Thermogravimetric analysis for the evaluation of coffee grounds in combustion and gasification processes

Colantoni Andrea1, Leonardo Bianchini1\*, Enrico Paris2, Monica Carnevale2 Beatrice Vincenti2, Adriano Palma2, Francesco Gallucci2

1 Tuscia University-Department of Agriculture and Forestry Science (UNITUS-DAFNE) - 01100 Viterbo, (Italy)

2 Council for agricultural research and economics research; engineering and agro-food processing (CREA-IT) - 00015-Monterotondo (Rome, Italy)

\* Leonardo Bianchini, Tuscia University-Department of Agriculture and Forestry Science (UNITUS-DAFNE) - 01100 Viterbo, (Italy). +39 0761357357, l.bianchini@unitus.it

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**Abstract.** Fossil fuels are still widely used, and this generates a lot of environmental pollution. There are many resources and technologies to progressively replace the use of these sources. Among these, agro-industrial residues are of interest. Instead of treating them as waste, they could be recovered to produce energy. Thermochemical conversion processes such as combustion, gasification and pyrolysis are promising technologies for the use of renewable energy resources. Spent coffee grounds represent a high proportion of agro-industrial residues, so that scientific and industrial interest in this raw material is growing.

In this work, after a detailed chemical-physical characterisation, combustion and gasification spent coffee grounds pellets and a variant of combustion coffee pellets to which olive pomace oil was added in the pelletisation process were tested. The tests were carried out using thermogravimetric analysis (TGA) to check the process and the reaction of the biomass at varying temperatures in terms of weight and energy output.

The results provide important information on the properties of coffee grounds on energy production. Spent coffee grounds in combustion are exhausted at 550 °C and in gasification at about 675 °C, while pellets mixed with pomace oil have not yet exhausted their mass at 800 °C. The largest amount of power is provided by the pellets with olive pomace oil with a peak of 247.63 mW, followed by the pellets in combustion 205.64 mW and the pellets in gasification 61.47 mW. Non-parametric tests were applied and significant differences between the factors were observed.

This represents preliminary work within a larger project that will involve the analysis and comparison of many types of biomass used in thermochemical processes. The data obtained are important for using biomass in the most appropriate technology and optimising the process.