Calculation of Ecological Indexes of Waste Management Scenarios in Sirjan City with the Life Cycle Assessment Approach

Alireza Rastikerdar[1*]

1. Sirjan University of Technology

Extended Abstract

Introduction

Solid waste is one of the unavoidable products of every society that necessitates the establishment of municipal solid waste management system. Because of variability in quantity and composition of municipal solid wastes, several management scenarios are considered. Assessing the environmental impacts of the life cycle of these scenarios will have a significant role in reducing and resolving urban service management problems. The aim of this study was to compare different scenarios of municipal solid waste management in Sirjan city using life cycle assessment (LCA) approach. LCA methodology is used to evaluate the environmental performance of the waste management of Sirjan for different scenarios, according to the ISO standards 14040 series 2006.

Material and methods

After identifying the quantitative and qualitative characteristics of the produced wastes within the scope of the study, the quadratic steps of the LCA method are followed in relation to each of the scenarios. The stages of life cycle assessment in the present research are as follows:

1. Determining goals and scope: Our goal is to compare environmental impacts of scenarios that include different methods of disposal. The boundaries of the study start from the collection of municipal solid wastes from the transfer station and ends with the final disposal of waste (Figure 1)
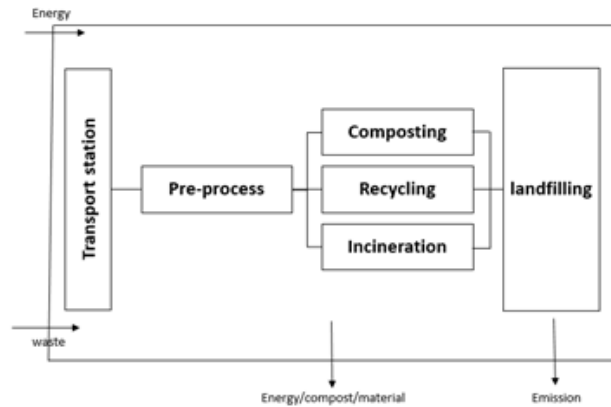
Figure 1. System boundary

Four scenarios have been investigated and evaluated in the environmental field (Table 1).

Table 1. Disposal solid waste scenarios

Landfill (%)	Incineration (%)	Recycle (%)	Compost (%)	Scenario
100	0	0	0	1
12.4	0	19.2	68.4	2
12	55.9	15	17.1	3
11	69.8	19.2	0	4

2. Collecting data and life cycle inventory (LCI): Various tools have been developed for LCI, one of which is the IWM-2 model. The IWM-2 model is one of the lifecycle assessment models that can be used to define different scenarios and then to compare the environmental impacts of each scenario. At this stage, the data from physical analysis, the amount of waste produced, the stages of separation at source, collection, transportation and final disposal, were collected and analyzed and the amount of contamination caused by each of the scenarios and energy consumption were determined.

3. Life cycle impacts assessment (LCIA): Assessing the impacts of the life cycle is a step of life cycle assessment, aimed at understanding and assessing the magnitude and significance of the potential environmental impacts of a product or service. At this step, the

various information and data obtained at the LCI stage are reduced to less indicators and impact categories in order to facilitate the interpretation of this information and provide clearer outcomes to decision makers and managers. In this step, input data are allocated to the five impact categories of energy consumption, greenhouse gases, acid gases, photochemical gases and toxic emissions.

4. Interpretation of results: At this stage, the results of the LCI and LCIA will be evaluated so that the stages or points which have the greatest and least harmful impacts on the environment in the production and consumption of the product have been determined. Finally, conclusions and solutions are explained.

Results and discussion

Results of the model were allocated to five categories consisting of energy consumption, greenhouse gases, acid gases, photochemical gases and toxic emissions. In every category, the ecological index as a quantitative measure to compare scenarios was calculated.

Conclusion

In this study, the life cycle assessment approach was used as a decision tool for choosing the appropriate waste disposal scenario in Sirjan city. The second scenario (68.4% compost, 19.2% recycling, 12.4% landfill) was selected as the preferred option for municipal waste disposal in Sirjan city. Also the results of this study show that in an integrated municipal waste management system, increasing the rate of separation and recycling will significantly reduce the release of environmental pollutants.

Keywords: Waste management, Life Cycle Assessment, Ecological Index, Sirjan City

*Corresponding Author:Alirezarstkrd@yahoo.com