THERMOPHYSICAL PROPERTIES OF COMPONENTS OF BIODIESEL FUEL AND RAW MATERIALS FOR ITS PRODUCTION

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Biodiesel is a renewable energy resource and has some advantages over petroleum fuels. Biodiesel is a blend of fatty acid methyl or ethyl esters and is produced through the esterification reaction from vegetable oils and animal fats which mainly consist of triglycerides. The paper presents the results of measuring the critical temperatures T_c, the critical pressures p_c, heat capacities C_p, and thermal diffusivities of some fatty acid methyl and ethyl esters and saturated triglycerides. These properties have been measured for the following compounds:

methyl esters of n-alkanoic acids $CH_3O_2C_nH_{2n-1}$ with the number of carbons $n = 6, 7, 8, 9, 10, 11, 12$, as well as oleic, linoleic, linolenic, and erucic acids;

ethyl esters of n-alkanoic acids $C_2H_5O_2C_nH_{2n-1}$ with the number of carbons $n = 10, 11, 12, 14, 16, 18$;

saturated triglycerides $C_3H_5[O_2C_nH_{2n-1}]_3$ with $n = 8, 10, 12, 14$.

The purities of the samples (Sigma-Aldrich, Alfa Aesar) were from 98.5 to 99.9 mol.%.

The compounds stidied are thermally unstable at near-critical temperatures, so that the measurements of the critical properties have been made by the pulse-heating method developed by the authors (GSSSD 163-2010); the method provides ultra-low decomposition of compounds under study in the course of measuring the critical properties. The uncertainties of the measurement of the critical parameters are $\delta T_c = 0.01 T_c$ and $\delta p_c = 0.03 p_c$, where T_c is the absolute temperature. Equations for the calculation of the critical properties of n-alkanoic acid meythyl (ethyl) esters have been obtained.

Heat capacity was measured with the help of a differential scanning calorimeter DSC 204 F1 Phoenix (Netzsch) with the uncertainty of 2%. The measurements of thermal diffusivity were taken by the laser flash technique using LFA 457 MicroFlash (Netzsch); the uncertainty is no more than 5%. Equations for the dependence of molar heat capacities and thermal diffusivities of the compounds studied on temperature have been obtained.

The study was supported by the Complex Program for Basic Research of the Ural Branch of the Russian Academy of Sciences N 18-2-2-13.