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THE IMPORTANCE OF THE PHYSICOCHEMICAL CHARACTERIZATION OF BIOMASSES FOR PLANNING THEIR ENERGY USE.

SILVA, A.P.S..[1,2] *, ANATER, M.J.N.[2] AMARAL, D.H.[2] and COELHO, S. T. [2]
* Autor para correspondência: Ana Paula de Souza Silva, aanapaula2010@gmail.com, +551137674534
1. Instituto de Pesquisas Tecnológicas (IPT) e Grupo de Pesquisa em Bioenergia (GBio), Instituto de Energia e Meio Ambiente, Universidade de São Paulo, Av. Luciano Gualberto, 1289, CEP 05508-900, São Paulo / SP, Brasil
2. Grupo de Pesquisa em Bioenergia (GBio), Instituto de Energia e Meio Ambiente, Universidade de São Paulo, Av. Luciano Gualberto, 1289, CEP 05508-900, São Paulo / SP, Brasil

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Aim and approach used

This article presents the evaluation of forest residues generated in the processing of wood logs in a sawmill, located in the municipality of Santarém, in the state of Pará in Brazil. Sawmills do the primary processing by sawing logs and transforming them into different products: slats, boards, planks, rafters, beams, boards and others. In this operation, 50% of the sawn wood is turned into waste. For a better use of these residues, it is necessary to characterize, based on physical-chemical tests such as elemental and immediate analysis and heating value to know the residue and define the best energy utilization technology.

Therefore, a sample composed of sawdust waste was collected at the sawmill and sent to the laboratory, where the sample was characterized in natura and the preparation carried out, according to the methods proposed by ASTM E1757 and ISO 14780 Standards. The sample was prepared at the Bioenergy and Energy Efficiency Lab at the Technological Research Institute - IPT, through the following steps: drying and milling, requiring granulometry smaller than 60 mesh to meet the requirements of the standards used in the physical-chemical characterization.

The methods used for the tests were:

- Determination of carbon, hydrogen and nitrogen contents, based on ASTM D5373-21 – Method A;
- Determination of total sulfur content, based on ASTM D4239-18e1 – Method A;
- Determination of oxygen content, ASTM D3176-15;
- Determination of fixed carbon, ASTM D3172-13(21) e1;
- Determination of ash content, based on ASTM D1102-84(21);
- Determination of volatile matter content, ASTM D1762-84(21);
- Determination of heating value, based on ASTM D5865/D5865M-19;
- Determination of moisture content, based on ASTM E871-82(19).

Scientific innovation and relevance

The waste generated in primary processing at sawmills has potential for energy use, but to know its potential it is necessary to carry out its physical-chemical characterization based on elemental and immediate analysis tests and heating value. Knowing the physicochemical properties of biomasses, such as sawn wood residues, is important to define and choose the most appropriate energy conversion process for said residues, being one of the main stages of planning when thinking about energy use.

Combustion, gasification, pyrolysis and liquefaction are examples of thermochemical processes. Among the biochemical processes are fermentation, to convert sugar into ethanol, and anaerobic digestion to produce biogas. Mechanical processes are not exactly a conversion process, as they do

not change the physical state of the biomass. Examples of mechanical processes are the compaction of residues in the form of pellets, grinding or chopping of biomass and mechanical extraction of oil in a filter press.
Then, thinking about the planning for energy use, a sample composed of sawdust from the species: *Lecythis lúrida*, *Lecythis oisonis, ManilKara huberi* and *Manilkara bidentata* was collected to carry out the physical-chemical characterization by the tests: elemental analysis (CHNSO), immediate analysis (Ashes, Fixed Carbon, Volatile Materials and Moisture Content) and Heating Value.

Results or preliminary results and conclusions
The results of the tests of immediate analysis, elemental and heating value of the sawdust sample from the sawmill, carried out on a dry basis, were:

- Elemental analysis: Carbon (51.30%), Hydrogen (6.26%), Nitrogen (0.3%), Oxygen (40.56%) and Sulfur (0.18%);
- Immediate Analysis: Ash (1.4%), Volatile Materials (78.5%), Fixed Carbon (20.1%) and Moisture Content (27%) and;
- Heating: HHV: (20.76 MJ/kg) and LHV: (19.41 MJ/Kg).

The carbon content is a chemical property with the highest mass % in the elemental composition of the evaluated sample. This feature contributes to combustion generating more energy. Biomass with higher carbon contents indicate a great potential to be used in thermal processes (SANTOS et al., 2011). On the other hand, high concentrations of sulfur and nitrogen, according to Obernberger (2005), contribute negatively to human health and the environment. This happens due to the formation of nitrogen oxides (NOx) and sulfur dioxide (SO_2) during biomass combustion, but in samples of species of forest origin, these rates are low.
The sample showed a low variation in relation to the HHV and LHV results that may be related to the moisture content. The ash content in samples of forest origin is generally low, which is good, as this characteristic can directly influence the corrosion of energy conversion equipment.
The physical-chemical characterization of biomasses presents information about the chemical and physical-chemical properties that can be considered determinant, particular for each application and, mainly, the energetic value for the definition of the technology of energetic exploitation, emission control, corrosion and better performance of the process in the generation of bioenergy.