TECHNIQUES FOR THE TOXICITY REDUCTION OF EXHAUST GASES FROM THE DIESEL ENGINES ON MOBILE MACHINERY

The technique and results of monitoring research into the pollution with heavy metals of the soils adjacent to M1 highway (Brest—Minsk—boundary line of the Russian Federation) are put forward.

The installation of the plasma-chemical reactor in the exhaust system of the diesel engine applied to the mobile automotive engineering is under study. The type of the plasma-chemical reactor on offer develops the electrodischarge plasma-chemical technology for cleaning exhaust gases. The optimized parameters in the electrode systems of the plasma-chemical reactor allow gaining the best performance characteristics.

Key words: diesel engine, exhaust gas, heavy metals, plasma-chemical reactor, electrode systems.

Introduction. Today the improvement of ecological indices is acute in combustion engine upgrading. Recently much attention has been paid to the methods of exhaust gas (EG) extra cleaning from harmful substances at the stage of gas release, as the reserves of engine improvement are almost exhausted.

For the mobile motor and tractor vehicles the most promising solution to the problem can be the use of the sputter-ion plasma-chemical technology of gas cleaning. This technology intends to set the plasma-chemical reactor (PCR) in the gas exhaust system of the engine. Being the devices of direct energy conversion, plasma-chemical reactors provide the high-level efficiency of EG cleaning both from hard particles (HP) contributing to the lower effective soot level.

The paper also discloses the negative effect of EG toxic components on the environment, and the results of the theoretical and experimental research on the application of the low-temperature non-equilibrium plasma in the EG cleaning systems of diesel engines with useful capacity up to 5 dm$^3$ (cubic decimeters), which are used as power unites on the agricultural tractors.

Research technique. For the purpose of the analysis of the negative effect of EG toxic components on the environment the monitoring research has been carried out. The aim of monitoring researches was to determine the index of soil pollution by the EG toxic components on the territories around the busy motorways.

The monitoring research was carried out in the following way [1]: 12 checkpoints were selected long the motorway Brest—Minsk—frontier of the Russian Federation at a distance of 50 + 12 km (picture 1); sampling selection was done with a sampler from a depth of 3…6 cm on both the sides of the motorway at a distance of 1, 10, 100 m and directly near the solid pavement. Thus, we have obtained 96 soil samples and carried out the chemical analysis of the mobile forms of the heavy metals’ content.

For the purpose of general pollution evaluation along the whole length of the motorway M1 we marked out the zone with a maximum heavy metals concentration of 0…10 m (lands, which aren’t used in agriculture) and a zone within 10…100 m (lands, which are used in agricultural production).

The concentration of heavy metals in soot, extracted from the interior surfaces in gas-discharge systems of different size types of diesel engines, was determined by means of the atomic absorptive spectrophotometer AAS-30.

The research technique in the parameter optimization of the sputter-ion plasma-chemical system was aimed at searching for the constructive variant of electrode possessing the outmost discharge characteristics, the dependence of the integral discharge characteristics of electrode systems on the parameters of gas flow, blasting the corona discharge.

The program of the research in optimizing the electrode system parameters envisaged: constructing the experimental volt-ampere characteristics of the electrode systems; finding out the optimal needle spacing in the...