Wastewater Production, Treatment and Use in Agriculture in Zimbabwe

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Wastewater production and treatment

Since the turn of the new millennium Zimbabwe has experiences severe water and environmental problems that has seen the country implementing a number of legal and institutional reforms aimed at addressing the challenges (Nhapi, 2009; Nhapi and Gijzen, 2002). One area that has received attention relates to different aspects of management of wastewater that emanates from various socio-economic activities. There is, however, no comprehensive database on the production, treatment and use of wastewater. Most of the data that is available is from individual often isolated research that does not given a complete picture of the status of wastewater in the country.

As a consequence data on wastewater production is sketchy. A recent World Bank-commissioned study estimated that 35 x 10^6 m^3 of water is produced annually, which was said to be equivalent to 65% of potable water (Murungweni, 2012), This figure is from major cities and towns and does not include wastewater generated from major economic activities such as mining, industry, mining and irrigated farming. The cited figure is from local authorities. It is important to collate this information with some of the information that is held by a different agency, the Environmental Management Agency (EMA), which is responsible for issuing permits to discharge effluent into the environment. Currently treatment of wastewater is estimated to be between 0 and 30%. This is because of sophisticated treatment systems that require huge operational and maintenance costs, are no longer operating efficiently. As a matter of fact many are not operational at all.

Wastewater use/disposal

The location of the country ‘s major settlements such as cities, towns and rural settlements, at the top of catchments has meant that untreated wastewater is discharged into rivers and reservoirs that are the water sources of the same settlements. The discharge of raw and partially treated effluent into the river systems and reservoirs has resulted not in just environmental problems. There have also been financial implications as cities face now huge water treatment chemicals. A case in point is Harare, the country ‘s capital, which needs 8-9 chemicals to treat the water at a cost of USD$3 million per month. This has caused the city to look for new clean water sources in the shape of Kunzvi dam. It is doubtful that this will be a solution in the long run. The problem

has been exacerbated by the high rural to urban population, which has resulted in a mismatch between the population and the provision of basic social services such as water and sewerage infrastructure. For example, Harare 's population is growing at a rate there is higher than the national average. There has not been attendant investment investment in infrastructure to the extent that the infrastructure can only cater for 75% of itswater requirements.

The common uses of wastewater include irrigating pastures, tobacco and maize on municipal farms as well as recreational parks. Vegetables are also grown by individual for home consumption. There are also cases where formal irrigation schemes in reality use wastewater, which is allocated as standard irrigation water. This is the case on those irrigation downstream of major settlements such as cities and towns. While the quality of the wastewater that is used for irrigation is stipulated as discussed below, the problem is one of compliance.

Policies and institutional set-up for wastewater management

The Government of Zimbabwe has put in place a legislative and institutional framework designed to ensure effective wastewater management. The Environmental Management Act of 2002 is the overall legislative framework. It is supported by more specific statutory instruments. As far as wastewater use is concerned the most pertinent institutional organization is the Environmental Quality Standards and Enforcement Committee, which is a committee of the Environmental Management Board, which oversees environmental management in the country. The Committee is responsible for setting the minimum standards for different water uses, including wastewater. The main legislation is also supported by secondary legislation that are known as statutory instruments that address specific sectors of the environment. With regards to the wastewater the major ones include statutory Instrument 6 of 2007 (Effluent and Solid Waste Disposal) and .Statutory Instrument 10 0f 2007: Environmental Management (Hazardous Waste Management) Regulations.

The country operates a polluter pays principle where the polluter is held responsible for cleaning up the environment. This is achieved by a licensing system where users, whose operations make it necessary to discharge harmful substances into the environment, are required by law to apply for a discharge permit. This is in four categories depending on the potential harm to the environment, namely blue, green, yellow and red in increasing order of potential harm. The various categories attracted different charges. The licences are annually renewed so as to monitor the level of pollution. There is also a legal requirement placed upon local authorities to develop waste management plans that spell out waste prevention targets. Designated waste management collection points are also required. There are stipulated maximum thresholds for irrigation using waste water.

Research/practice on different aspects of wastewater use

Research into wastewater use has focused on irrigation of various crops using wastewater from industries and from the cities' sewerage systems. The main focus has been on the accumulation

of heavy metals (lead, copper, zinc, cadmium, nickel, chromium) in the soil and in the irrigated crops which included pastures, maize, vegetables (Mapanda et al, 2005; Mapanda et, 2007: Masona et al, 2011). The results show that soil pH is less acidic in soils exposed to wastewater. The studies concluded that long term wastewater use for irrigation has the net effect of increasing the concentrations of heavy metals in the soil that had negative consequences on the soil. There was also bioaccumulation of heavy metals in the crops irrigated by wastewater, which had negative human health especially for the those crops that were consumed directly by humans such as vegetables and maize. Even in crops that were not consumed directly by humans such as pastures human health can still be compromised through thefood chain. To this end it may be useful to grow crops solely for phytoextraction. However, the economic imperatives need to be studied closely. From the studies what constitutes long term use of wastewater for irrigation is given as 10 to 30 years. One study concludes that annual heavy metal loading rates showed that within 5-60 years all heavy metals could exceed their permitted limits in soils.

There is one study that looked at how biological treatment of wastewater could be used to improve the quality of wastewater before it was discharged into the environment. Manhokwe at al (2009) conclude that Anaerobic Sludge Bed process had the potential to treat potato-processing wastewater as a pretreatment step before discharge into the sewerage system of Harare.

Status and need for the knowledge and skills on the safe use of wastewater (150 words)

There are a number of challenges that relate to wastewater production, treatment and use in Zimbabwe. These include lack of information on the quantity and quality of wastewater produced and used. This has resulted inlack of capacity to enforce regulations worsened by poor monitoring, limited human capital, inadequate financial resources and inadequate penalties. There is a need to research into assessment of the quantity and quality of wastewater is needed.

There is also a need to assess the level of optimal capacity of the Environmental Management Agency, which is responsible for managing the environment, in terms of licensing, monitoring and enforcement (including deterrent penalties that are required). Related to this is the need to ensure that there was coordination between the different agencies that have responsibility for managing the environment such as the Environmental Management Agency and catchment councils (Manzungu et al, 2012). Alternative methods of managing wastewater are also critical (Nhapi, 2005) - in the long run there is a need for alternative technologies that can be used to treat wastewater at affordable cost.

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