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A MULTI-OBJECTIVE OPTIMIZATION MODEL TO SUPPORT THE MUNICIPAL SOLID WASTE MANAGEMENT

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Abstract

This study aims to define a municipal Solid Waste Management (SWM) strategy using Multi-objective Optimization Problem (MOP) and ELECTRE method. Four waste treatment technologies were considered: recycling, composting, incineration and landfilling. Firstly, a Multi-objective Linear Programing (MOLP) model was developed. The solutions obtained from this model were ranked using the ELECTRE method. It was considered as case study a hypothetical city of 1,000,000 of inhabitants, presenting the average Brazilian waste per capita generation and composition.The results indicate 21 optimal solutions. The top ranked solution presents a combination of all the technologies considered. This solution presents the following waste allocation: 51.4% composted, 18.4% recycled, 16.7% landfilled and 13.5% incinerated. A sensitivity analysis was carried out by varying waste composition and criterion weights. The waste composition sensitivity was evaluated by substituting the average waste characteristics of Brazil to Europe, Japan and USA ones. The sensitivity analysis indicates that the ranking of solutions was very sensitive to waste composition changes and low sensitive to the variation of criterion preferences. Thus, although the MOP model presented is a simple approach for SWM when compared with other literature models, it shows to be efficient. The proposed model is able to decide between the trades-off related with the material allocation.

Key words: ELECTRE, Multi-objective Optimization Problem, Solid Waste Management, Weighted Sum Method

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