CZU:621.436: 662.756

THEORETICAL MOTIVATION OF BIOFUEL COMPOSITION FOR COMPRESSION IGNITION ENGINES

Cerempei Valerian, Banari Eduard
Technical University of Moldova, Chisinau, Republic of Moldova
E-mail: eduard.banari@tran.utm.md

The purpose of this paper is to improve the situation in the ecological field and to improve the technical-economic performance of compression ignition engines (CI engines) by theoretically motivating the composition of the biodiesel-diesel mixed biofuel for fueling these engines. Therefore, diesel (control) and experimental biofuels served as *the object of the research* - pure biodiesel B100, biodiesel-diesel mixtures B20, B40, B50, B60, B75 with respectively biodiesel content of 20, 40, 50, 60, 75% vol.

Exothermic oxidation chemical reactions between fuel and oxidizer serve as the primary source of energy in internal combustion engines, including CI engines. The main indices of the stoichiometric reactions were: the theoretically necessary amount of air L_0, kmol, for burning 1 kg of fuel; the amount of combustion mixture M_1, kmol/kg comb., m_1, kg/kg fuel; lower calorific value *NCV* of the fuel, MJ/kg, and of the combustion mixture MJ/kmol mixt., MJ/kg mixt.; molar variation, ΔM, kmol/kg, of combustion products.

For a more extensive and objective motivation of the composition of the mixed biofuel, we, for the first time, proposed and calculated the values of the coefficients of change in the amount of the combustion mixture $K=M_1^B/M_1^m$ (kmol/kg fuel) and $K_c= NCV^m /NCV^B \cdot K$ (kmol/cycle), as well as of the conventional excess air coefficient $\alpha_{conv} = L^B/ L_0^B= L_0^m/ (K^B \cdot L_0^B)$.

The results of the calculations demonstrate that the Kc coefficient values vary within narrow limits: from the maximum value of 1,00199 with B20 to the minimum value of 0,98347 with B100 (in the case of diesel combustion Kc =1,0).

The calculated values of the conventional coefficient of excess air in the case of fueling with diesel and biodiesel-diesel mixtures vary within the narrow limit α_{conv}=1,0-0,99, which demonstrates the possibility of supplying CI engines with biodiesel-diesel mixtures without introducing changes in construction and in fuel and air system adjustments.

The results of the theoretical reasoning indicate that pure B100 biodiesel and biodiesel-diesel blends ensure good operation of the compression ignition engine without changing the geometrical parameters of the combustion chamber and the CI engines fuel and air supply system. However, taking into consideration the economic and energetic performances, it would be more efficient to use small biofuels with the volumetric fraction of biodiesel of 20%-40% (B20-B40).

Keywords: biodiesel, calorific value, coefficient, combustion, Diesel engine, excess air, mixture, parameters.