

DETERMINATION OF CARBON DIOXIDE EMISSIONS WITH DIESEL ENGINE EXHAUST GAS FLOW

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As is known from the analysis of studies of scientists who specialize in ensuring the ecological safety of exploitation process of power plants with reciprocating ICE, except for the legislative normalized directly indicators of its level – mass hourly emissions of particulate matter PM, nitrogen oxides NO_x, unburned hydrocarbons C_nH_m, carbon monoxide CO, exist also legislative regulated indirectly, among which emissions of carbon dioxide CO₂ should be singled out, since this pollutant is both a toxic substance and a greenhouse gas, and its emission is limited by the quota of the Kyoto Protocol [1].

To account of such emissions in the criteria-based assessment using the mathematical apparatus of the complex fuel-ecological criterion K_{fe} , the value of mass hourly emission $G(\text{CO}_2)$ and dimensionless index of the relative aggressiveness of this pollutant $A(\text{CO}_2)$ should be determined. It was found that under normal conditions the concentration of CO₂ in dry atmospheric air is 250 ... 450 ppm, physiologically normal content in the air of the room is 600 ... 800 ppm, there is a negative impact on the state of health of the person from 10³ ppm, lethal dose $LD_{50} = 90 \cdot 10^3 \text{ mg/m}^3$. For Ukraine, the Kyoto Protocol's CO₂ emission quota is 922 million tonnes/year, of which 45 % remains unclaimed. $MPC(\text{CO}_2) = 9000 \text{ mg/m}^3$, so $A(\text{CO}_2) = 0.002$. The study analyzes the features of the processes that lead to the formation of CO₂ and proposes to determine the value of $G(\text{CO}_2)$ by the formula (1).

$$G(\text{CO}_2) = G_{fuel} \cdot 3,20 - G(\text{CO}) \cdot 1,59 - G(\text{C}_n\text{H}_m) \cdot 3,07 - G(\text{PM}) \cdot 2,85, \text{ mg/h.} \quad (1)$$

Distribution of magnitude of $G(\text{CO}_2)$ by the regimes of the ESC standardized steady test cycle (UNECE Regulation No. 49) for 2Ch10.5/12 autotractor diesel and by the field of its operating regimes obtained in this study by the proposed method is illustrated in Fig. 1.

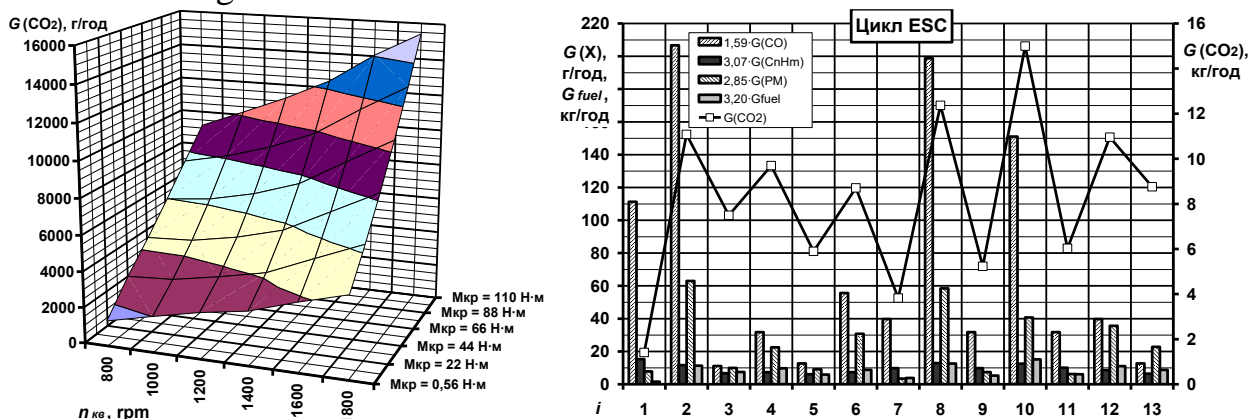


Fig. 1 – Results of the study

References:

1. Kondratenko O.M. (2019). Metrological aspects of complex criteria-based assessment of ecological safety level of exploitation of reciprocating engines of power plants: Monograph. Kharkiv. Publ. Style-Izdat. 532 p. ISBN 978-617-7738-33-5.