

Thermogravimetric analysis of spent coffee grounds

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Due to the prevailing environmental and energy conditions in the world, an urgent task is to study the possibility of consuming waste as energy resources. Coffee is one of the most common agricultural products, as well as one of the most widely consumed beverages in the world. Spent coffee grounds (SCG) are a solid residue with a fine particle size, high moisture (within 80–85 wt %), obtained as a result of making a coffee drink. In the commercial production of coffee drinks, SCG can be separated from other waste, which potentially makes it possible to use it as a recyclable material to produce commercial products, including biofuels.

This paper presents the results of thermogravimetric analysis of spent coffee grounds. The mass loss, the rate of mass loss and the constituent of volatile products were determined depending on the temperature when the samples were heated in an inert medium to 905 °C. The study was conducted using the method of Fourier-transform infrared spectroscopy (FTIR).

As a result of the study, it was found that SCG are characterized by the absence of sulfur in their composition, also a carbon content above 50 wt % and high calorific value (about 20 MJ/kg). As a result of pyrolysis of SCG, up to 75 wt % by weight is released of volatiles. The volatiles contain water vapor, CO and CO₂ gases, the intensity of which decreases with increasing temperature, giving way to the release of more complex organic compounds. Among them, the class of aliphatic hydrocarbons is most active in the composition of volatiles. Carbonyl compounds corresponding to the functional groups of aldehydes, ketones and esters were also identified throughout the active gas release phase.