

A Decision Making Tool for Selecting the Most Environmental Friendly Wastewater Treatment Plant for Small-Scale Communities

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Abstract : Wastewater treatment systems are designed and used to minimize adverse impacts of the wastewater on the environment before discharging. Various treatment options for wastewater treatment have been developed, and each of them has different performance characteristics and environmental impacts (e.g. material and land usage, energy consumption, greenhouse gas emission, water and soil emission) during construction, operation or maintenance phases. Assessing the environmental impacts during these phases are essential for the overall evaluation of the treatment systems. In this study, wastewater treatment options, such as vegetated land treatment, constructed wetland, rotating biological contactor, conventional activated sludge treatment, membrane bioreactor, extended aeration and stabilization pond are evaluated. The comparison of the environmental impacts is conducted under the assumption that the effluents will be discharged to sensitive and less sensitive areas respectively. The environmental impacts of each alternative are evaluated by life cycle assessment (LCA) approach. For this purpose, data related to energy usage, land requirement, raw material consumption, and released emissions from the life phases were collected with inventory studies based on field studies and literature. The environmental impacts were assessed by using SimaPro 7.1 LCA software. As the scale of the LCA results is global, an MS-Excel based decision support tool that includes the LCA result is developed in order to meet also the local demands. Using this tool, it is possible to assign weight factors on the LCA results according to local conditions by using Analytical Hierarchy Process and finally the most environmentally appropriate treatment option can be selected.

Keywords : analytical hierarchy process, decision support system, life cycle assessment, wastewater treatment

Conference Title : ICWEEM 2017 : International Conference on Water, Energy and Environmental Management

Conference Location : Boston, United States

Conference Dates : April 24-25, 2017