

## Performance of constructed wetlands in dry tropical climate regions

### Summary

The use of macrophyte plants in the constructed wetlands systems for wastewater treatment is a proven efficient technology, with advantages such as ease of operation and maintenance, limited use of resources (energy and materials) and competitive construction costs. These features confer a strong potential for its application in developing countries. However, the study of the performance of these type of systems in countries on the African continent, especially in countries with a dry tropical climate is still limited. This study focused on the evaluation of the efficiency of subsurface horizontal flow constructed wetlands for wastewater treatment for reuse in agriculture, and estimation of the economic yield resulting from the use of the macrophyte biomass in the production of handicraft products. The treatment efficiency study addressed three topics of analysis, namely the effects on the quality of water, quality of the soil and quality of the food irrigated with treated wastewater. The experimental component of the thesis result from the operation of two beds, one bed with plants and one without plants for control. For the soil analysis two experimental "machambas" (experimental plots) were set up, one irrigated with wastewater treated by the constructed wetland and another irrigated with water from the Zambezi River.

The cultivated foods were three namely: lettuce, eggplant and tomato. In view of broader perspective for circular economy, the feasibility of the reuse of biomass from macrophyte beds was studied as a source of additional economical income. The analysis was based on the production of a constructed wetland to serve a neighborhood of the city of Tete, Mozambique, and based on information gathered through questionnaires and interviews with artisans in that city. The bed planted with macrophytes proved to be more efficient in removing physico-chemical and microbiological parameters compared to the bed without plants. The planted bed achieved an average efficiency regarding Chemical Oxygen Demand removal of 45%. The water of the Zambezi River revealed concentrations of microbiological parameters above limit values for agriculture use of raw vegetables.

Tomato and lettuce dry matter yield was higher (15.7 and 21.8 g/m<sup>2</sup>) in crops irrigated with constructed wetland effluents compared to crops irrigated with water from the Zambezi River (10.7 and 13.4 g/m<sup>2</sup>). The estimated economic yield from the use of reed biomass was satisfactory and may represent a significant increase in the artisan's average income. However, the benefits can be further enhanced by setting up a Wastewater Treatment Station with constructed wetlands, which will provide raw material to produce handicrafts.

### Keywords

Biomass reuse, constructed wetland, dry tropical climate, reuse in agriculture, wastewater.



Assembly and operation of the constructed wetlands treatment system with subsequent use in crop irrigation.



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