United Nations Framework Convention on Climate Change to use green technologies.

Adoption of Bacterial Technology for River quality remediation

Surface water resources as in rivers and lakes need to be managed effectively with the adoption of the Integrated Water Resources Management (IWRM) approach. IWRM concept has been considered as the most viable way for Africa and other developing countries to harness and utilise their water resources effectively and sustainably[16, 17]. It also offers a way to contribute to the MDGs [18].

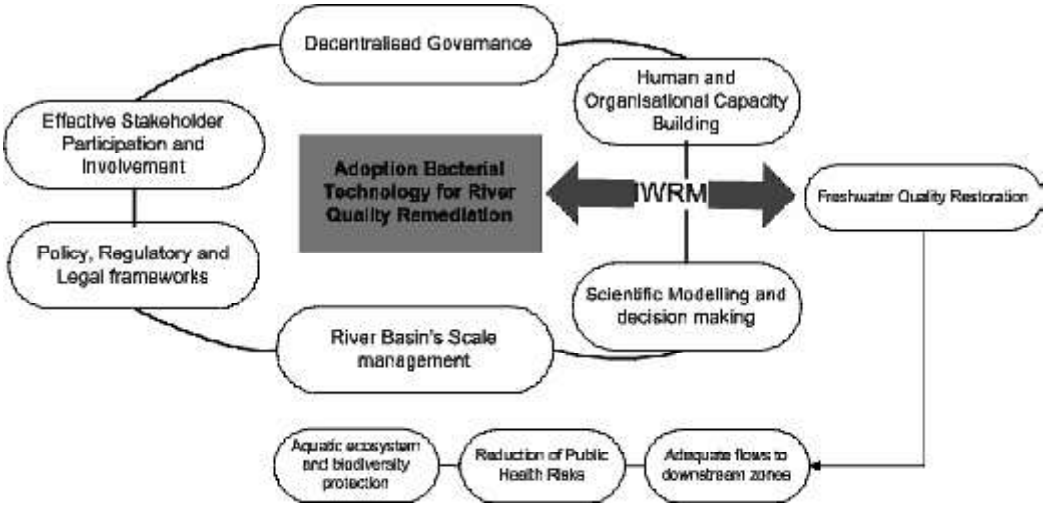

Fig. 1. Integration of bacterial technology into the mainstream of river quality remediation in Africa based on IWRM concept

For bacterial technology to be effectively transferred to Africa, experts who are currently using the technology in China could organise workshops to educate stakeholders interested in the use of the technology. Once this is conducted, trained Africa personnel in the use of the bacterial technology can now integrate and implement the bacterial technology as per the guidelines of IWRM. Figure 1 presents a way through which the bacterial technology can be integrated to the mainstream of planning and management of water resources in Africa.

For new technologies to have the needed socio-economic impact as in the case of prevention and control of polluted rivers in urban settlements in Africa, integrating such a technology into the mainstream becomes the most sustainable way. Notwithstanding, communities in river basins could also be organised to prevent and control river pollution based on the principles spelt-out in Figure 1. The key issue is that, the acceptance of this new technology, training of communities and integrating the principles as a norm for local and national water resources planning and development is the most effective approach.

CONCLUSION

Environmental pollution is one of the key challenges faced by most cities in Africa. Such pollution has rendered many natural flowing rivers dead. These dead rivers lack the ability to support aquatic life and have also increased the cause of water-related diseases. In China, the world fastest economy that is currently facing huge environmental pollution, there is the emergence of the bacterial technology that has proven positive results for river quality remediation. This paper examined some of the benefits of this technology and its role to treat polluted rivers in Africa. The technology does not need complex technological equipment and can easily be learned by a community interested in the use of the technology. Africa which is already plagued by issues of poor access to health and education, high poverty levels and inadequate access to safe and reliable water supply and sanitation may not have enough financial resources to engage in large funding for river restoration projects. Therefore, the bacterial technology offers the leap-way to address this situation. It is recommended in this paper that, an integration of the technology into the mainstream of the IWRM concept currently implemented by many African nations is the most sustainable way to recoup the enormous benefits of the technology.

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