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THE USE OF GEOTHERMAL ENERGY IN INTENSIVE COMPOSTING, A SUSTAINABLE AND ENERGY-EFFICIENT OPTION

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Introduction

The purpose of this study was to evaluate the availability of biodegradable wastes and thermal power resources for intensive composting.
Organic biodegradable waste includes fruit and vegetable peels, food scraps, fallen leaves, grass clippings, sawdust, paper and cardboard, and other similar organic materials. In municipal waste management, it is important to collect selectively at source this fraction in order to properly recycle through composting, or other treatment methods the containing nutrients as valuable resources while avoiding at the same time the negative impact on the environment. Composting has become an effective management approach to recycle and transform organic waste into a useful product (compost) with high nutrient content and low prevalence of pathogenic microorganisms. Composting is an aerobic process, which requires oxygen, optimal moisture content and porosity to stabilize organic waste, and the common process control variables are temperature, oxygen and humidity. Microbial activity is responsible for the decomposition and fractional humification of organic matter, through complex metabolic processes, which ultimately transforms it into a material suitable for soil amendment and crops fertilizing. Geothermal energy can be a viable alternative, offering an accessible and guaranteed solution for intensive composting in the medium and long term. The geothermal energy confers a series of advantages, such as a minimal environmental impact limited development space, and availability 24 hours a day.

Materials and methods

An estimation of the resources availability (e.g. organic waste, energy source) has been carried out by evaluating the available statistical data, relying on reliable sources (national and regional waste management plans). Table 1 shows the estimation of waste quantities for Valcea County, identified in the National Waste Management Plan (PNGD). According to this data, the trend of the generated waste quantities (total and respectively bio-waste) is decreasing. From the evaluation of the data identified in the plans of Valcea County, for 2016-2025, a biodegradable fraction between 54% and 60.87% resulted. Keeping the focus on the biodegradable component of waste as a source of materials for the composting process, the quantities generated at the Valcea County level (2014-2019), as well as the statistical

estimates for the next period (2020-2025) were studied and represented graphically in Figure 1.

Table 1. Centralization of the amounts of total waste and bio-waste at national level according to PNGD

	Category	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Total waste at national level	Total waste [megaton/year]	5142.4	5406.2	5492.2	5830.4	6091.6	4741.2	5723.1	5866.6	5780.7	5691
	Bio-waste percentage [%]	55.42	55.42	54.76	55.55	55.56	55.56	55.31	54.88	54.46	54.01
	Bio-waste [megaton/year]	2670.8	2773.7	2817.6	2994.3	3182.3	2623.4	2983.2	3050.3	2988.6	2920.5

Intensive compsting requires heating. Romania has rich geothermal resources, with variable temperatures depending on the region. Geothermal energy is used in the heating systems of buildings in Vâlcea county.

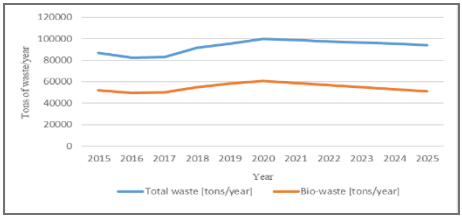

Fig. 1. The variation of the quantities of waste generated.

Results and conclusions

Using geothermal energy in intensive composting can be a sustainable and option. Geothermal energy can be accessed through geothermal wells or thermal waters and used in intensive composting by providing direct heat to composters. Geothermal systems can be connected to the composters heating system. This can help maintain an optimal temperature during the composting process. Since the geothermal water can only be cooled to a temperature of around 50°C, with which it is discharged into the Olt the thermal potential of the geothermal water is only partially exploited. The residual geothermal energy can be used to heat the water needed in intensive composting process. Warm water can be used to increase the composting piles moisture contents in order to ensure favorable conditions for decomposition.

The use of geothermal energy in intensive composting can bring several advantages, the solution being a sustainable one because geothermal energy is a renewable and virtually unlimited source, which reduces dependence on traditional energy sources and associated greenhouse gas emissions.

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