

Potential recovery assessment of resources embodied in the organic component of municipal wastewater: The case of Zvishavane Urban, Zimbabwe

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Abstract

Traditionally, wastewater treatment plants are designed for the removal of nutrient rich and bacterial components from water to enable disposal into surface water bodies. However, growing population, depleting resource and the need for sustainability call for the implementation of circular economy practices in all aspects. This paper aims to assess the resource recovery potential from municipal wastewater in Zvishavane Urban, Zimbabwe. The potential for water reclamation, energy and nutrient (nitrogen, phosphorous and potassium) recovery from municipal wastewater treatment was based on wastewater data and material flow analysis using the linear and mathematical relationships between physico-chemical parameters of wastewater and the quantities of resources to be recovered. Data input and analysis was done using the Resource Value Mapping online tool and was presented using descriptive statistics. Findings from the study highlighted that 103 660 m³ of water are available for reuse which will meet 22% of water requirements for local agriculture and landscape/greenspace irrigation in Zvishavane Urban. Further, the results demonstrate that valorisation of sewage sludge could potentially yield 92 940Nm³ of biogas, 1557 tonnes of solid fuel and up to US\$ 1 739 142.80 in revenue per annum. In terms of nutrient recovery, the study demonstrated that 11 861 tonnes of digestate and 3613 tonnes of compost can be derived from Mabula wastewater treatment plant. In terms of nutrient content, there is potential to recover phosphorous (589 tonnes), nitrogen (663.2 tonnes) and potassium (294 tonnes). Potential revenues from nutrient recovery amounted to US\$ 1 413 600. The study demonstrates the resource recovery potential of municipal wastewater streams in Zvishavane, a growing town in a developing country. This knowledge is often missing in studies on circular economy in developing countries. Considering wastewater for resource recovery is well aligned with Zimbabwe's National Development Strategy 1 and international priorities as specified in the Sustainable Development Goals and both local. This paper gives testament that wastewater in Zvishavane urban has significant resources embedded in it which can be recovered. Results from this study are important for planners and decision maker in Zvishavane Urban and Zimbabwe as they provide insight into the benefits of resource recovery. This is a necessary way forward in providing sound wastewater management and mapping pathways towards resource recovery

from municipal wastewater within the context of not only Zimbabwe but also other developing countries within the region and beyond.