Development of an experimental set-up for the two-stage pressurized (up to 100 bar) pyrolytic processing of biomass into synthesis gas

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The two-stage pyrolytic conversion method, which combines pyrolysis and subsequent high-temperature cracking of volatile substances in a fixed coal bed, provides a high degree of conversion of the energy of the raw material into synthesis gas, which has a lower calorific value of 10–12 MJ/m^3 and consists of at least 90 vol % from hydrogen and carbon monoxide in a ratio of 1:1 to 3:1 or more, depending on the type of raw material and process parameters. It can be used for the catalytic synthesis of methanol, DME and biofuels after compression to 60 bar, but compressor equipment for hydrogen-containing gas is extremely expensive and energy-consuming. The two-stage pressurized pyrolytic conversion can be used, which will reduce the size of the cracking zone and minimize heat loss to the environment, as well as reduce or completely eliminate compression costs. The process of pyrolysis of wood under high pressure proceeds differently: the composition of pyrolysis gases changes, the yield of the liquid fraction decreases and the yield of solid residue increases, while the resulting biochar has a significantly different microstructure with a developed microsurface, which suggests the prospects for using the solid residue as a sorbent. The JIHT RAS has developed a schematic diagram and determined the design of an experimental set-up for conducting research into the process of two-stage pressurized (up to 100 bar) pyrolytic processing of various wastes (wood at the first stage of research) into synthesis gas.