# VEGETABLE RAW MATERIALS AND COMBUSTION HEAT DETERMINATION OF CHARCOAL

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The purpose of the work was to establish the relationship between the data of express analysis (moisture, ash content, output of volatile substances, non-volatile carbon content) and elemental (carbon, hydrogen, nitrogen, sulfur, oxygen content) composition of various types of vegetable raw materials and charcoal with their higher heat combustion, as well as the effect of changes in technical and elemental analysis indicators on the value of the higher heat of combustion ($Q_s^{daf}$) of the studied samples. Mathematical dependencies have been developed for predicting the higher calorific value of plant raw materials and charcoal with high accuracy (correlation coefficients exceed r > 0.5) based on carbon and oxygen content, atomic ratios between carbon and oxygen.

The heat of fuel combustion is defined as the amount of thermal energy released when a certain amount of it is burned. Heat of combustion is an important plant property that may reflect the ability to capture solar radiation during photosynthesis. The heat of combustion is also an important indicator for assessing the material cycle and energy transformation in forest ecosystems.

The paper shows that the heat of combustion of coniferous wood species is higher than that of deciduous wood, moreover, different components of wood, such as stump, trunk, top, bark, leaves and branches also have different heat of combustion.

The heat of combustion of vegetable raw materials is related to its elemental composition, particularly the carbon, hydrogen and oxygen content. Different types of vegetable raw materials are characterized by different elemental composition and, therefore, have different amounts of heat of combustion.

It contains equations (1) and (2), which allow predicting the higher heat of combustion of plant raw materials based on its elemental composition:

$$Q_s^d = 0{,}3491 \cdot C^d + 0{,}1783 \cdot H^d + 0{,}1005 \cdot S^d - 0{,}1034 \cdot O^d - 0{,}0151 \cdot N^d - 0{,}0211 \cdot A^d, \quad (1)$$

$$Q_s^d = 0{,}2949 \cdot C^d + 0{,}8250 \cdot H^d, \quad (2)$$

where $Q_s^d$ – is the higher heat of combustion in the dry state, MJ/kg;
$C^d$, $H^d$, $S^d$, $O^d$, $N^d$ – the content of carbon, hydrogen, sulfur, oxygen and nitrogen in the dry state, %;
$A^d$ – ash content, %.

The coefficients in equations (1) and (2) show that the content of carbon, hydrogen and sulfur has a positive effect on the higher heat of combustion, and the content of nitrogen and oxygen has a negative effect.