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RESEARCH AND DEVELOPMENT OF A METHODOLOGY FOR ASSESSING THE TECHNICAL CONDITION OF VEHICLE BRAKING SYSTEMS

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A model of the energy saving process in a compression ignition engine is used for mathematical modeling of the internal combustion engine working process when using fuels of different quality. This model is quite versatile. Energy conservation under the internal cylinder space of a piston internal combustion engine can be considered as the result of thermodynamic processes carried out with a working body of variable mass and characterized by external energy exchange. The first option - the initial duration of the supply of clean fuel in the internal combustion engine is optimal (from the point of view of achieving the highest economic efficiency). Then an increase in duration due to a change in fuel quality will lead to an increase in specific fuel consumption. The second option - the initial duration of supply of clean fuel is less than optimal. Then an increase in the duration of the supply due to the dilution of the fuel with water will initially cause a decrease in the specific fuel consumption until the duration of the supply is reached, which is equal to the optimum. Further dilution of fuel with water will lead to an increase in specific consumption.

The change in specific fuel consumption when using emulsified fuels (EP) is determined by the change in the calorific value of its fuel component and there must be a balance of the heat introduced into the cylinder. Then we have:

$$g_e Q_T^H = g_{e_{ВТЭ}} \cdot Q_{T_{ВТЭ}}^H, \tag{1}$$

where g_e - specific fuel consumption;

Q_T^H - calorific value of fuel;

$g_{eВТЭ}$ - specific fuel consumption when working on EP;

$Q_{T_{ВТЭ}}^H$ - calorific value of the fuel in the EP.

The DVZ workflow model when using EP should be supplemented with the following dependencies. The cyclic supply of fuel and EP is equal to:

$$q_{цт} = \frac{G_1}{\alpha l_0}, \tag{2}$$

$$q_{ц} = q_{цт} + G_w, \tag{3}$$

$$G_w = \frac{q_{цт}}{\left(\dfrac{1}{C_w} - 1\right)}, \tag{4}$$

where C_w - relative water content in EP;

q_{ts}, q_{ts} - cyclic supplies of fuel and EP, respectively, kg / cycle;

α - coefficient of residual air;

l_0 - the amount of air theoretically necessary for the complete combustion of 1 kg of fuel.

Taking into account the given formulas, the heat spent on heating and evaporation G_w, kg of the additive, is equal to

$$\Delta Q_w = \mu_w G_w \left[\mu C_{vw}\left(T_s - T_{нач}\right) + \mu_w r\right], \tag{5}$$

where T_{nach} is the initial water temperature, K;

r - latent heat of vaporization, r = 2253 kJ / kg;

μ_w - molecular weight of the additive.

Based on the results of the calculation of the processes that take place in the middle of the sleeve, the effective indicators of the work process are determined: effective efficiency η_e, average effective pressure P_e, effective power N_e, specific effective fuel consumption q_e, engine torque M_k. The characteristics of active heat release show that the use of EP leads to a decrease in heat release to TDC. At the same time, the initial intensity of heat release on EP is lower than on standard fuel, but then heat release accelerates. Thus, the use of EP on diesel leads to a shift in the second period of combustion relative to TDC, as a result of which the amount of fuel vapor in the cylinder increases until the moment of ignition.

According to the obtained pressure values of the working medium in the internal combustion engine cylinder, the temperature values of the working medium and the parameters of the exhaust gases are calculated using known expressions. The processes of formation of toxic components of LPG exhaust gas are modeled taking into account the current value of pressure and temperature in the cylinder ($P_ц$, $T_ц$), atmospheric pressure and ambient temperature. Empirical dependences and formulas of chemical reactions of toxic components of exhaust gases are used in the separation. The software works in relation to personal computers and includes a program for calculating the working process of the KamAZ-740.37.400 diesel engine using EP and modeling the processes of the formation of toxic components of exhaust gases. The adequacy of the model was tested using Fisher's test. As a result of the verification, it was found that the model allows to determine with 95% reliability the power and economic indicators of a diesel engine, as well as the composition of exhaust gases at the exit from the diesel cylinders.

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