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## VALORIZATION OF RESIDUAL FRACTIONS FROM MUNICIPAL WASTES IN THE FORM OF ALTERNATIVE FUELS

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### **Introduction**

The priority of the transition to a circular economy is well known at the European level. One of the main elements that defines the circular economy is represented by the transformation of waste into resources.

The constant increase in the quantities and complexity of the composition of municipal waste permanently requires the identification of appropriate solutions for sustainable management. A first step was the development of the "waste-to-energy" concept. It is part of the context of reducing the impact on the environment generated by the production of energy from fossil fuels and aims to capitalize on the energy potential contained in waste in an ecological manner through the development of modern technologies.

The energy recovery of waste "waste to energy" can be applied to those wastes that do not lend themselves to recycling, it is based on the energy potential contained in them (expressed by the calorific value) but which must also meet certain quality conditions (relevant for the environment and the processes combustion). Starting from the mentioned aspects, the paper presents the experimental results of obtaining alternative fuels from fractions of municipal waste that are currently sent to storage, with the addition of various additives.

### **Materials and methods**

The following materials were used in the conducted experiments:

- waste fraction resulting from the preliminary mechanical treatment phase of municipal waste after magnetic separation of ferrous components (A);
- the fraction of inert materials remaining from the mechanical separation phase of the biologically treated material through composting (B);
- corn starch (Am), bentonite (Bn), sludge from wastewater treatment resulting from paper manufacturing processes (NP), sludge from urban wastewater treatment (NG).

In order to densify the mixtures, four types of briquettes were made from waste, with the addition of different binders: 33% A + 33%B+ 7%Am (1), 33% A + 33%B+ 7%Bn (2), 33% A + 33%B+ 7%NP (3), 33% A + 33%B+ 7%NG (4).

Both the waste and the additives used to obtain the briquettes, as well as the briquettes themselves, were characterized in terms of *technical parameters* (moisture-W, ash-A, volatile substances-V, *elemental* (carbon-C, nitrogen-N,

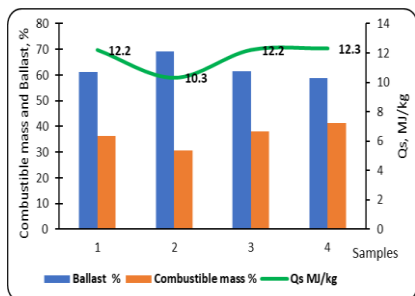
hydrogen- H), sulfur-S, chlorine-Cl and *energy content* (higher calorific value-Qs and lower calorific value-Qi).

### Results and conclusions

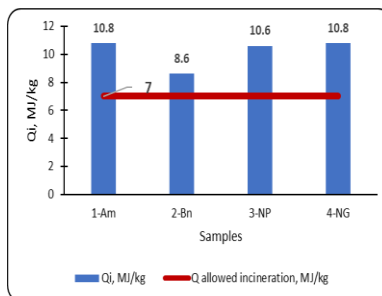
The values of the analytical determinations for the above-mentioned parameters allowed the calculation of the two components of a fuel: *the ballast* (consisting of non-combustible mineral mass - *ash and moisture*) and *the combustible mass* (consisting of the active elements that participate in the combustion process - *carbon, hydrogen, nitrogen, sulfur*).

The energy performances of the briquettes depending on the ballast and fuel mass have highlighted the fact that the briquette with the lowest value of the combustible mass and the highest ballast content also has the lowest value of the calorific value (Figure 1).

The addition of different additives in the waste mixture demonstrated the obtaining of briquettes with relatively close calorific values, with the exception of the briquette containing bentonite which had a lower calorific value (Figure 2).



**Figure 1.** The energy performances of the briquettes depending on the composition



**Figure 2.** The variation of the lower calorific value of the briquettes depending on the added additives

The obtained results indicated a corresponding quality in terms of composition, similar to classic solid fuels. All the briquettes made, regardless of the added additives, presented values of the lower calorific value that are above the allowed incineration value of 7 MJ/kg.

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