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DESIGNING A LOGISTIC NETWORK FOR HOSPITAL WASTE MANAGEMENT: A BENDERS DECOMPOSITION ALGORITHM

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Abstract

Healthcare wastes are produced from all medical and therapeutic activities in hospitals and healthcare centres. Around 15-20% of these wastes are classified as infectious wastes that could be hazardous. Therefore, an effective approach is required for handling costs and environmental issues. In this paper, a bi-objective Mixed-Integer Linear Programming (MILP) model is presented for logistics of infectious and non-infectious wastes. The proposed bi-objective model aims to minimize network costs and the risk of exposure to contamination. In this respect, a multi-stage network consisting of hospitals, recycling centres, treatment centres, disposal centres, mainly covering the location-routing problem, is considered. To deal with computational complexity of the proposed model, a Benders Decomposition Algorithm (BDA) has been employed. The researchers were faced with two important questions: (1) whether the proposed model can be applied to real-world scenarios or not, and (2) how efficient is the proposed algorithm in solving standard test problems and real-world cases. To answer these questions, the outputs of the BDA have been compared with the optimal solutions provided by the CPLEX software. The results imply that the BDA has been able to achieve optimal solutions in less computation times. Moreover, the proposed model and algorithm have been applied to a real-world study in Alborz Province of Iran. The outputs demonstrate that the proposed model and algorithm can yield applicable solutions for the case study which have been approved by experts. The proposed model can be extended by considering compatibility of wastes in storage.

Key words: benders decomposition algorithm, infectious waste management, location-routing problem, mathematical programming

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