

Titolo della tesi: MSW management in developing countries (case study: Tehran): LCA comparison of Long-term scenarios (Tesi sperimentale)

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Nowadays solid waste management (SWM) has become an issue of increasing global concern as urban populations continue to rise and consumption patterns change. The health and environmental implications associated with SWM are mounting in urgency, particularly in the context of developing countries; for this purpose, the capital of Iran, Tehran, was selected as the case study. The aim of this thesis is to review and assess the different municipal solid waste management scenarios using a comparative life cycle assessment approach which can be considered as a tool for decision making in terms of the choice of waste management strategies on the basis of environmental impact assessment considerations.

The present thesis is the first of a two-part work in which the potentially applicable waste management scenarios in Tehran were identified and assessed with a view to environmental sustainability criteria. Two different timeframes, namely a short-term and a long-term perspective, were assumed for the analysis. Distinction between the two was made on the basis of an evaluation of the reasonable timeframe for implementation of each waste management scenario.

The present work was specifically focused on the short-term perspective. In this framework, three different scenarios including:

- landfilling combined with composting (Sc-0), representing the currently practiced scenario,
- biodrying combined with incineration (Sc-1), and
- anaerobic digestion combined with incineration (Sc-2)

were taken into consideration.

In this study, after a review of municipal solid waste management strategies in developing countries and related LCA studies, along with a brief description of SWM systems, the MSW scenarios of Tehran were analyzed through an LCA approach in order to assess environmental impacts of the identified scenarios. To this aim, SimaPro version 8.0.5.13 with CML method and Ecoinvent data bases were used. The application of the LCA methodology required the preliminary description of the system layout for each scenario and the definition of the mass flows for each process unit, which was based on mass balance considerations. Specific ad hoc models for the identification of

the treatment performance and output/emission generation from each unit of the system were also applied to derive a complete description of input and output flows from the system.

The predicted effects of each waste management scenario on climate change, acidification and eutrophication were specifically assessed, so that their respective impact indicators (global warming potential, acidification potential and eutrophication potential) were taken as a measure of their absolute entity.

Based on the results, the combination of anaerobic digestion with incineration (Sc-2) is suggested as the one having the most favourable effect on climate change, while regarding the acidification and eutrophication impact scenario Sc-1 had the most favourable effect compared to Sc-0 and Sc-2. This is probably due to the indirect emissions deriving from electricity consumption for the biodrying system without leachate production compared to landfilling in Sc-0 and anaerobic digestion in Sc-1. Although the 'incineration combined with biodrying' scenario (Sc-1) is being considered to be implemented in Iran in the future, the findings of this study reveal that it may not represent the most environmentally sound waste management strategy.

Keywords: Waste management in developing countries, Life cycle assessment, Climate change, Anaerobic digestion, Biodrying, Landfilling, Incineration, Tehran