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MUNICIPAL SOLID WASTE MANAGEMENT

Dan DANCIU[1], Florentina-Daniela MUNTEANU[2*]

[1]Faculty of Engineering, „Vasile Alecsandri" University of Bacău, Calea Mărăşeşti, nr. 157, 600115, Bacău, România
[2]Faculty of Food Engineering, Tourism and Environmental Protection, "Aurel Vlaicu" University, Romania, 2 Elena Dragoi, Arad 310330, Romania
Corresponding author email: florentina.munteanu@uav.ro

Abstract: *The present paper has in attention the alleviation of the environmental issues when a proper management of the solid waste is considered by the authorities. Moreover, the most used waste management activities are screened in order to evaluate which one is providing sustainable social and economic benefits.*

Keywords: solid waste, management, sustainability, environmental impact.

INTRODUCTION

The accelerated population growth in the urban areas has led to an increase in the amount of waste, resulting in a major impact on the environment, health and the socio-economic climate. The human activity leads to different by-products known as municipal solid waste (MSW). MSW consists of different solid wastes that may include biodegradable wastes, but also hazardous, medical, electrical and electronic and composite wastes.

Nowadays a big concern is raised in connection to the municipal solid waste management, as the activities associated with this process might lead to an inappropriate impact on human health, environmental quality and economic benefits. A simple search in Web of Science, Clarivate Analytics, on the topic „municipal solid waste" leads to almost 18000 search results, most of which are considering different options for a sustainable municipal waste management (Haupt et al., 2018; Heidari et al., 2019; Soni et al., 2016; Yadav and Samadder, 2018). In general, for environmental good practices is necessary to apply a systematic management of the solid waste, independent of the origin, composition or the hazardous potential of the waste. Therefore, a rigorous environmental planning will critically contribute to the hygiene of the environment (Mohammadi et al., 2019; Simatele et al., 2017).

For the evaluation of the environmental burden and of the benefits that are brought by a product or of an industrial process one can use computer-based tools referred as Life Cycle Assessment (LCA) (Klopffer, 1997). In the case of waste management, this tool can be used to study the life cycle of the wastes and their impact on the environment as it is presented by several published papers on this subject (Bartolozzi et al., 2018; Haupt et al., 2018; Liu et al., 2017).

In the present study, we will present different procedures for the treatment of the solid waste having in attention the European Commission Circular Economy Package (EC, 2015) that should be seen as be primarily seen as a starting point for any research initiative in this field.

DISCUSSION

The least friendly option for the management of the solid waste is the landfilling, which, unfortunately is still the most used method. Even though, there are some results (Babu et al., 2014) that show that landfilling might be a better option than open burning or open dumping. However, according to the Final Circular Economy Action Plan, adopted by the European Commission in 2015 (EC, 2015), there are certain restriction on regard to the landfilling. In this document it is specified that the municipal waste landfilled must be below 10% of the total amount of the generated municipal waste.

The thermal treatment of the solid waste is another common method for the solid waste removal. The pyrolysis and gasification are not very attractive because of their costs constraints,

while incineration is much more applied (Boesch et al., 2014), but in this case a strict control of the emissions from the waste treatment plants should be controlled.

Soni et al. proposed in their studies a method to obtain energy from waste (Soni et al., 2016). Firstly, they were looking to the composition of the solid waste (Figure 1) that can be processed and valorised.

In their studies they concluded that waste should not be considered just as simple waste, but rather as a source of energy.

Moreover, with proper treatments the biodegradable part of the solid waste can be successfully used for the obtaining of the biodiesel, Bio-CNG, Fuel ethanol and liquid manure. The non-biodegradable part, after recycling can be further used for incineration or landfilling.

Figure 1. Composition of municipal solid waste that can be treated as a source for production of the necessary energy. From (Soni et al., 2016)

During the entire process of the solid waste management, it has to be taken the best decision in terms of the most appropriate option for the treatment techniques. In Figure 2 are shown the techniques that can be used.

Figure 2. Techniques used for waste management. Adapted from (Khandelwal et al., 2019)

During the composting process the organic fraction is partially degraded by the microorganisms, and carbon dioxide and water is obtained, while the other fraction is continuously humidified in order to obtain a stable compost material that can be used as biological fertilizer (Milinković et al., 2019). It has to be mentioned that the quality of the compost is depending of the air supply, temperature control, homogeneous mixing. If all these parameters are monitored then the processing and capital costs can be controlled (Baeta-Hall et al., 2005).

However, the acceptance of the composting as an option for the solid waste management is dependent on how well-developed are the exploitation strategies used for the obtained products as well as for the environmental protection. As a consequence, it is necessary to have an appropriate evaluation of the systems in terms of the products acceptability and maximized efficacy (Khandelwal et al., 2019; Muscolo et al., 2018).

CONCLUSIONS

Based on the impressive number of studies present in the Clarivate Analytics database, and that are treating the options for an optimal management of the municipal solid waste, it has to emphasize the fact that the regional conditions play an important role. The site-specific composition of the waste should be placed on a higher position in the hierarchy of the decisions, followed by the treatment efficiency, energy yield, etc. Moreover, a special attention should be paid to the action plan that is contained in the Annex 1 of the EC Circular Economy Package. Last, but not least is commendable to use life cycle assessment as a tool of evaluation in the municipal solid waste management.

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