

The Possibility of Biomasses and Coal Co-Firing, New Trend in the Environment Saving in the Czech Republic

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Introduction

In the past, biomass as a energy source was almost only one usable energy which had accompanied man since the past until the last century.

The development of civilization, industrial revolution and mechanization of production have led to an enormous growth of consumption of all kinds of energy and recoverable sources of energy have become insufficient.

The second half of the twentieth century has seen the trend directed towards the decreased consumption of energies and mitigation of unfavourable impacts of high consumption on the environment.

One of many opportunities arises from the use of recoverable sources of energy and it is the utilization of biomass as a supplementary source of energy. In our climatic conditions, of particular concern is the utilization of timber as biomass.

Timber material

The opportunities of the utilization of timber material are given by its physical and chemical properties. The basis of timber waste is organic timber material which is formed by cellular walls turned to wood whose chemical substance is cellulose. The interior content of cells consists of proteins, starch, sugars, fats, tanning materials, resins and plant colouring matter. The timber material contains also a small percentage of inorganic substances (not burnable substances).

A high portion of burnable substances creates the condition for releasing a significant quantity of heat when the timber material is burnt or if the objective is to get noble fuels.

Due to low contents of ash in timber material and the absence of sulphur the timber material represents a high-value and environmentally-friendly fuel. In total, about 70% is burnt from the timber material used.

The moisture plays a very important role during a combustion process of biomass. The greater values it will contain, the more heat will be needed (it will be consumed) to dry up and heat the biomass. A limit content of water in fuel accounts for 60%, then starting from this figure the biomass is almost impossible to be burnt. The increased water content brings along problems with conveyance of fuel to a boiler. Average values of moisture are recorded around 30%, however, this value depends on a type and on a

method of fuel storage. In the case of the controlled combustion process, waste gases resulting from the combustion process comply with the emission limits, sometimes problems with a limit for CO and the production of soot may be encountered.

Possibilities of the common combustion process of solid fossil fuels together with timber material

Since the first beginnings of combustion processes of fossil fuels there have been attempts to burn together the timber material with coal. Even today, the dried up waste wood is used for ignition in a majority types of stoker-fired boilers.

From the viewpoint of a choice of a suitable type of combustion equipment which would be capable to burn together the timber material, the following group of additional operational systems should be solved:

- storage of timber material on wood stores,
- conveyance of timber material to a boiler house
- storage and conveyance of timber material from the existing containers into a boiler
- treatment of timber material prior to burning
- a choice of a suitable type of combustion equipment
- emissions and disposal of ash matter.

Basic problems during the combustion process of timber material, the reconstruction of boiler houses

- a) Storage of timber material on wood stores
- b) Transportation of timber material to a boiler house
- c) Storage and transportation of timber material for treatment or combustion in a boiler house
- d) Treatment of timber material prior to the combustion process
- e) Selection of a suitable type of combustion equipment
- f) Emission and disposal of ash matter.

Biomass burning in the boilers for fossil fuels

At present, solid fossil fuels are burnt on the following types of grates:

- stoker-fired boilers with a stationary grate

- stoker-fired boilers with a travelling grate (a shifting grate, a reversible moving grate, a belt grate)
- granulation boilers with powder furnaces
- fluidized bed boilers.

Possibilities for the reconstruction of the particular types of boilers depend primarily on:

- expected quantity of biomass to be burnt
- local conditions given by the existing boiler equipment
- character and physical-chemical properties of biomass.

Involvement of students in the problems of industrial enterprises

Within the framework of research activities conducted at the Department of Energetics at VSB- Technical University of Ostrava, the students are involved in research split into the particular phases.

Within the framework of dissertations of engineer and bachelorship studies, the students have been assigned to the relevant research programmes primarily with regard to the fact that the approach of man to the given problem who is not "overloaded" with the detailed specialized knowledge in the given field can be surprisingly creative.

This principle is also applied by the industrial companies that appreciate the co-operation from the side of students, especially from those in their final year of studies, while attempting to find out new solutions. Evidently, not all solutions suggested by students are usable and in many cases only some solutions are viable.

Clearly, this co-operation is advantageous for students. Often, for the first time in their lives they have to face the problem how to cope with the particular technical issues and that they are not expected to focus on more or less simple "school" tasks. In some cases, the students get their chance and their suggestions are realized, and/or they get explanations why their ideas cannot be implemented in practice. The problem of project which is described in the paper submitted, is solved by the students as well as who focus their efforts on the solution of problems of a considerable interest in an unconventional way. Figs. at the annex summarize some achieved results.

The students during the research stage into a problem have come to conclusion that the primary measures oriented to the environmental protection are very advantageous both from the environmental and economic standpoint. The fact that ecology, energy and economy have the same first letter in their names almost in all languages has been shown to them in practice.

Evaluation

The contribution of students and for students

In the light of future involvement of students in work at the industrial companies it seems almost inevitable for them to become familiarized with a daily work at these companies,

not only through visits or through specialized lectures. In many cases, the students have a rather vague idea of „an usual working day“ of employees at an industrial enterprise and the students ideas may greatly differ from the reality.

Moreover, based on our experience the utilization of measuring equipment used in a daily practice, not only at the University's laboratories seems very important and it offers our students to carry out the measurements on real power generation units. However, this fact brings problems in the connection with the organisation of the course of studies and employment at the industrial company.

However, the advantage for both sides was explained (the Department of Energetics was successful with its efforts at several industrial companies) and the problem with safety of students at the enterprises has been solved and it is clearly shown that such preparations have contributed to a better involvement of students in practice, the period of acquirement of necessary training has required a shorter time even in situations when students have acquired a managerial post at a company.

Improvement of the environment

No emissions of SO₂ occur during the combustion process of timber material and sulphur is not bound even of a slight quantity of ash produced (this bond occurs in the case of fossil fuels) which may be further used as fuel. The quantity of fuel nitrogen falling on 1 MNWh of heat is lower at burning the timber material in comparison with brown coal. Then due to this reason the production of NO_x is lower. The contents of molecular nitrogen affects the origin of thermic NO_x. It depends on the burning temperature and on the time of contact of reacting substances. The restriction of the quantity of produced NO_x may be affected by a construction (a reconstruction) of furnaces.

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