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An Analysis of the Fayoum Governorate in Egypt's Rural Areas' Sustainable Solid Waste Management

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Abstract

Due to the growing population, particularly in developing nations, and the lack of an adequate waste management service, municipal solid waste generation and disposal are major environmental issues in both urban and rural communities. In order to choose a suitable treatment facility and enhance the waste management system, the current effort intends to research the waste management system in rural areas. Due to the flaws in the waste management system, three villages in Markaz Etsa, Fayoum Governorate, were chosen as research areas. Characterization studies in these three communities, where MSW management services are either non-existent or insufficient, are therefore of the utmost importance and a significant step forward in reaching the larger objective of sustainable municipal solid waste management [1,2]. The outcomes revealed indicating the proportion of organic in these three communities is, respectively, 76%, 67%, and 80% without diapers, or 9.3%, 14.3%, and 5.8%. WRATE software was used to carry out and simulate three life cycle assessment scenarios [3,4].

Keywords: Municipal solid waste management, Rural area, Strategic waste management, Environmental analysis, Life cycle assessment

Introduction

The potential for global warming, acid rain, eutrophication, and resource depletion are areas where the values for the anaerobic and composting scenarios are equal and identical. The anaerobic and composting categories produce greater results than the landfill scenario in the domain of acidity. Eventually, the feasibility analysis demonstrates that the compost treatment plant is the best option for the current municipal solid waste scenario in order to achieve annual savings by a certain percentage during the course of the project. Also, the availability of places in Fayoum makes the compost option advantageous [5,6]. The Egyptian government has begun reclaiming a sizable desert area close to these communities, thus the governorate will be used for land reclamations. Everyone is aware that the municipal solid trash produced by rural families is a big global challenge. The majority of the garbage produced in rural regions is organic and biodegradable, which has caused a significant issue because the waste is not separated. Hence, combined solid waste management that uses a variety of methods for treatment, including composting, anaerobic digestions, refuse-derived fuel, incineration, material recovery facilities, and sanitary landfilling, is crucial and desperately needed. Hence, the organic portion of household garbage is currently collected using waste-to-energy combustion treatment plants. A different scenario called fertiliser production is contrasted with the reference scenario of burning municipal solid waste to make biogas. To these two scenarios, a life cycle assessment study is applied. The emissions that were created by the treatment techniques. The transportation process is extremely important and emits a significant amount of greenhouse gases. In order to reduce the cost of the system and greenhouse gas emissions from transportation activities, such as carbon dioxide emissions, a bi-objective optimization model is intended in the locational planning of MSWM systems. With no or little cost increase, significant reductions in emissions can be made. Economic development is essential due to a fast increase in garbage generation, particularly in emerging nations [7,8]. Traditional garbage disposal practises have led to a number of issues, including air pollution, soil and groundwater contamination, and greenhouse gas emissions. To reduce overall expenditures, a linear programming paradigm is developed. and a real-world case study in

Qazvin, Iran, taking the population, generation rate, and frequency of collection into account, validates this model. The results of this model show that it is feasible and more effective for the decision-maker to design the cost and risk attitude of municipal solid waste management. Yet, 90% of MSW is disposed of in open dumps and landfills due to a lack of waste management. Thus, it is crucial for the management of MSW to optimise the transportation and logistics networks. A mixed-integer linear programming model is developed to produce the ISWM system in the context of the Fleet Size and Mix Vehicle Routing Problem with Time Windows. MSW generation ratios are unclear, hence a two-stage [9,10].

Discussion

The cost-effective ISWM transportation system is effectively supported by randomised optimization technique, which identifies the best fleet size and decomposition, vehicle routes, and capacity allocation to system components. The total cost of transportation was determined using the fixed and variable costs of transportation. This includes the price of various vehicles as well as the fines associated with moving extra rubbish to larger reserve processing facilities. A real-world instance of ISWM in southern Tehran, Iran, was effectively handled using the provided technique. This will be accomplished through selecting the best vehicle routes, fleet size and decomposition, and capacity distribution among system components. The approach's usefulness in lowering the economic costs of the system under uncertainty was shown by the numerical trials. Furthermore, the

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results confirmed the method's robustness and effectiveness when higher variances between the estimated and actual values of the unknown parameter are present, as well as when the system network experiences unforeseen disturbances. In a genuine case study related to the Tehran MSW system, another model is presented. The findings indicate that composting is the worst option for final waste disposal, whereas anaerobic digestion and incineration perform better in terms of sustainability indicators [11,12]. There have been numerous studies on turning solid waste from landfills into valuable materials to lessen trash there and the need for further landfills and dumpsites. A novel multiobjective mathematical programming model that takes into account new employment opportunities as well as the social component of sustainability is created. This technique is particularly utilised in developing countries. As numerous academics have noted in papers, recycling is a favoured alternative to energy recovery. Ineffective waste management practises that entail dumping waste in landfills degrade important land resources and release methane gas, a greenhouse gas that is more potent than carbon dioxide. Due to the growing population, particularly in developing nations, and the lack of an adequate waste management service, municipal solid waste generation and disposal are major environmental issues in both urban and rural communities [13,14]. In order to choose a suitable treatment facility and enhance the waste management system, the current effort intends to research the waste management system in rural areas. Due to the flaws in the waste management system, three villages in Markaz Etsa, Fayoum Governorate, were chosen as research areas. Characterization studies in these three communities, where MSW management services are either nonexistent or insufficient, are therefore of the utmost importance and a significant step forward in reaching the larger objective of sustainable municipal solid waste management. The outcomes revealed indicating the proportion of organic in these three communities is, respectively, 76%, 67%, and 80% without diapers, or 9.3%, 14.3%, and 5.8%. WRATE software was used to carry out and simulate three life cycle assessment scenarios. The potential for global warming, acid rain, eutrophication, and resource depletion are areas where the values for the anaerobic and composting scenarios are equal and identical[15].

Conclusion

The anaerobic and composting categories produce greater results than the landfill scenario in the domain of acidity. Lastly, the feasibility analysis demonstrates that the compost treatment facility is the best option for the existing municipal solid waste scenario, saving EGP 1,365,043 in yearly savings throughout the course of the project. Also, the compost approach is advantageous because When the Egyptian government began to recover a huge desert region close to these settlements, lands in the Fayoum governorate would be used for land reclamations. LCA Life cycle analysis GHG from municipal solid trash MSW Environmental Gases OFMSW Integrated Solid Waste Management MS Municipal Solid Waste Natural Fraction Solid municipal waste Management of Mixed Solid Waste (MSWMM) SDGs Objectives for Sustainable Development Waste Management – Solid Everyone is aware that the municipal solid trash produced by rural families is a big global challenge. The majority of the garbage produced in rural regions is organic and biodegradable, which has caused a significant issue because the waste is not separated. Hence, combined solid waste management that uses a variety of treatment techniques is crucial and desperately needed. Hence, the organic portion of household garbage is currently collected using waste-to-energy combustion treatment plants. A different scenario called fertiliser production is contrasted with the reference scenario of burning municipal solid waste to make biogas. Using a life cycle assessment study these two situations the emission generated by the transportation

and treatment processes is quite important and generates a sizable amount of greenhouse gas emissions. In order to reduce the cost of the system and greenhouse gas emissions from transportation activities, such as carbon dioxide emissions, a bi-objective optimization model is intended in the locational planning of MSWM systems. It is possible to reduce emissions significantly without significantly increasing costs. Economic development is essential due to a fast increase in garbage generation, particularly in emerging nations. Traditional garbage disposal practises have led to a number of issues, including air pollution, soil and groundwater contamination, and greenhouse gas emissions. The development of a linear programming model is a real-world case study in Qazvin, Iran, taking into account the population, generation rate, and frequency of collection, validates this model's ability to minimise overall expenditures. The results of this model show that it is feasible and more effective for the decision-maker to design the municipal solid waste management cost and risk attitude. Yet, 90% of MSW is disposed of in open dumps and landfills due to a lack of waste management. Thus, it is crucial for the management of MSW to optimise the transportation and logistics networks. A mixed-integer linear programming model is developed to produce the ISWM system in the context of the Fleet Size and Mix Vehicle Routing Problem with Time Windows.

Acknowledgement

Conflict of Interest

None

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