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Results of analysis of fuel converter

to the Director General of

CJSC "Eko-Avto-Tytan"

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CONCLUSION

by the results of sanitary-hygiene expertise of spent fuel converter.

The converter of fuel catalytic ПТК-4 is installed on cars with gasoline engines that do not have a neutralization system of exhaust gases and is designed to reduce the content of harmful substances in the exhaust gases, reduce fuel consumption, as well as to pre-purify of fuel before feeding it to the carburetor. The owners of the patent for this invention are CJSC "Eko-Avto-Tytan".

The following documentation was submitted: ТУ У 24587493. 001-98 "Converter of fuel catalytic ПТК-4", approved by Ministry of Public Health of Ukraine and Ministry of Ecology of 17.05.97; ТУ У 19235220. 002-97 "Cartridges catalytic"; Patent for invention No. 17582 A; Passport for the converter of fuel catalytic ПТК-4, OJSC "Kyiv Plant "Analitprylad"; Comparative characteristics of the converter-burner (manufactured in USA) and the catalyzer-converter of fuel "Tytan" (manufactured in Ukraine, CJSC "Eko-Avto-Tytan"); Results of tests of fuel catalyzers "Tytan", carried out by 14 profile organizations for the period of 1990-1996; Minutes of meeting about the issue of caring out of interagency tests of the catalyzer-converter of fuel "Tytan" of 17.05.97, approved by the Deputy-Director of State Center of Standardization, Metrology and Certification; Act and minutes of interagency acceptance tests of the fuel catalyzer "Tytan" No.No. 1, 2, 3, 4; Program of use of catalytic filters-converters of fuel, approved by the Chairman of the Council of Ecological Safety in Nyzhniy Novgorod Region; Program of tests of catalyzers-converters "Tytan" on the cars "Tavria" and the report of 22.10.97 and 20.11.97, approved by the Chief of testing Center of Zaporizhzhia Automobile Plant; Results of researches of influence of catalyzer-converter of fuel ФТА ОО ООО for the level of toxicity of discharge gases of automobile engines of 19.07.99, issued by Zaporizhzhia State technical University; Minutes of stand tests of catalytic converter of fuel for gasoline engines ПТК-4 "Tytan" of 9.04.98, issued by State Motor Transport Scientific-Research and Designing Institute; Acts of tests of catalytic converter of fuel for ecological compatibility and fuel economy of 7.12.98, 22.01.99, 15.07.98, 28.05.98; Reports on comparative road and laboratory tests of experienced samples of catalyzers-converters of fuel "Tytan" of 20.11.97, about the test of catalytic filter-converter of fuel on the diesel locomotive ЧМЭ3 of 16.04.99, on the ship diesel of 24.10.98; Minutes of researches of ПТК-4 of 26.08.98, 27.10.98, 15.07.99, No. 46/4-3 of 12.05.98; Results of hygienic assessment of machine building products No. 23 of 12.10.98, issued by the research laboratory DTS and labour medicine on transport.

The fuel converter is a device of the chamber type chamber structure, consisting of: a filter element with titanium compounds, active elements of the chemical catalyzer, gamma-glycosin in granules, basalt fabric. Preliminary purification of fuel is carried out in chambers at the molecular level by metal salts, when a combustible mixture in the cylinders is burned, a "cladding" effect is created, thereby balancing the compression on the cylinders and increasing the life of the engine. Analysis of the submitted materials shows that ПТК-4 has the following main characteristics: reduction of the toxic substances content in the exhaust gases from the maximum permissible standards - carbon monoxide CO - by at least 30%; - hydrocarbons CmHn - by at least 20%; - nitrogen oxides NOx - not regulated; increase of engine compression - at least by 8%; reduction of specific fuel consumption - by at least 5%; the mean time between failures of ПТК-4 in operating conditions of use is not less than 6000 liters of fuel.

Purpose of work: to perform the expertise of spent fuel converter, which includes a plastic housing, three cups of titanium, alumina in the form of elongated granules and the glass fiber filter.

The study program included:

- extraction of cups, alumina and glass fiber filter with an organic solvent, the extract control at tetraethyl lead;
- processing of alumina with acids, acid extracts analysis for the presence of heavy metals: lead, cobalt, nickel, zinc, copper and possibly other metals;
- study of volatile components from the plastic parts of the fuel converter.

The following studies were carried out:

1.5 g of alumina was extracted three times with ether, the extracts were combined. In ethereal extract, the presence of tetraethyl lead was confirmed by qualitative reaction with dithisone.

The ether is evaporated, the residue is poured into 1 ml of concentrated nitric acid, evaporated to dryness. The residue is dissolved in water, the volume is adjusted to 200 ml and analyzed by thin layer chromatography. Results of analysis in mg/l

zinc - 0.02; copper - 0.08; nickel - 0.02; lead - 0.2; cobalt - 0.2

Extruded with ether alumina, is poured by 300ml of 6N acetic acid and drawn for 2 days. Alumina is filtered, washed with water, the filtrate is adjusted to 200 ml and analyzed. Results of analysis in mg/l

zinc - 0.6; copper - 1.6; nickel - 0.08; lead - 0.4; cobalt - n/a.

2. The filter of glass wool, weight 0.67 g, extracted three times with ether, the extracts are combined. In ethereal extract, the presence of tetraethyl lead is confirmed by qualitative reaction with dithisone.

The ether is evaporated, the residue is poured into 1 ml of concentrated nitric acid, evaporated to dryness, dissolved in water, filtered and adjusted to 200 ml. Results of analysis in mg/l

zinc - 0.6; copper - 0.25; nickel - 0.07; lead - 0.25; cobalt - 0.05.

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Filter after extraction with ether is poured by 30 ml of 6N acetic acid, drawn for 2 days. The extract is drained, the glass wool is washed with water, the filtrate is adjusted to 200 ml and analyzed. Results of analysis in mg/l

zinc - 1.2; copper - 0.3; nickel - ED lead 0.2; cobalt - n/a.

3. The titanium glass with the weight of 23.0 g is extracted three times with 25 ml of ether. In ethereal extract, tetraethyl lead was not detected. The ether was evaporated to 2-3 ml, tetraethyl lead was not found in the residue. The extract was not analyzed further.

4. Plastic parts of the fuel converter with the total weight of 66.6 g were kept in the desiccator with the volume of 6 liters 24 hours at a temperature of 20 °C. Air samples were analyzed on a gas chromatograph. Results of the analysis:

hexane, benzene, toluene- n/f,
heptane - 0.35 mg/m³,
fraction of white spirit-0.8 mg/m³,
xylene - 0.1 mg/m³

Name of harmful substance	Hygienic standards of content of harmful substances in environmental objects			
	Water of water bodies of economic-potable water supply		Air	
	GDK (mg/l)	DR (mg/l)	GDK, r.a.	GDK/OBRV a.k.m.
Zinc (oxide)	1.0	5.0	0.5	0.05/
Copper	1.0	1.0	0.5	-
Nickel	0.1	*	0.05	0.001/
Lead	0.03	0.05	0.01	0.0003/
Cobalt	0.1	1.0	0.05	0.001/
Hexane	-	-	300.0	
Benzene	0.5	-	15.0	0.1/
Toluene	0.5	-	50.0	0.6/
White Spirit	-	-	300.0	/1.0
Xylene	0.05	-	50.0	0.2/

* - "Information materials on sanitary-hygienic standards of harmful substances", Kharkiv, 1994.

** - "Methodological indications on hygienic control over articles from synthetic materials offered for use in practice of economic-potable water supply", No. 2349-81.

***State standard ГОСТ 12.1.005.88 "SSBT General sanitary-hygienic requirements for air of working zone".

**** "Maximum permissible concentrations (MPC) of pollutants in the atmospheric air of populated areas No. 3086-84.

Conclusion:

The presented results of the analysis of the metal content in the test samples were obtained after extraction under the stringent experimental conditions. Under normal conditions, such migration is unlikely and possible in contacting environments, only under the influence of an aggressive environment. As can be seen, from the data presented above

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the migration of organic fuel components from the plastic parts of the fuel converter catalytic ИТК-4 is much lower than the approved hygienic standards.

Titanium cups from spent fuel converters, given the absence of contamination, can be recommended for reuse.

The plastic parts of the spent fuel converter housing are slightly contaminated with gasoline components and can also be recommended for reuse, if they lose their marketability or elasticity, they are used for recycling to packaging materials.

The filter and alumina contain adsorbed metal compounds, they are low-hazard waste that can be removed in the established order, or, with appropriate development, they are recycled as an additive to asphalt concrete pavements, reinforced concrete blocks for use in road

construction.

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