Biblid: 1821-4487 (2016) 20; 3; p 122-124
UDK: 662.767.2

Original Scientific Paper
Originalni naučni rad

CHARACTERISTIC OF BIOMASS AS A ENERGY FURNACES FOR DRYING TOBACOO

KARAKTERISTIKE BIOMASE KAO ENERGENTA LOŽIŠTA KOD SUŠENJA DUHANA

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ABSTRACT

Excessive use of fossil fuels has an extremely negative impact on the environment and climate because it results in toxic gas emission into the atmosphere. The negative effects of the fossil fuels use leads to distinctive need for renewable energy sources that affect environmental pollution less. One of little-used renewable energy source today is biomass. Biomass combustion chambers have been so perfected that we can say that the combustion of biomass (as far as work and serving) equals the combustion of coal or even liquid fuels. The study was conducted in Croatian tobacco factory on the tobacco dryer combustion chambers at „A" and „B", with the aim of justified introduction of new chambers as new technological measures. In addition to increasing the income, measures taken to lower drying costs are as important. Such measures are of great importance for the development of certain regions, employment and Republic of Croatia entrepreneurship promotion.

Key words: *biomass, drier tobacoo, combustion chamber.*

REZIME

Prekomjerna uporaba fosilnih goriva ima izrazito negativan utjecaj na okoliš i klimu jer rezultira emisijom štetnih plinova u atmosferu. Negativni učinci uporabe fosilnih goriva dovode do izrazite potrebe za obnovljivim izvorima energije koji manje utječu na zagađenje okoliša. Jedan od danas premalo korištenih obnovljivih izvora energije je energija biomase. Ložišta za biomasu danas su toliko usavršena da možemo slobodno reći kako je loženje biomase (što se tiče rada i posluživanja) jednako loženju ugljena ili čak tekućih goriva. Cilj istraživanja je uporediti karakteristike biomase (peleta) kao energenta za sušenje duhana u odnosu na energent zemni plin. Istraživanje je provedeno u Hrvatskom poduzeću duhana na ložištima sušara za sušenje duhana na lokaciji „A" i „B", s ciljem opravdanosti uvođenja novih ložišta kao nove tehnološke mjere. Pored mjera povećanja prinosa važnu ulogu imaju i mjere smanjenja troškova sušenja. Takove mjere imaju veliki značaj na razvoj pojedinih regija, zapošljavanje i poticanje poduzetništva u RH.

Ključne riječi*: biomasa, sušare za duhan, ložišta.*

INTRODUCTION

The progress of civilization has led to great discoveries and great improvements in the quality of human life. But at the same time there was also a great attachment to energy sources that allow the maintenance of the achieved level of progress and ensure further progress. The consequences of energy supply loss are almost unthinkable today. Fossil fuels are the primary source of energy used in the world today, they are non-renewable, and sources of fossil fuels will be exhausted in not too distant future, therefore, we must begin to use new forms of energy. One of today's under-used energy sources is biomass. Biomass as a fuel has a significant advantages in terms of environmental protection, because its use does not increase the concentration of carbon dioxide atmosphere, which fully fits into the Kyoto agreement *(Dakić, et al., 2009)*. The means for obtaining energy from biomass are different. Direct production of electricity or thermal energy is possible, as well as the conversion to solid, liquid or gas fuels. Directly cultivated plants can be used as biomass for energy production, or plant residues generated in forestry and agricultural production *(BIOEN, 1998)* can be used. In the production of tobacco Croatian companies introduce new technological measures in order to maximize the incomes and reduce costs. In addition to measures for income increase, an important role have the measures to reduce the cost of drying tobacco, the same problems are recognized in fossil fuels (mainly used - natural gas), and in drying tobacco in recent years new coal is introduced - thermogen with the technical characteristics required for the basic conditions in the tobacco drying process and to get the thermal energy required for drying, biofuels in the form of firewood, pellets and wood chips are used. The goal of the research is to compare the characteristics of biomass as fuel for drying tobacco in relation to the natural gas energy source.

MATERIAL AND METHOD

The research included drying tobacco with thermogen "XY" which uses biofuel pellets. The same is incorporated in the tobacco dryer of the owners "A" and "B". Due to the comparison study was deducted on the classic tobacco drying with gas as fuel as well.

Thermogen "XY" can use pellets and firewood. Thermogen in the location "A" is installed in place of the existing one and uses pellets that are stored in the container of 0.5 m^3 volume for drying. The same can hold approximately 300 kg of pellets. Pellets, through dispensers, enter into a combustion chamber where they burn with the support of air which is introduced below the firebox. Gases transfer heat to the air in the dryer through exchangers. The air temperature is maintained manually via thermo-regulator and humidity is determined by opening the valve gate through which the fresh air of lower moisture content enters the dryer. Radial fan of 18,000 m^3/h capacity in the space

above the combustion chamber and heat exchanger (Picture 1) is used when drying tobacco. Thermogen at the location 'B' is installed outside the space of the existing in a way that is connected with the drying chamber via the lower channel in which is a radial fan for air circulation in the oven and the upper channel through which air returns to the thermogen heating. Fan capacity is 18,000 m^3/ h. Pellet tank is installed sideways of the thermogen and has a volume of 0.60 m^3. Pellets are introduced into a combustion chamber through dispensers where they burn with the support of air which is introduced below the firebox (Figure 2).

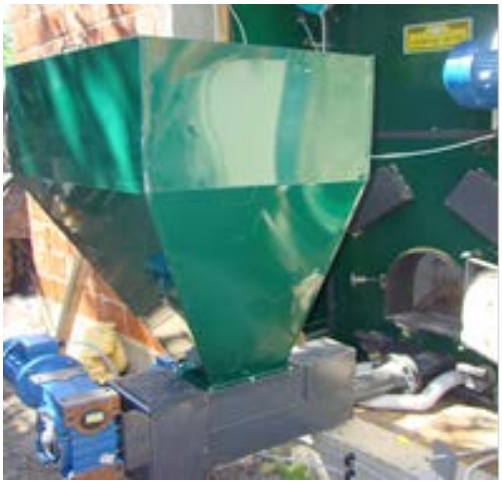

Fig. 1. Heat generator "XY", location A

Fig. 2. Heat generator "YX", location B

The temperature required for drying is regulated manually and humidity by manual latch opening.The pellets are packed in plastic bags and have a mass of 15 kg. The diameter of pellets is 6 mm, length is 30 mm, and moisture is 8 %. The mass volume of 1 m^3 is 650 kg. Energy value of pellets is 18000 kJ/kg. Price of 1 kilogram of pellets is 1.29 kn (Picture 3). Price of one cubic meter of natural gas was 4.54 kn, and by the decision of Government brought on August 1, is now 3.20 kn for smaller consumers. Energy value of natural gas is 33.120 kJ/m^3.The study used: scales to measure the weight of tobacco before and after drying. Electronic thermometers, in the drying process, were used to measure the air temperature and humidity in the dryer, and gas temperature in the chimney. Data was transmitted wirelessly to the computer through the sensors. Data is stored in numerical and graphical form in the computers so that the drying process can be continuously monitored from start to finish.

RESULTS AND DISCUSSION

After drying tobacco in the dryer SD 105 times 105 frames, and 3 channels, with the heat generator "XY", on location "A", following results were obtained:

Average tobacco filling was 50.42 kg per frame, and there was total of 5294 kg of tobacco in the dryer. Humidity of harvest tobacco is around 82 %. The process of drying tobacco is carried out by gradually increasing the temperature and humidity of tobacco by gradually reducing to 10 % at the end of drying.

Drying process of wood pellets was performed in a way that the pellets from the piles near the dryer were inserted into the tank heat. Drying temperature, with the pellets, was achieved without difficulty and at every stage of drying the same could be easily maintained (figure 4). The pellets were of uniform size, and did not cause dispenser congestion. The green curve indicating the drying temperature in the chart has the necessary value greater than 60 °C in the moment when drying the leaf is planned to start, when the heat for drying is most needed and has the right growth. The blue curve shows correct decrease of moisture during the drying. Temperature of the combustion gases in the chimney ranges from 55 up to 180 °C, visible as the red curve. After drying the tobacco in the dryer SD 1153 times 153 frames, and 3 channels, to the heat generator "XY", at the location B. the following results were obtained:

Average tobacco filling was 60.28 kg per frame, and there was total of 9223 kg of tobacco in the dryer. Humidity of harvest tobacco is around 80 %. The process of drying tobacco is carried out by gradually reducing to 10 % at the end of drying.

Drying process with the wood pellets was performed so that the thermogen container was filled from the bags, and using two-axle dispensers pellets were put into the firebox.

Drying temperature, with the pellets, was achieved without difficulty and at every stage of drying the same could be easily maintained (figure 4). The pellets were of uniform size, and did not cause dispenser congestion. The green curve indicating the drying temperature in the chart has a bit lower value (40 °C) from the necessary one (50 °C) in the moment when drying the leaf is planned to start, when the heat for drying is most needed and has the right growth. The blue curve shows correct decrease of moisture during the drying. Temperature of the combustion gases in the chimney ranges from 65 up to 205 °C, visible as the red curve.Tobacco drying, with natural gas, was carried out in the smokehouse with 78 frames, total mass of 4196 kg. The air temperature in the dryer, shown as the green curve in figure 5,

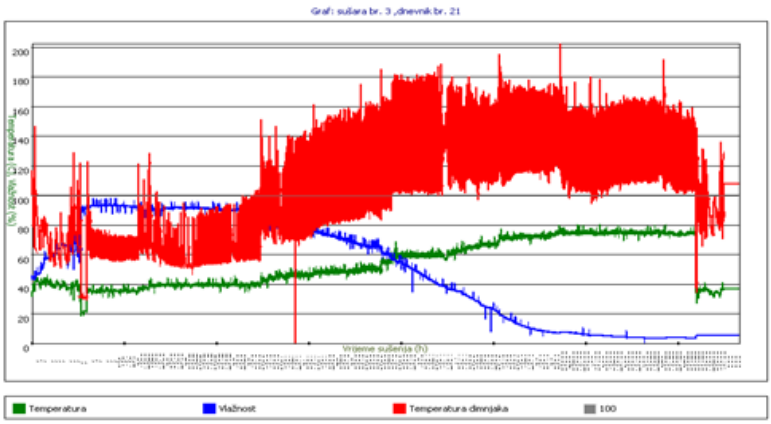

Fig. 3. Temperature movements and air humidity when drying tobacco with pellets in a dryer SD105

had the proper growth and was in default values. Humidity, shown as blue curve, has a more rapid decline which means faster drying. The red curve represents the temperature at the exit of the chimney ranged from 25 °C in the phase of yellowing to 130 °C in the phase of drying the leaves and fins.

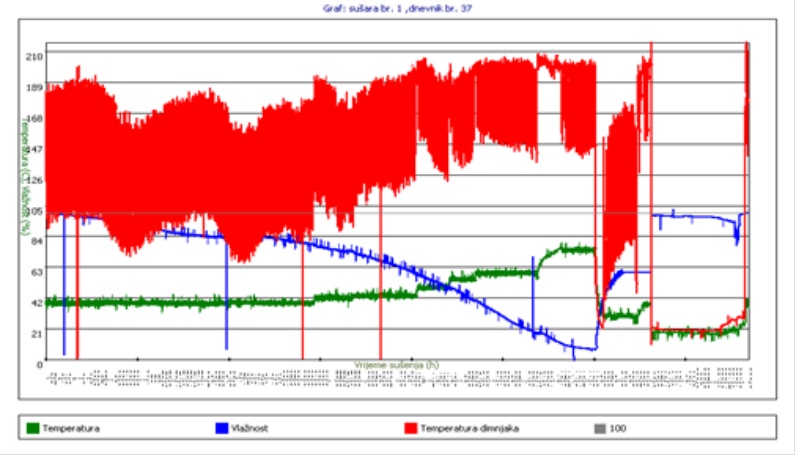

Fig. 4. Temperature movements and air humidity when drying tobacco with pellets in a dryer SD153

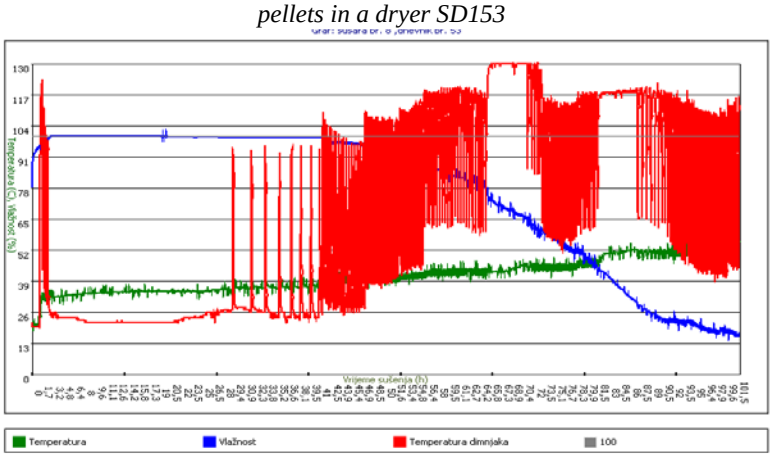

Fig. 5. Temperature movements and air humidity when drying tobacco with ntural gas

CONCLUSION

After conducting the research on the tobacco drying with the heat generator "XY" built into the dryers SD 105 and SD 153 following conclusions were obtained:

1. Using pellet the heat generator at the dryer SD105 has provided the required temperature in all stages of drying.
2. Using pellet the heat generator at the dryer SD153 has provided the required temperature in all stages of drying. It is necessary to strengthen the capacity of the combustion chamber with wood to be able to dry the tobacco without difficulty.
3. When drying tobacco with pellets installation of a radial fan which provides higher pressure and better circulation of air in the dryer is recommended.
4. Using biofuel when drying tobacco in comparison to natural gas is both ecologically and economically justified.

REFERENCES

BIOEN (1998). Program korištenja biomase i otpada I. Energetski institut "Hrvoje Požar", Zagreb.

Dakić, D., Erić, A., Đurović, D., Erić, M., Živković, G., Repić, B., Mladenović, M., Nemoda, S., Mirkov, N., Stojanović, A. (2009). One of the possibilities how to use agricultural biomass by-products as fuel. Journal on Processing and Energy in Agriculture, 13 (1), 81-84.

Domac, J. (2000). Hrvatski sustav korištenja biomase. Magistarski rad, Fakultet elektrotehnike i računarstva Sveučilišta u Zagrebu, Zagreb.

Đonlagić, M. (2005). Energija i okolina, udžbenik, Tuzla. 235 – 278.

Katić Z. (1997). Sušenje i sušare u poljoprivredi, udžbenik, Zagreb, 379 – 388.

Kostić S.(1987). Tehnologija sušenja duhana svijetla virginija. III Savjetovanje tehnologa sušenja i skladištenja, Stubičke Toplice, 252 - 268

Received: 03. 03. 2016. Accepted: 08. 04. 2016.