MEASUREMENT OF POLYCYCLIC AROMATIC HYDROCARBONS IN COMBUSTION PRODUCTS OF A GASOLINE ENGINE

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Abstract: The concentrations of 16 polycyclic aromatic hydrocarbons (PAHs) in the combustion products of gasoline emitted into the atmosphere by internal combustion engines (ICE) have been measured using gas chromatography. The concentrations of PAHs in the exhaust gases sampled before and after the catalytic converter have been determined when ICE operated in cold start and in transient regimes. The influence of octane number of gasoline on the PAHs content in the exhaust gases of 92 RON, 95 RON, and 98 RON gasolines has been established. The concentration of the most carcinogenic component (benzo(a)pyrene) in the exhaust gases before the catalytic converter was shown to significantly exceed the threshold limit value in workplace air for 92 RON gasoline during the ICE's cold start. After passing of the exhaust gases through the catalytic converter, the benzo(a)pyrene concentration was reduced for all grades of gasoline, except for 95 RON gasoline in the cold start regime.

Keywords: internal combustion engine; polycyclic aromatic hydrocarbons; combustion products; octane number

References

1. Kanilo, P. M., K. V. Kostenko, and M. V. Sarapina. 2013. Minimizatsiya kantserogennoy opasnosti avtomobiley [Minimization of carcinogenic risks of vehicles]. *Vestnik Khar'kovskogo Natsional'-nogo Avtomobil'no-Dorozhnogo Un-ta* [Herald of Kharkov National Automobile and Highway University] 60:133–143.
2. Assad, M. S., and O. G. Penyaz'kov. 2010. *Produkty sgoraniya zhidkikh i gazoobraznykh topliv: Obrazovanie, raschet, eksperiment* [Products of combustion of liquid and gaseous fuels: Formation, calculation, experiment]. Minsk: Belarus. navuka. 305 p.
3. Matveev, S. G., I. V. Chechet, V. Yu. Abrashkin, and A. V. Semenov. 2013. Obrazovanie kantserogennykh politsiklicheskikh aromaticheskikh uglevodorodov v model'noy kamere sgoraniya GTD [Formation of carcinogenic polycyclic aromatic hydrocarbons in the model combustion chamber of gas turbine engine]. *Izvestiya SNTs RAN* [Proceedings of Saratov Research Center of RAS] 6(3):881–885.
4. Matveev, S. G., M. Yu. Orlov, I. V. Chechet, and A. V. Semenov. 2009. Vzaimosvyaz' mezhdu vybrosami sazhi i benz(a)pirena teplovymi dvigatelyami na uglevodorodnom toplive [Relationship between carbon and benzo(a)pyrene emissions by heat engines working at hydrocarbon fuels]. *Vestnik Samarskogo Gosudarstvennogo Aerokosmicheskogo Un-ta im. S. P. Koroleva* [Herald of the S. P. Korolev Samara State Aerospace University] 3(19(2)):210–214.

5. Assad, M. S., V. V. Grushevskiy, O. G. Penyaz'kov, and I. N. Tarasenko. 2015. Kontsentratsiya politsiklicheskikh aromaticheskikh uglevodorodov v produktakh sgoraniya benzinovogo dvigatelya [Concentration of polycyclic aromatic hydrocarbons in the combustion products of gasoline engine]. *4th Minsk Colloquium (International) on Physics of Shock Waves, Combustion, and Detonation*. Minsk. 32–35.

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