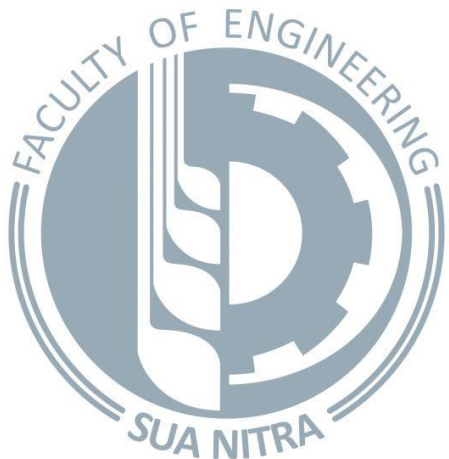




ANALYSIS OF DEGRADATION OF ECOLOGICAL TRANSMISSION-HYDRAULIC FLUID USED IN AGRICULTURAL AND FORESTRY MACHINERY



Slovak University of Agriculture in Nitra


Faculty of Engineering

Department of Transport and Handling

Janoušková, Nosian, Feriancová, Markiewicz



Introduction

- ▶ Transmission hydraulic fluid - universal hydraulic fluid.
 - ▶ Ecological fluid.
 - ▶ Hydraulic stand.
 - ▶ Accelerated tests.
- 



Methods

- ▶ The fluid deforms during use.
- ▶ 500 hours working, at intervals of every 125 hours.
- ▶ Ferro-graphic analysis, acid number analysis and particle counting and classification.



Methods

Ferro-graph analysis:

- diagnose the place of wear,
- Analytical Ferro-graph T2FM,
- KAPA 6000 microscope,
- TRICO wear particles atlas.



Methods


Acid number:

- indicator of the applicability of the fluid,
- determine the number of acidic products,
- potentiometric titration,
- FluidScan Q1000.



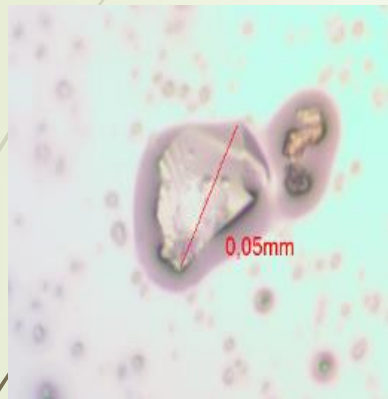
Methods

Particle counting and classification:

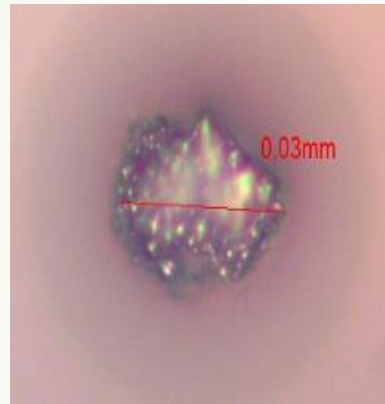
- ▶ LNF – laser particle counting technology, analyze hydraulic fluid and lubricating fluid.
 - ▶ Obtain information about the state of fluid and technical condition of the device.
 - ▶ Identify particles up to size 100 μm .
- 

Result

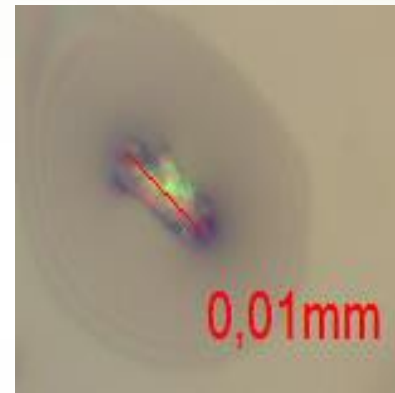
Ferro-graph analysis



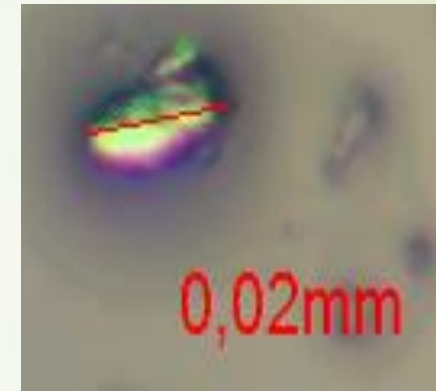
a



b



c



d


Fig. 1 Wear particles in fluid samples

a – 125 hours worked, b – 250 hours worked, 375 – hours worked, 500 – hours worked


Result

Hours worked	0	125	250	375	500
TAN (mgKOH.g ⁻¹)	1.56	1.34	1.43	1.7	1.6
Limit value (mgKOH.g ⁻¹)	3.56	3.56	3.56	3.56	3.56

Tab. 1: The dependence of the acid number of the TAN and the limit value on relation to the number of hours worked



Results



- Classification of wear particles according to LNF:
 - a) The cutting particles 25,2 μm at 0 hours worked and after 500 hours worked increased to 33,2 μm , which represent increase 31,7 %.
 - b) The sliding particles 24,9 μm at 0 hours worked and after 500 hours worked increased to 27,2 μm , which represent increased 9,2 %.
 - c) The fatigue particles 25,7 μm at 0 hours worked and after 500 hours worked increased to 31,5 μm , which represent increased 22,6 %.
 - d) The nonmetallic particles 31,8 μm at 0 hours worked and after 500hours worked increased to 37,0 μm , which represent increased 16,4 %.

Result

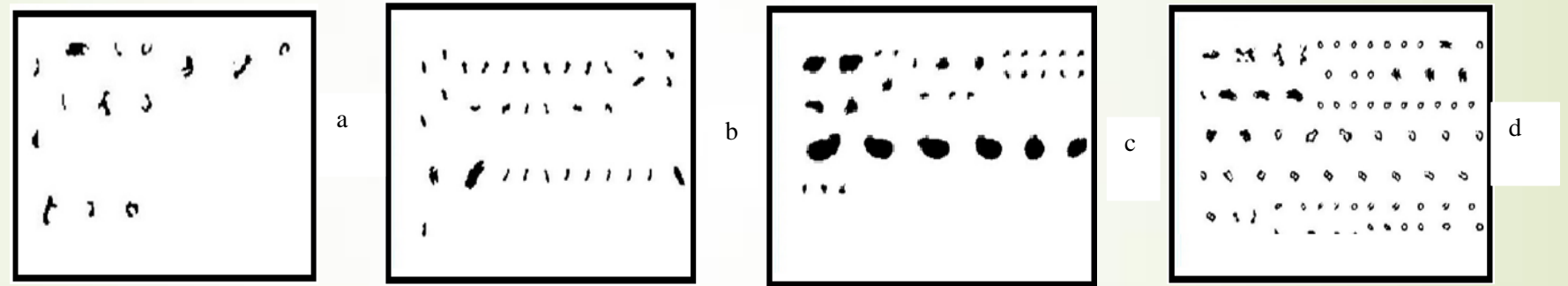


Fig. 2 Particles in the LNF analyzer
cutting (a), sliding (b), fatigue (c) and nonmetallic (d) particles

Results

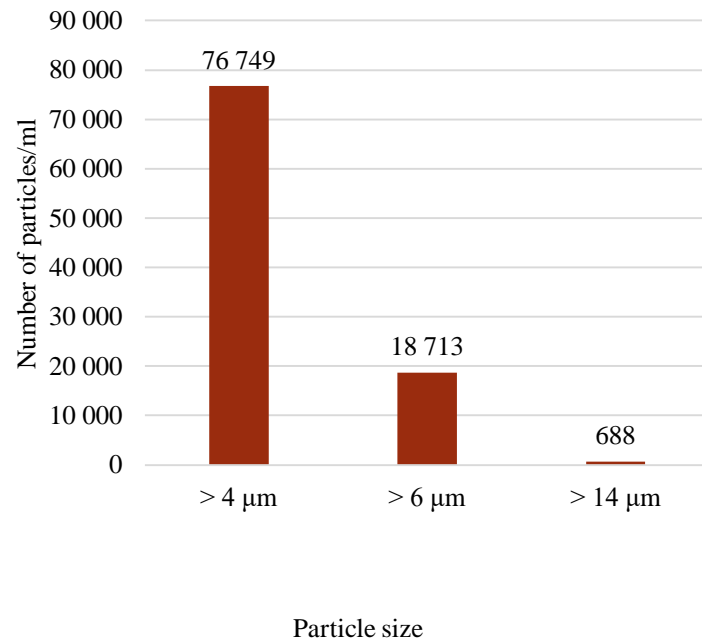


Fig. 3 Wear comparison at 0 hours worked

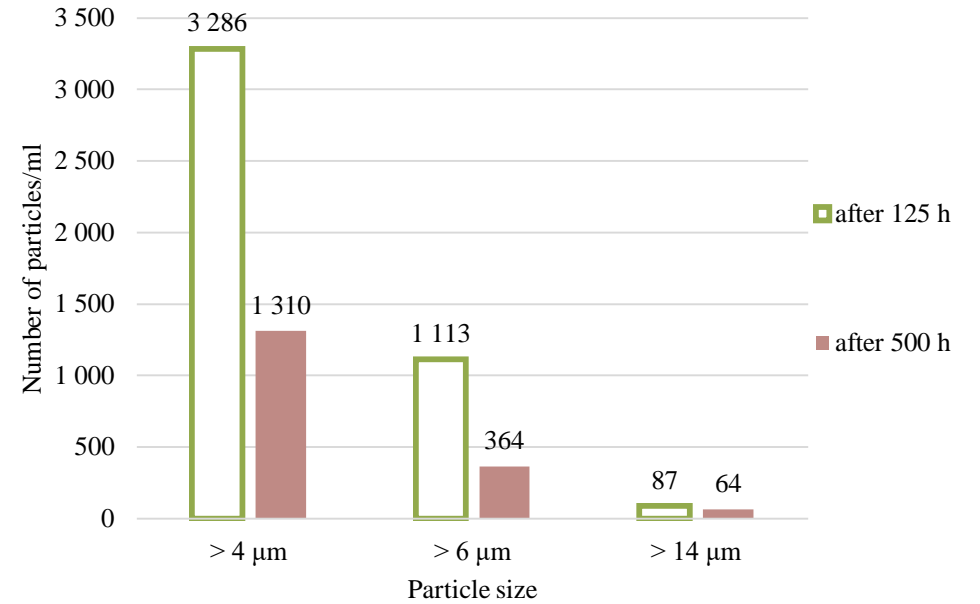


Fig. 4 Wear comparison after 125 and 500 hours worked



Conclusion

- ▶ 500 hours worked.
- ▶ Ferro-graphic analysis – sliding wear.
- ▶ Acid number analysis – increase 1,9 %.
- ▶ Particle counting and classification – cutting, sliding, fatigue and nonmetallic particles are present in the fluid. The number of particles in the individual categories decreased.



Thank you for your attention!