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RESEARCH ON THE IMPORTANCE OF THE QUANTITY OF AVAILABLE BIOMASS AND ITS USE

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Abstract: This research approaches a present topic in the field of energy production from energy renewable sources, evaluating the energetic potential of biomass, by increasing the caloric power and the efficiency of using the wood in combustion. Taking into consideration the fact that the biomass is a world wide spread source and presents a potential to produce solid, liquid and gaseous fuel, an experimental research is necessary. The present researches must start from the determination of caloric power, to continue with the determination of moisture influence, and finally to move forward to the assessment of the efficiency of using wooden biomass by increasing the caloric power, by dry thermal treatment in oxygenated environment.
Keywords: biomass, calorific value, moisture content, wood

INTRODUCTION

In 1870, at a world-wide level, the biomass was covering approximately 70% of the necessary of energy, which then let the floor for the hydro and photovoltaic fuels, and nowadays is still the main fuel for the production of energy in the countries in developing process (Cleveland 2009, Astbury 2008, Priddle 1998). The energetic sources present nowadays on the energetic market were classified on three categories: fossil fuels, nuclear resources and renewable energetic resources (Lunguleasa, 2007).
According to the descriptions of (Swithenbank, 2011), the first stage consisted on the decomposition of fossil fuels (1892) and the methods of obtaining energy from them, the second stage starts in the moment when the energetic crisis appeared in the 1970, which led the population towards new directions and visions of producing energy among which renewable energy sources. The third stage consists on exploiting and providing the necessary of energy.
There are known several methods to produce energy, respectively: water power, sun power, wind power, geothermal power, fossil fuels power and nuclear power. The development of the society depends on a great measure on the energy consumption. According to some researches it is considered that fossil fuel will be enough just until 2015 – 2020.
On a world-wide level there were implemented solutions to solve these problems with a tendency of using rationally the energy and discovering new sources of renewable energies.
Nowadays, energy is mainly produced from fossil fuels, which are non-uniformly spread on the Earth. In the world, fuels might be found in three different shapes, respectively fossil fuels, nuclear and renewable fuels. Fossil and nuclear fuels, according to the research conducted by European Union are seriously harmful to the environment.
The biomass is one of the renewable energy sources used from the oldest times by people.
Biomass is a renewable energetic source, because it increases from one year to another, it is widely spread world – wide and presents low costs in comparison to the fossil fuels, the biomass resources, from which fuel material is produced may include wood and wooden wastes, agricultural cereals and wastes resulted from their production, aquatic biomass and algae.
Biomass is one of the forms of renewable sources which may be converted in solid, liquid and gaseous energetic fuel and which may generate energy as heat by its burning, as well as electrical energy by conversion processes (Lunguleasa, 2007).
Biomass is environmentally friendly and a neutral energy against the emissions of carbon dioxide. The carbon dioxide is absorbed by the plants during the growing process and forms a closed circuit, because the quantity of carbon dioxide which was absorbed by the plants during the growing process will be equal to the one which was eliminated during the complete burning process (Eisentraut A, Brown A., 2012). The biomass may be used in the combustion process and mainly its does not require very high investments as hydro, solar, wind and geothermal energy do.
Currently, the biomass contributes with approximately 12% to the production of primary energy in the world, and in the countries in developing process it covers 40-50% of the necessary of energy. The Biomass is the alternative source that, according to (Berkesy, 2012) contributed with 7% from the energy produced in the world. Presently, the use of renewable fuel materials such as wooden wastes for producing biofuels increases the chances of biomass in the availability level on the energetic market.
The research of energetic market highlighted the following fuels materials which produce energy: fire wood, sawdust, woodchips, briquettes, pellets.
The sawdust resulted from the wood processing has an important role in many European countries. Normally, the wood bark and the sawdust are organic materials which usually do not pollute the environment.
The frame saw sawdust combined with the rain, snow or waste water easily enters the environment and pollute the underground water or the lake close by carrying along the dissolved material,

including substances used for treating the wood. According to the statistics, approximately 1600 tons of sawdust collected and processed yearly come from renewable resources, this thing means approximately 1600 tons of forest wood less or saving 9,2 hectares of forest, at an average of 218 m^3 of wood per hectare.

MATERIALS AND METHODS

— Determining the caloric power of the bark

The installation used for determining the caloric power of the wooden biomass was the explosive burning calorimeter type XRY-1C, produced by Shanghai Changji Geological Instrument Co from China.

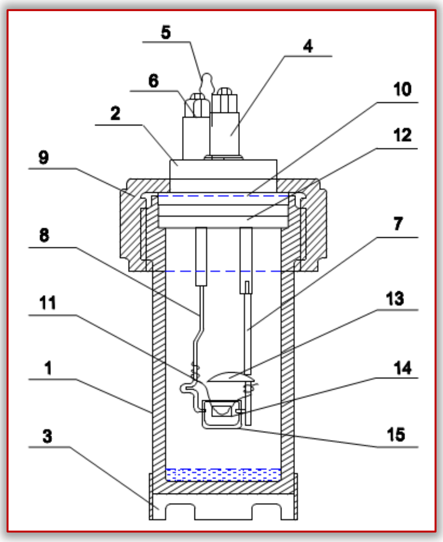

Figure1 - Section view through calorimetric bomb

Before proceeding to the attempting, the gauging of the calorimetric bomb is made with benzoic acid, using benzoic acid with a value of known caloric power (26463 kJ/kg).

The inferior caloric power of wood is determined based on the superior caloric power.

$$PCi = PCs - 6\,(U + 9h)\ [kJ/kg] \qquad (1)$$

where:

PCs - superior caloric power, kJ/kg

U - wood sample moisture, kJ/kg

h - hydrogen content of wooden sample, 3,6%.

The method to determine the caloric power of the wooden material refers mainly to the preparation of the raw material and the installation, then to the proper determination and finally to the obtaining of the result.

The testing sample 1 is tied to the cotton thread 2 and is put in the bomb box 3. The copper nickel thread 4 is tied to the sample and the cotton thread, after which the protection covers 5 is put correctly. The box is connected to the calorimetric bomb cover 6 through two electrodes 7 and 8, which continue with the electrical threads for calorimetric bombs coupling 9 and 10. By threading the cover the bomb 11 is coupled to fitting 12 to the oxygen cylinder, introducing 30 atmospheres.

— Determining ash content

In order to determine the ash content of the grapes remains, the general method of standardized determination was used (ASTM D2866-11, 2012). According to this method, the milled and dried material until 0% humidity is baked at a temperature of 750°C in a lab oven, during 3 hours at least (Figure2). The advanced burning operation is made on a metallic melting pot resistant to high temperature, and the weighting was made on an analytical balance with a 3 decimal precision.

When determining the ash content it will be taken into consideration that the sample is completely dried and the cleaned and empty melting pot weight.

$$A_c = \frac{m_{a+c} - m_c}{m_{s+c} - m_c} \cdot 100\ [\%] \qquad (2)$$

where:

m_{a+c} -mass of ash plus crucible;

m_{s+c}- mas of sample plus crucible;

m_c- crucible mass.

Figure 2 - Baking oven for determining the ash content

RESULTS

The description of the process to determine the caloric power is presented in figure 3.

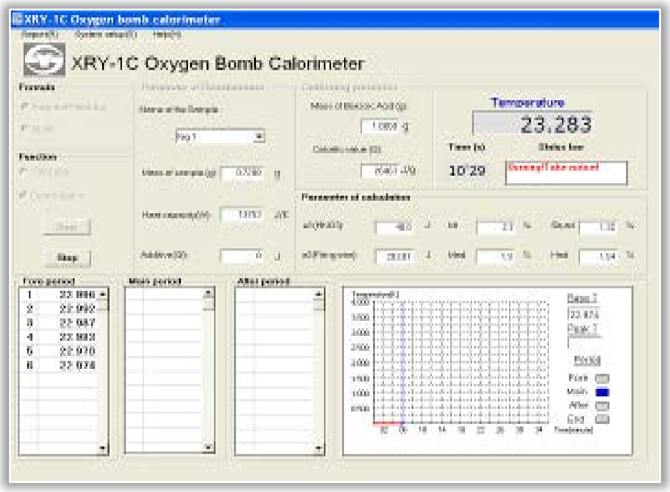

Figure 3 - Description of the process to determine the caloric power

The test consists in three different stages:

The initial stage ("fore") has as purpose the determination of temperature variations of water in the calorimetric recipient, due to the heat exchange with the exterior before burning. During this period, usually for 5 minutes, it is indicated and read at one minute periods the temperature with the precision thermocouple. The last reading of the temperature form the initial period represents in fact the first temperature in the main period. The values of the temperature registered in this period

are generally six. After registering the 6th value the lighting of the material takes place and its reading on the menu bar (Burning time).

The main period ("main") begins by burning the sample and has as consequence the increase of water temperature in the calorimetric recipient, due to the burning of wooden particles and heat delivery. To determine the final temperature the value of the temperature is indicated at one minute periods. The values registered during this period vary according to the burning time of the fuel material in the calorimetric bomb. The number of values may vary between 19–42 values of temperature registered during this period.

The final period ("after") has as purpose the determination of the average water temperature in the calorimetric recipient, due to the heat exchange with the exterior after burning. Identical to the first stage, the temperature is indicated at half minute periods, for 4-5 mutes, averagely there are registered 8 – 10 values of the temperature variation.

With measurement are performed values: for spruce of bark, mass sample 0.5100 g, net calorific value 19441 kJ/kg, gross calorific value 18943 kJ/kg, for U =0%, mass sample 0,4914 g, net calorific value 17372 kJ/kg, gross calorific value 16672 kJ/kg, for U =10%, mass sample 0.7100 g, net calorific value 15552 kJ/kg, gross calorific value 14153 kJ/kg, for 20%, mass sample 0.7890 g, net calorific value 10092 kJ/kg, gross calorific value 6594 kJ/kg, for U = 50% (Figure4).

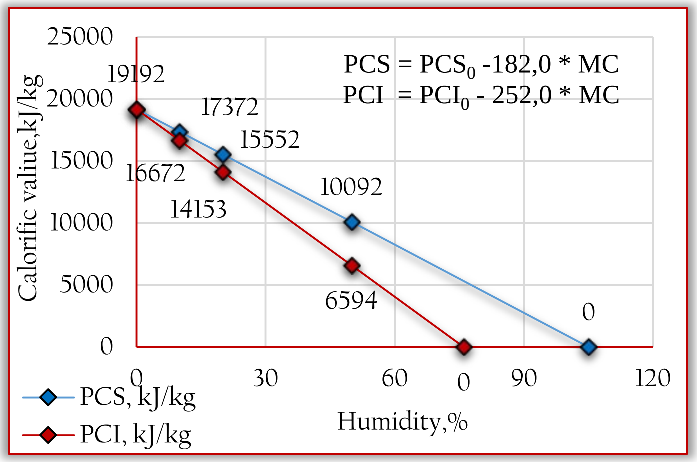

Figure 4 - Calorific value for spruce bark

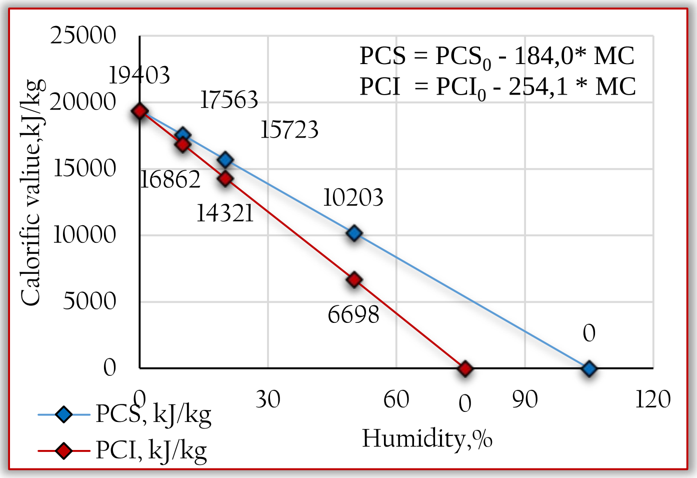

Figure 5 - Calorific value for populus of bark

The following values are obtained from measurements: for poplar bark, mass sample 0.7400 g, net calorific value 19665 kJ/kg, gross calorific value 19152 kJ/kg, for U =0%, mass sample 0.4964 g, net calorific value 17563 kJ/kg, gross calorific value 16862 kJ/kg, for U =10%, mass sample 0.3800 g, net calorific value 15723 kJ/kg, gross calorific value 14321 kJ/kg, for 20%, mass sample 0.8730 g, net calorific value 10203 kJ/kg, gross calorific value 6698 kJ/kg, for U = 50% (Figure5).

The following values are obtained from measurements: for beech of bark, mass sample 0.8900 g, net calorific value 19181 kJ/kg, gross calorific value 18681 kJ/kg, for U =0%, mass sample 0.6600 g, net calorific value 17137 kJ/kg, gross calorific value 16737 kJ/kg, for U =10%, mass sample 0.6371 g, net calorific value 15344 kJ/kg, gross calorific value 14544 kJ/kg, for 20%, mass sample 0.8790 g, net calorific value 9963 kJ/kg, gross calorific value 7963 kJ/kg, for U = 50% (Figure 6).

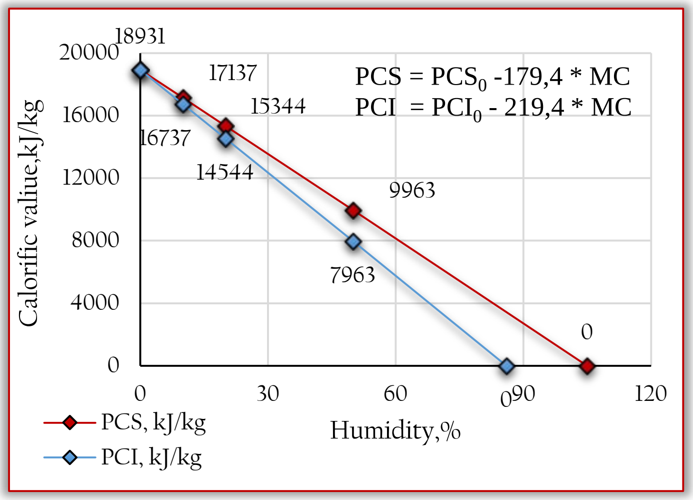

Figure 6 - Calorific value for beech of bark

CONCLUSIONS

The incomplete combustion has severe effects on the environment discharging in the atmosphere a large quantity of carbon dioxide.

Generally, the burning process of the bark develops in the same conditions as the massive wood biomass. The sole difference is the content of ashes which it presents and the difference of chemical composition. This thing contributes to the implementation in the field of bark burning of the technologies adapted to large contents of ash.

The ash content for spruce of bark is 2.6%, for populus of bark is 2.8%, for beech of bark is 2.9%.

Note:

This paper is based on the paper presented at ISB-INMA TEH' 2018 International Symposium (Agricultural and Mechanical Engineering), organized by Politehnica University of Bucharest – Faculty of Biotechnical Systems Engineering (ISB), National Institute of Research-Development for Machines and Installations Designed to Agriculture and Food Industry (INMA) Bucharest, The European Society of Agricultural Engineers (EurAgEng), Society of Agricultural Mechanical Engineers from Romania (SIMAR), National Research & Development Institute For Food Bioresources (IBA), University of Agronomic Sciences and Veterinary Medicine Of Bucharest

(UASVMB), Research-Development Institute for Plant Protection (ICDPP), Hydraulics and Pneumatics Research Institute (INOE 2000 IHP), National Institute for Research and Development in Environmental Protection (INCDPM), in Bucharest, ROMANIA, between 01–03 November, 2018.

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ACTA TECHNICA CORVINIENSIS BULLETIN OF ENGINEERING
ISSN: 2067-3809