Optimization of the Production Process of Wood Pellets by Adding Additives

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ABSTRACT

In this work are described the possibilities for improving efficiency of wood pellets production. The introductory part is devoted to analyzing the properties of wood pellets, combustion and production of pollutants when combusted it. The production of wood pellets and used pelleting machines was analyzed. The main task of this work is to introduce efficiency pelleting lines and cost reduction of the wood pellets production as fuel with a focus on the effects of adding additives. The results of experimental measurements and properties of wood pellets with different additives are presented in the final part.

Keywords: Additives, Efficiency, Lignin, Matrix, Pellet Mill, Wood Pellets

INTRODUCTION

With declining reserves of fossil fuels and increasing energy consumption, it is necessary to seek new sources of energy. Biomass plays an increasingly important role in reducing fossil fuel consumption. Wood pellets are a form of biomass. This noble biofuel meets in addition to energy, ecological and environmental criteria and the criterion of comfort and safe combustion. Although the consumption of wood pellets in Slovakia can be estimated only for a few thousand tons per year but with the gradual erosion of fossil fuels can be estimated that the use of wood pellets will expand. But with the gradual erosion of fossil fuels and their growth rates can be estimated that the use of wood pellets will expand.

The work should familiarize themselves with the characteristics of wood pellets, with the manufacturing process of wood pellets production line, with each used equipment with a focus on the principle of individual species pelleting mills. It has pointed out, what happens during the pelleting process, and the problems they may encounter in pelleting. The main objective of this work is determined what influences have additives on production efficiency and properties of wood pellets.

DOI: 10.4018/ijeoe.2012040102
The authors did not find work that would be similar in experiments on wood pellets production on this scale. It is expected that the addition of additives will be spread among producers of wood pellets after the experimental testing.

WOOD PELLETS

Pellets are a form of wood fuel. They are cylinders with a diameter of 6-10 mm and a length of 10-50 mm manufactured from raw wood (chips, sawdust) made by compression, called pelletizing, usually with no chemical additives. It is a modern form of compaction of biomass, which offers interesting possibilities for the development of renewable energy worldwide. In the use of compacting biomass is dominated by wood residues, which are otherwise not processed and still contain large amounts of energy. Trees are not only intentionally harvested for their manufacture.

The advantage of pellets is their low relative humidity - about 8 to 11%. They have relatively high bulk density material, a minimum of 650 kg.m$^{-3}$. The energy content of wood pellets is approximately up to 20 MJ.kg$^{-1}$, which allows burning them with very high efficiency. These properties are close to traditional fuels such as coal. Their regular geometry and small size allow automatic operation with a very large power control. The burner can be easily fed screw or pneumatic conveyor. Currently, there are many heat sources compatible with the pellets. They are also applied to local heat sources (fireplaces, stoves). Their advantage is that they require less frequent monitoring, in contrast to traditional heat sources.

The production of wood pellets in Europe and North America began in the seventies of the twentieth century after the start of the oil crisis. At this time, pellets were attractive for people's attention because of their high quality and can be a substitute for fossil energy fuels. However, when oil prices returned to its original value, people had no interest of this alternative method. Their rebirth occurred in the nineties of the last century, as some States have introduced the use of pellets due to its policy (green taxes, state subsidies, etc.) and as countermeasures against global warming, energy security and the rise of oil prices.

The disadvantages of using wood pellets are high investment costs for heating equipment (boiler, storage, transport system) and high technology requirements for compliance. Contain relatively complex components compared with conventional devices which can be a source of disorder. For correct operation, requiring a small amount of electricity and in case of blackout is needed some backup power, usually in the form of a backup battery. Storage space must be large enough and well protected from moisture. Another disadvantage is that installation is not completely unattended. The boiler requires regular cleaning and ash removal.

PROPERTIES OF WOOD PELLETS

The most important characteristics of pellets are: composition, calorific value (lower calorific value), density and bulk density, residual water content, hardness and abrasion.

Composition and Colour of Wood Pellets

Wood pellets are usually made only of wood. Types of pellets can be different depending on the used wood (coniferous, deciduous), or the amount of used bark, which sometimes can be observed according to their colour. Dark pellets are usually regarded as inferior because they are often made of a material with a lot of bark. Bark of wood is in contact with the surrounding environment and its structure is very porous, so naturally captures the surroundings not only chemicals but also particles of solid materials. On this basis, it can be assumed that the dark pellets contain more undesirable constituents, which impair their quality (increase the amount of ash). If pellets as a whole are dark without distinct dark spots, they need not be made from a bark. When the manufacturing process ac-
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