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# СРАВНИТЕЛЕН АНАЛИЗ НА ГОРИВА ОТ БИОМАСА
# COMPARATIVE ANALYSIS OF BIOMASS FUELS

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**Abstract**

One of the most reliable and highly effective methods for the full utilization of waste biomass containing lignocellulose is its conversion into briquettes and pellets for energy purposes. In this regard, the use of agro-bio-mass, including straw for energy production is enforced as an effective renewable energy source. In current practice, the majority of agro-cellulose waste is allowed to decompose naturally, providing manure for the soil. Some waste can lead to significant environmental problems (e.g. the pollution of surface waters). On the other hand, the burning of stubble often leads to the occurrence of forest fires. Therefore, the utilization of agro-biomass as a cheap energy sourcebecomes an increasingly important alternative.The article studies the influence of technological factors on the biomass calorific value and shows the technology for biomass utilization at a maximum calorific value.

**Key words:** biomass, bio-reactor, the energy complex, power plants.

## INTRODUCTION

It Biomassas an energy source, covers the entire range of organic matter that surroundsus. (Aniskin, 2005). The neutral character in relation to the carbon content, its relatively evenly geographical distribution and not thel east – the price are the most important of its competitive advantages. One of the most rational and high efficient methods for full utilization of the wasteligno cellulose biomass is using its energy needs. In this regard the use of agro-biomass, including and straw for energy production is inforcedas an effective renew able energy source. In current practice, the greater part of agro-cellulose waste is allowed to decompose naturally, which to some degree recovered as fertilizer for the soil. About some waste, placing the mat the treatment may lead to substantial ecological problems (eg. Pollution of surface waters). Of the other part the burning of stubble of ten leads to the occurrence of forest fires and soil degradation. Therefore, more and more becomes important alternative for utilization of agrobiomass as cheap energy source. Calorific value of straw is relatively high (18 MJ/kg). Depending on changes in the water contents changes and calorific value biomass. Thus, due to the high moisture content of the lumber, calorific value of the wood is reduced almost twice.

AIM: To explore and define the bottom calorific value of various types of biomass depending on the humidity as biofuel.

## MATERIALS AND METHODS

To conduct laboratory experiments using wheat straw. That delivers twice as density bales respectively 90.5 kg/m$^3$ - the first delivery and 125.0 kg/m$^3$ - for the second. The measured moisture content by weighing method is 9.5% for the first and 10.3% for the second delivery. Low levels of moisture due to the fact that the bales are stored in covered warehouses. The other type biomass is wood with a diameter not greater than 80 mm at different humidity. The survey was held industrial combustion installation, workshop of "BAMEX" JSC Karlovo.

## RESULTS AND DISCUSSION

The tables shows that the chemical composition of agro-biomass (wheatstraw) does not differsubstantially from that of wood. High erash content in straw was mainly due to the inclusion of soil and sand when harvesting and tran sported. In the sebiomass does not contain dangerous to human health heavy metals.

***Fig. 1.*** *Laboratory unit for the Study of calorific value of the biomass*

**Table 1.** Lower calorific value [in kJ] of the biomass depending on the humidity

| **Humidity, %** | 5% | 10% | 15% | 20% | 25% | 30% | 35% | 40% | 45% | 50% |
|---|---|---|---|---|---|---|---|---|---|---|
| **Solid biomass** | | | | | | | | | | |
| Oak | 4653 | 4377 | 4100 | 3824 | 3547 | 3271 | 2994 | 2718 | 2441 | 2165 |
| Hornbeam | 4530 | 4260 | 3990 | 3720 | 3450 | 3180 | 2910 | 2640 | 2370 | 2100 |
| Beech | 4596 | 4323 | 4049 | 3776 | 3502 | 3229 | 2955 | 2682 | 2408 | 2135 |
| Acacia | 4720 | 4440 | 4160 | 3880 | 3600 | 3320 | 3040 | 2760 | 2480 | 2200 |
| Wheat straw | 5005 | 4710 | 4415 | 4120 | 3825 | 3530 | 3235 | 2940 | 2645 | 2350 |
| Poplar | 4530 | 4260 | 3990 | 3720 | 3450 | 3180 | 2910 | 2640 | 2370 | 2100 |

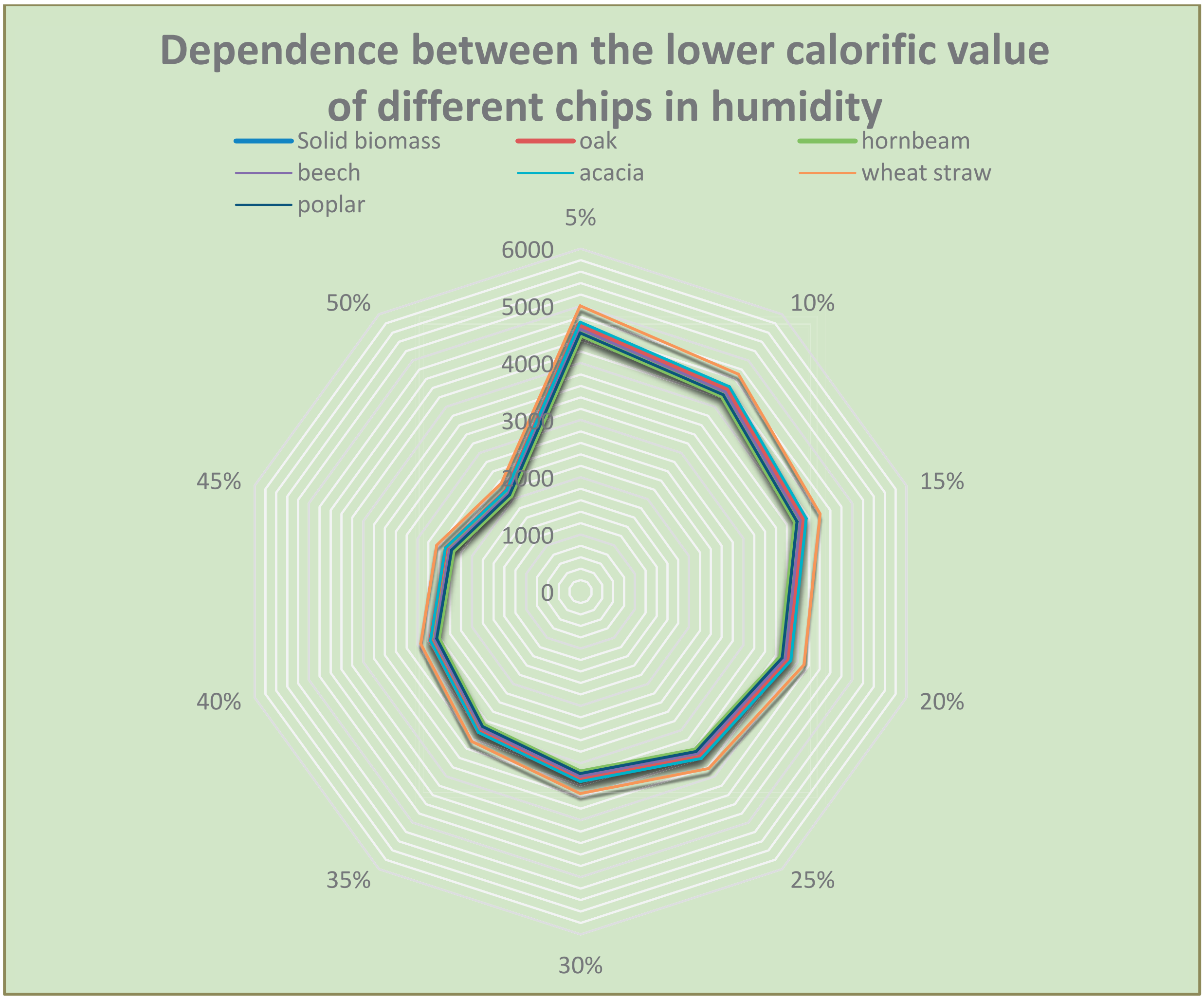


***Fig. 2.*** *Dependence between the lower calorific value of different chips in humidity 50%*

**Table 2.** Chemical composition of biomass

| № | TYPE OF BIOMASS | C | H | O | N | S |
|---|---|---|---|---|---|---|
| **1** | pine with bark | 49,5 | 6,5 | 42,6 | 0,12 | 0,014 |
| **2** | spruce with bark | 49,8 | 6,3 | 43,2 | 0,13 | 0,015 |
| **3** | beech with bark | 49,7 | 6,2 | 45,2 | 0,22 | 0,015 |
| **4** | poplar | 47,5 | 6,2 | 44,1 | 0,42 | 0,031 |
| **5** | willow | 47,1 | 6,1 | 44,3 | 0,54 | 0,045 |
| **6** | bark of conifers | 51,4 | 5,7 | 38,7 | 0,48 | 0,085 |
| **7** | wheat straw | 45,6 | 5,8 | 42,4 | 0,48 | 0,082 |
| **8** | rye straw | 46,6 | 6 | 42,1 | 0,48 | 0,082 |
| **9** | straw rape | 47,1 | 5,9 | 40 | 0,84 | 0,27 |
| **10** | millet straw | 47,5 | 5,8 | 41,4 | 0,46 | 0,089 |
| **11** | coal | 72,5 | 5,6 | 11,1 | 1,3 | 0,94 |

**Table 3.** Harm ful substances when burning

| CONTENTS | ONE TONE COAL, % | ONE TON BIOMASS, % | INGREDIENTS |
|---|---|---|---|
| Ash | 25,6 | ≤ 5 | 5 TIMES LESS |
| Sulfur oxides | 25-30 | ≤ 2 | 12,5 TIMES LESS |
| Nitrogen oxides | 5 | 1,8 | 2,6 TIMES LESS |
| Carbon dioxide | 40 | 1 | 40TIMES LESS |

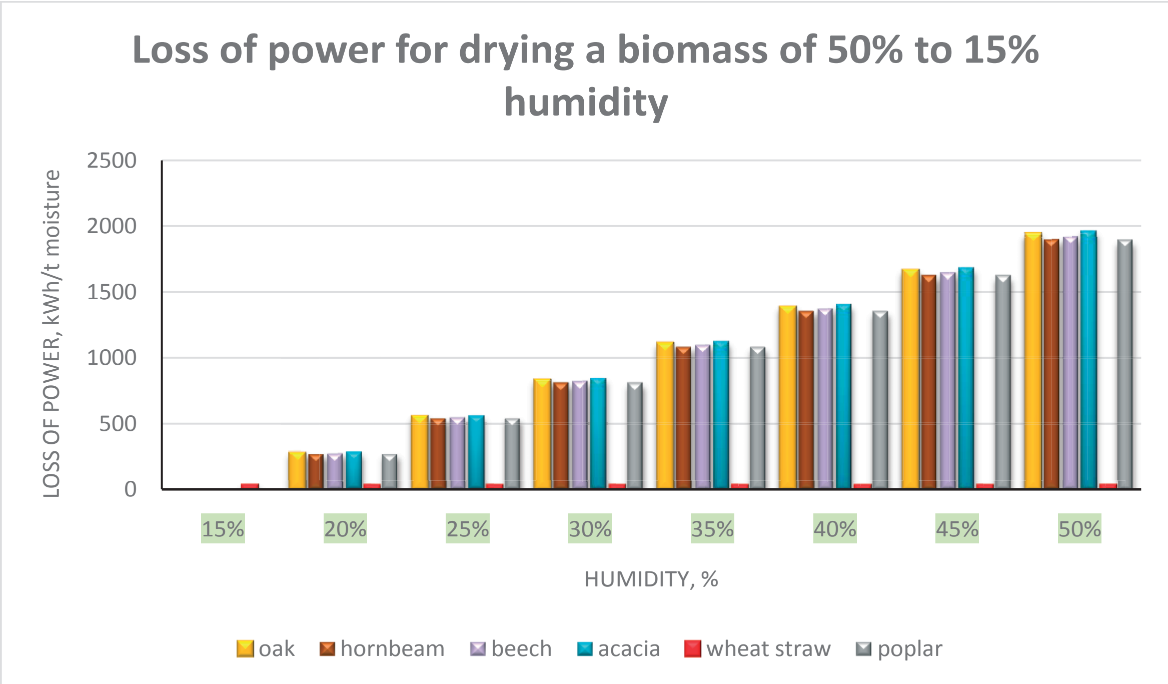


***Fig. 3.*** *Loss of power for drying a biomass of 50% to 15% humidity*

From this study, it appears that waste biomass did not differ significantly by energy content at the same humidity. In the preparation process, different types of biomass differin moisture, which leads to differences in the lower heat value. Another significant factor in the selection of biomass as an energy source is the energy density of the fuel. This parameter influences the storage capacity for biomass. It is possible to increase the energy density of biomass briquetting or by baling, but this approach leads to more expensive fuel.

## CONCLUSIONS

1. It is justified to use straw as biofuel in view the energy value of the material.

2. Problem is storage of straw as fuel due to the low density of the bales of fodder.

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