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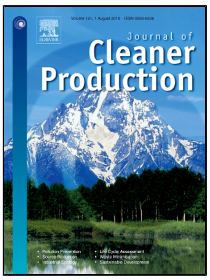

Designing and solving a reverse logistics network for polyethylene terephthalate bottles

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Designing and solving a reverse logistics network for polyethylene terephthalate bottles

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Abstract

In recent years, factors such as lack of valuable resources, economic importance, environmental concerns and increased customers' awareness caused the researchers to consider the design of a reverse logistics network. In this study, the process of collecting and remanufacturing polyethylene terephthalate bottles was considered. A mixed-integer linear programming model for a reverse logistics network was designed. A real case study of polyethylene terephthalate bottles was implemented in one of the northern cities of Iran to show the applicability of the model. The objective function was to minimize the total costs. In the current network model, new collection centers and remanufacturing centers can be opened. Also, the optimal number and location of the facilities along with the flow between them were determined. The obtained results clearly demonstrated that the proposed model is efficient and applicable. Moreover, this paper provided effective and reliable managerial implication solutions for decision makers of polyethylene terephthalate bottle reverse logistics network. Two meta-heuristic algorithms, namely the genetic algorithm and imperialist competitive algorithm, were applied to solve large-scale problems. The efficiency of the two proposed algorithms and the optimum solution of the LINGO software were compared in terms of the CPU time and objective function value. To achieve reliable results from these algorithms, parameter setting was utilized by the Taguchi method.

Keywords: Reverse logistics; Genetic algorithms; Imperialist competitive algorithm; Polyethylene terephthalate bottle; Mixed-integer linear programming

1. Introduction

One of the reasons to consider used-products and reuse them is paying attention to valuable and expensive or non-renewable raw materials used for producing such products. Soft drink and mineral water bottles are a good sample for plastic remanufacturing. It seems that using polyethylene terephthalate (PET) bottles compared to glass bottles is easier and less costly, causing people to consume these bottles. The consumption of PET bottles is increasing every year (Şimşek et al., 2018). PET bottles do not decompose in short time like organic materials and occupy a lot of space, so are

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