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## **On the measurement of water content in charcoal mixes by microwave methods**

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### ***Abstract***

*We applied the microwave water content measurement method to investigate the moisture level in charcoal mixes of 4 types. The results of our experiments revealed possibility and the best approach to such measurement for charcoal mixes in desired range of moisture.*

**Keywords:** *Moisture, charcoal mixes, microwave water content measurement, transmission technique.*

### ***Objective***

The main goal of this work was to test applicability of microwave transmission technique to water content measurement in operational range for charcoal mixes of different types.

### ***Description of material and sample preparation***

The studied charcoal samples were supplied in the form of milled flakes/powder. Each sample consisted of different origin charcoals mixed in certain proportions, with or without husk. The codes of charcoal types were A, AA, B, and BB. Initial water content of the material was in the range of  $\approx 10\text{--}15\%$ .

To obtain more data points, we wetted the initial material and waited for uniform redistribution of additional moisture. We controlled the achieved moisture both by direct weighting and by weighting after 2-hour drying at  $105\text{ }^{\circ}\text{C}$ .

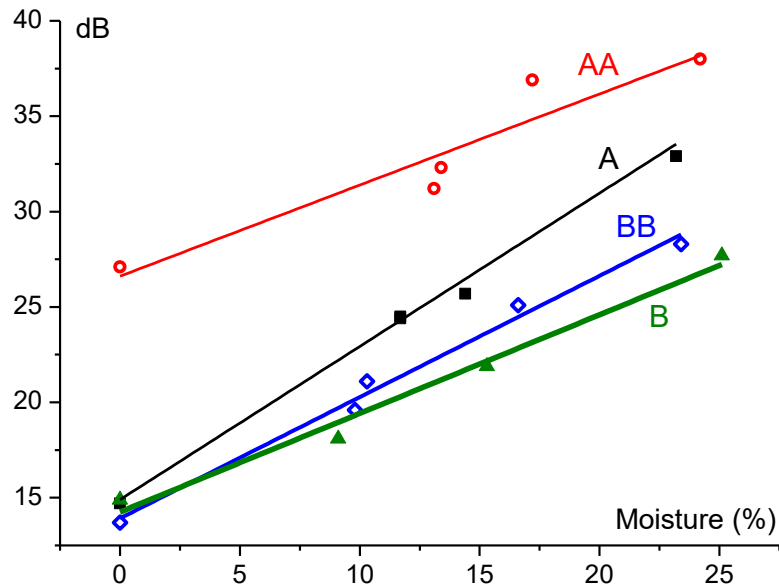
### ***Method and instrumentation***

In our test, we applied a transmission-type laboratory moisture meter. We put certain portion (always the same) of material inside a rectangular waveguide cell and lightly tapped it several times in order to avoid hollows in the layer, layer height being  $90\text{--}$

95 mm. Then 10 GHz microwave radiation was guided into the cell, and the output detector measured the amount of transmitted energy. All measurements were at room temperature.

## Results

The visualization of research results one can in Figure 1 below. There are the values of actual moisture vs. relative attenuation by charcoal layer in dB indicated by the laboratory device.



**Figure 1. Relative attenuation by the charcoal layer against the moisture**

## Conclusion

As it comes from our study, the microwave transmission technique at frequency 10 GHz is able to provide the measurement of water content in mixed charcoal powders in the range 0–25% with accuracy at least 2.5%abs. The factors that can affect the accuracy of measurement under actual industrial conditions are the variations in material composition and density.