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FUNCTIONS OF LUBRICATING OILS IN TRIBOLOGICAL SYSTEMS

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ABSTRACT
Lubrication is the primary activity in preventive technical system's maintaining. Lubrication is defined as the application of certain lubricant in order to decrease the force as well as the wear and sliding surface damaging. Sliding surface material which causes these effects is the oil. Even though the lubrication process and the oil are defined solely from tribological aspect, their primary role is much more important and diversely expressed in the wide range of technical systems. Each role demands the specific oil and their adhesives' characteristics. This paper will show the experimental investigation results expressed on the gear (dumper trucks' diesel engines) in Banovići coal mine, while the laboratory sample examination has been performed in refinery in Modriča.
Key words: Tribological system, technical state, diesel engine

1. EXPERIMENTAL RESEARCH

1.1. Plan of experiment

Research has been performed on the open-pit of coal mine –Banovići, on the dumper-trucks: Terex-MT 3600 B of bearing capacities 1540 HRK int. marked (5), Mark 36 bearing capacity 1540 HRK int. marked (11) and Wabko-170 D bearing capacities 1540 HRK int. marked (4).

The following has been done for the realization of aim function:

- technical systems,
- tribological system,
- research parameters,
- time interval of sample oils,
- method of oil testing,
- means - testing devices,
- testing the oil,
- processing of testing results,
- analyses of measured sizes - comparisons with boundary values,
- final considerations.

1.2. Results of experiment

In next tables the results research of physical-chemical characteristics of oils and the presence of mechanical dirt in the oil have been presented. The results for the diesel engine CUMMINS – KTA 50 C which is built in the dumper Mark 36 interior label (11) have been presented here. Lab testing of oil has been carried out in Refineries of oil in Modriča.

Table 1. Physical-chemical characteristics of oil

x	y	visc40	visc100	IV	TP	TBN	TAN
New	0	110,42	14,66	136	235	9,91	2,69
2	102	104,61	13,88	133	223	9,38	3,36
3	156	105,54	13,97	133	221	9,48	3,4
4	220	105,58	13,93	133	217	9,42	3,66
5	300	104,03	13,74	132	218	9,46	3,73
6	0	109,61	14,84	140	245	10,22	2,91
7	100	107,35	14,55	139	231	9,37	3,45
8	150	111,17	14,74	137	218	9,42	3,71
9	200	112,97	14,97	137	220	9,51	4,09
10	300	110,98	14,72	137	224	9,32	4,08
11	0	109,61	14,84	140	245	10,22	2,91
12	71	104,3	14,2	139	231	9,4	3,04
13	229	102,73	13,89	136	231	8,76	3,26

Table 2. Presence of mechanical impurities in the oil

Fe	Cu	Pb	Al	Cr	mph
5,74	0,97	5,7	0	0	4968
17,89	1,58	9,32	25,02	1,02	5070
25,81	1,39	9,66	11,72	1,04	5124
40,06	1,61	23,14	16,27	1,39	5180
40,98	1,39	25,98	14,01	1,39	5180
11,24	0,93	0	0	0	5563
14,34	1,6	4,97	13,57	0	5663
19,06	1,47	8,4	13,36	0	5713
24,69	1,26	12,81	17,72	0	5763
22,5	1,05	14,12	11,11	0	5863
11,24	0,93	0	0	0	
17,54	1,07	4,8	26,84	0	5934
40,76	4,12	10,95	49,9	2,45	6092

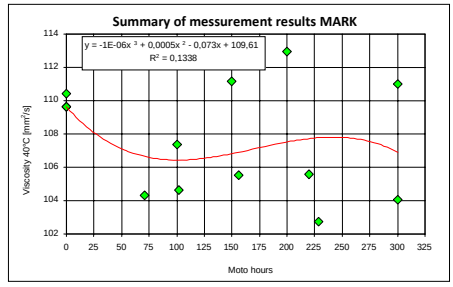

Figure 1. Viscosity on 40°

After lab testing of oils and data processing the regression analysis for the every characteristic has been carried out, especially because of the determining of trend, i.e. the establishing of mathematical models of change of oil characteristics and the presence of mechanical impurities (the presence of metal) with the time of exploitation of oil.
In this work the importance is in determining the trend of metals presence in the oil because of diagnosing of conditions of tribological systems in diesel engines.
On the following picture the dependence of change of viscosity in relation to the time of exploitation of oil has been presented.

On next figures the dependence of change of presences of metals in relation to the time of exploitation of oil has been presented.

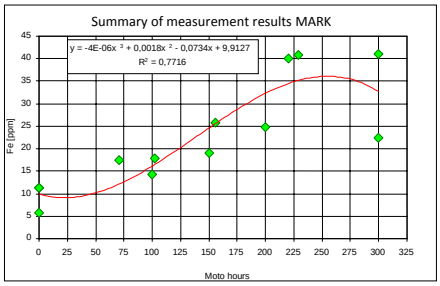

Figure 2. Presence of Fe in the oil

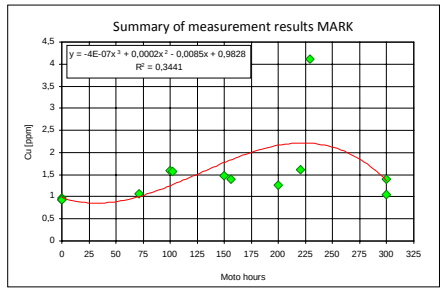

Figure 3. Presence of Cu in the oil

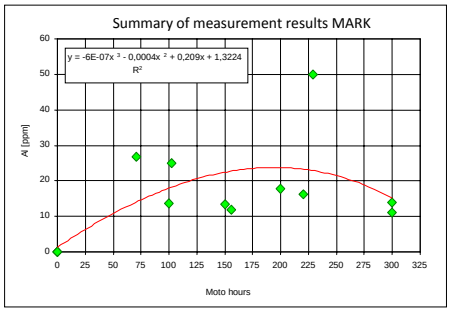

Figure 4. Presence of Al in the oil

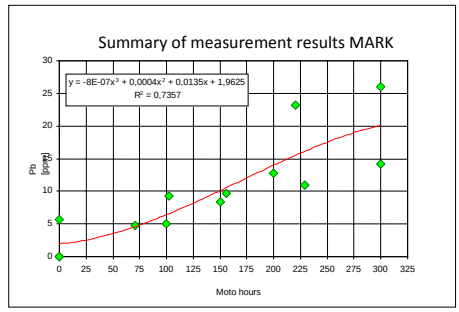

Figure 5. Presence of Pb in the oil

2. FINAL CONSIDERATIONS

There is currently the exploitation of 40 CUMMINS engines in the coal mine in Banovići, from that 17 engines have been built in the dumper truck of bearing capacity 1000 – 1700 [the HRK]. For each engine the time figure of condition is performed daily. Also, databases for each type of these engines have been done, which contains basic technical data with all necessary instructions (the instruction for the servicing, repair works and other). According to manual of the manufacturer the following actions are made regularly on all engines: daily examinations, services, minor, middle and large repairing. The diagnosing of work parameters of engines is regularly performed. The diagnosing of condition tribological complexes of engines through the use of diagnostic methods of control of products of wears (controls of mechanical dirt in the motor oil) has been presented in this work.

Results which have been gathered by the use of these two diagnostic methods are satisfying. Disadvantage of the atomic absorption spectroscopy is that it does not give data about the size (the fleshiness) of mechanical dirt but only the amount.

Further research needs to be directed on the creation of programs of diagnosing tribological complexes of engines for the purpose of lengthened interval of oil replacement, the longer work of engine and the forecast of work of engine in the future.

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