

Nutrient content in biochars derived from different feedstocks

Zawartość składników mineralnych w biowęglach uzyskanych z różnych materiałów organicznych

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Biochar is formed as a by-product in thermal conversion of biomass under limited oxygen conditions. As a result of this process carbon and nutrient rich material is produced. Mineral composition of biochar depends primarily on the type of feedstock material and pyrolysis parameters such as temperature and residence time in the reactor. Biochar is mainly dedicated as soil amendment due to its high capabilities for improving soil properties. Enhancement of sorption properties and abilities for nutrient storage, increased water retention, liming effect and promotion of microbial activity are the main advantages of this material as a soil conditioner. Many studies has reported increase of crop yield after biochar addition, however some researchers emphasize value of the material as a fertilizer. Biochar can also be used as a component of horticultural growing media. The aim of the study was to determine the mineral content and nutrient availability, in three types of biochars derived from different feedstocks. As a source of biomass wheat straw, corn cobs and miscanthus were used for thermal conversion process at 500°C. The total content of the components was determined by ICP – OES after microwave sample digestion with HNO₃ + H₂O₂ mixture. The content of available forms of nutrients in the aqueous extracts was determined after 2 hours shaking the samples in 1:40 ratio. Additionally pH_{H₂O} and C_{org} on th CS-MAT apparatus were determined.

Total mineral content varied between samples depending on the feedstock type. Wheat straw biochar had highest total contents of microelements (mg · kg⁻¹ d.m.): iron – 1042 manganese – 306, copper – 15, zinc – 40 and boron – 8. In corn and miscanthus biochar total content of micronutrients was much lower. The highest concentration of phosphorus, potassium, calcium were also found in wheat straw biochar, but corn biochar was the richest in nitrogen – 8 g · kg⁻¹ d.m. Available forms of mineral elements also depended strongly on the feedstock type but also on tested element.

The availability of nitrogen in all the tested biochars does not exceed 7%, similar to magnesium. High availability of K and P (respectively 42 and 17% in biochar prepared from wheat straw) was determined. Most of the available forms of micronutrients were in the range from 5 to 10% of the total content, except zinc (17.7%) and copper (25%) in miscanthus biochar.

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