

PAPER • OPEN ACCESS

## Different aspects connected with the lubricants and harmful exhaust gases

To cite this article: A Esbulatova *et al* 2021 *IOP Conf. Ser.: Earth Environ. Sci.* **626** 012002

View the [article online](#) for updates and enhancements.



The Electrochemical Society  
Advancing solid state & electrochemical science & technology

**240th ECS Meeting** ORLANDO, FL

Orange County Convention Center Oct 10-14, 2021

Abstract submission due: April 9

SUBMIT NOW

## Different aspects connected with the lubricants and harmful exhaust gases

A Esbulatova<sup>1</sup>, K Voinov<sup>2,\*</sup>, T Nasr<sup>2</sup>, Y Ghellab<sup>2</sup> and O Belili<sup>2</sup>

<sup>1</sup>West Kazakhstan Agrarian-technical University, Kazakhstan

<sup>2</sup>Saint-Petersburg National Research University of information Technologies, Mechanics and Optics, 197101, Kronverksky av. 49, Russian Federation

\*E-mail: forstar@mail.ru

**Abstract.** In this paper many important aspects connected with the lubricants are described, namely: the first, the cheapest organic lubricant in the world which effectively saves lubricant between pairs of friction in any operation. The second position is connected with the rational shapes for the lubricants which have to work decreasing wear and tear using the new organic lubricant; moreover, this lubricant is the cheapest in the world. Made experiments confirm this effect in full; some curves are shown in computer program MathCad with calculations. The third part in this article is linked with the plastic lubricant and with the attempt to save it into the tight zone of the contact in pairs of friction. The fourth aspect: there is one physical model which helps to catch car exhausted gases. It's very important to protect our environment against both the harmful gases and from the overheating for the air in atmosphere. In conclusion, some recommendations are given to realize them into the practice during the operation for the different mechanisms including ecology process.

**Keywords:** Organic Lubricant; Holding Lubricant in Mechanisms; Clear Ecology Air; Experiment and Calculations; Catch Gases

### 1. Preamble

Practically everybody knows, that lubricants have many different characteristics: temperature, adhesion, ductility, structure and so forth. Let's demonstrate some positive moments linked with lubricants:

- They can essentially decrease the coefficient of friction and the deterioration in pairs of friction (both in machines/mechanisms and devices);
- They essentially diminish different vibrations/oscillations;
- They can diminish the rotary forces in the turning mechanical systems;
- They reduce forces of friction in the guides and in the bearings (journal bearing, roller bearing, ball one);
- Usually they defend surface of friction against the high temperature and reduce the noise in any mobile junction.

However, unfortunately, there are several negative moments which are linked with lubricants (see Sketch 1).

Any plastic lubricant increases the initial forces to begin rotation or movement for pairs of friction.



Any liquid lubricant has the next negative property - such lubricant can penetrate deeply into each pits of the deterioration.

*Reminding.* Even the young pupil at school knows such property of liquid as incompressible effect. That's why the liquid lubricant under the influence of a load try to break off the surface especially in the places where there is the deep roughness. In this case the resistance against the wear will be smaller.

1) To get not the artificial but natural oil product a man must expend great labour (plant, grow, gather and get the definite oil fruit, for example). If the oil is produced, we have to save it for a long time.

2) One of the negative property of the natural oil is the tendency of ageing.

3) Many important components have rather bad smell and can be disappeared / evaporated into the open air.

4) Different lubricants are harmful to persons (smell badly and it irritates a man).

5) Moreover, there are many dangerous factors connected with lubricants: they can be linked with the specific properties of liquid or plastic lubricants.

6) Lubricant has to guard its properties during the full term of operation constantly.

7) It is not any possibility to mix different lubricants (through incompatible).

8) Any old packing before the new utilization must be cleaned carefully.

9) All plastic lubricants have the bad tendency to vanish very quickly from the tight contact and if there is too much oil in the bearing box it increases the temperature during the operation.

10) As usually, there are many specific demands connected with the ways of a storage for the lubricant (guarding, temperature and so on).

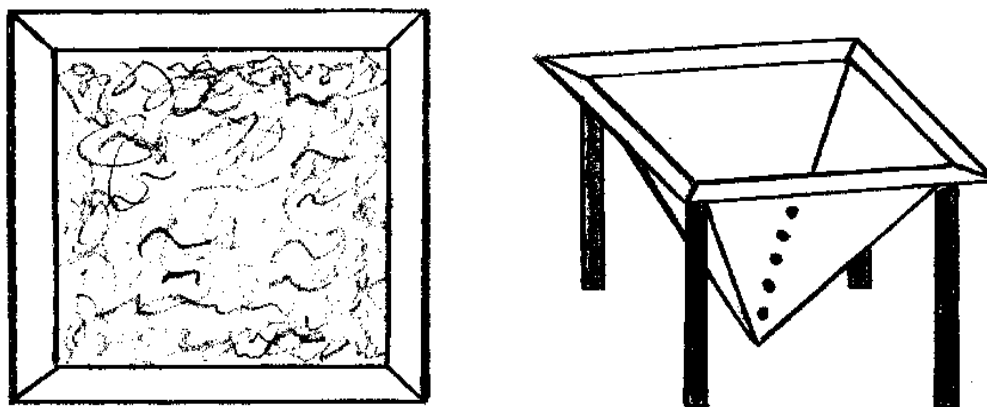
**Sketch 1.** Different aspects linked with lubricants.

That's why the main aim for us it was to delete all negative moments which we have just enumerated above.

And there is another important and negative factor it is the pollution of the fresh air from the gases which we have just liquidated successfully too [1-3].

## 2. About the first investigation

Evidently, if it is managed to essentially exchange the shape and structure of the lubricant, then it brings down the force of the influence from the liquid oil. That's right to transfer the tradition shape of lubricant into the form like resilient ball or small particles which permit to have free spaces among them. This is the main distinction from the water or from the any liquid in such case. These forms hinder for the lubricant to penetrate too deeply into the pit (till the bottom). Moreover, there is another important moment: in this case the coefficient of friction will be smaller and wear and tear will be insignificant too. Thus, many positive factors for the operation will be obtained at once. Before the experiments the next plan was approved: to prepare the physical experiment it was needed to make a new macro-model as the inverted pyramid. To get and to write the stress on the lateral side of this model five transducers were fixed (Figure 1). The results of experiments were obtained by means of the personal computer in the cover MathCad-15.



**Figure 1.** Two looks of the physical model (the right view with five transducers).

The definite media were being filled into this model (working principles) in turn.

Applying this offered new organic lubricant the stress on this physical model was reduced from 30 % to 10 times! It's the very high effect.

Further the new task was put, namely, to determine the rate of wear and tear for pairs of friction if the different lubricant will be taken for investigation (traditional version or even without any lubricant and with the new one).

As it will be shown below, the rate of deterioration was less in our case. Thus, this technical achievement can be realized in practice both for different mobile pairs of friction and for different conditions of operation.

## 3. Additional Materials and Methods for investigation

The next important question is – Where and how quickly we can get such a new shape of a dry lubricant in practice?

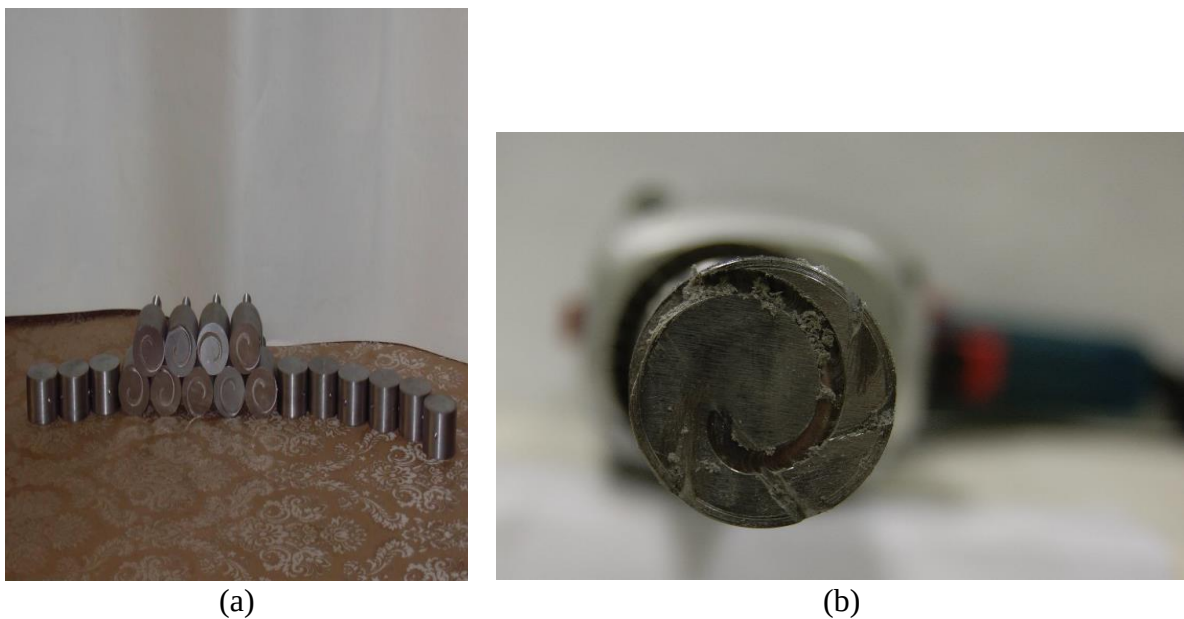
To solve this problem, the electrical razor was applied to cut hair on the face. And after such actions there were very much small elastic and fatty parts of lubricants which were gathered immediately.

Consequently, this effect was reached without many actions if a man has to make usually working many months in the field and in any weather.

Such method is very simple and cheap. The labour-intensiveness will fall to the minimum price.

The source of the energy can be the small as well (maybe the storage battery only). It is needed also to say that the hair must be cut in dry way.

All got species were placed into the glass cupping-glasses. Several spacers have the small cylindrical shafts/tails in the centre of the specimen (Figure 2(a)). Another specimens have spiral special grooves (Figure 2(b)) on their surfaces to catch species of hair effectively and constantly during the movement/rotation. It helps to save maximum species of hair in the zone of contact. The shafts/tails were made to take the possibility to put it into the spindle in the electrical mechanism.



**Figure 2.** Two versions of specimens.

To rotate upper specimen (spacer) we used the boring machine as the hand electrical instrument.

At the same time, of course, the lower spacer must be fixed firmly on the table or on the bench.

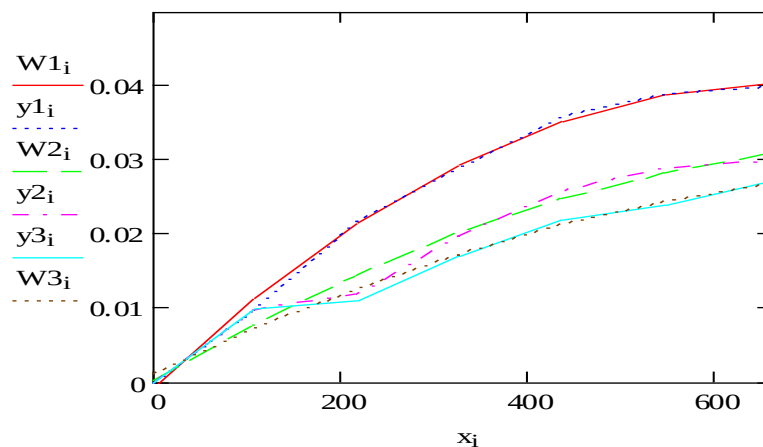
It may be observed in passing that new lubricant (as the human hair cannot stand for the chemical corrosion).

The term of the investigation was during in three months.

The main result of this work is the next: any corrosion on the both surfaces of friction was absent. Furthermore, this new organic lubricant doesn't have any harmful components or carcinogenic elements and it doesn't smell badly.

To get statistical information about wear and tear several measurements were done. After this actions the possibility to get the graph with the deterioration is appeared. The common results about this investigation is given in Figure 3 (without lubricant they are the upper two curves – prepared with the special computer program in MathCad-15. Practically, many statistical data were calculated by Nasr T [4].

At last, two lower curves of wear and tear in a figure 3 shows that the deterioration has the small meaning if for the experiments were taken the new organic lubricant. The thick of the layer with this oil was about 5 mm.



**Figure 3.** Results of deterioration for three steel specimens: dimensions – millimeter (axis on the ordinate) and minute (axis on the horizontal).

To describe the processes of wear and tear use the next parabola equations ( $W1$ ,  $W2$ ,  $W3$ ) which give the non-linear approximation:

$$W1 = -1,071 \cdot 10^{-3} \cdot (x_i - x_0)^2 / h^2 + 6,857 \cdot 10^{-3} \cdot (x_i - x_0) / h + 0,029; \quad (1)$$

$$W2 = -5,238 \cdot 10^{-4} \cdot (x_i - x_0)^2 / h^2 + 5,071 \cdot 10^{-3} \cdot (x_i - x_0) / h + 0,020; \quad (2)$$

$$W3 = -3,81 \cdot 10^{-4} \cdot (x_i - x_0)^2 / h^2 + 4,286 \cdot 10^{-3} \cdot (x_i - x_0) / h + 0,017. \quad (3)$$

Comment: the average step of measurement for deterioration was 110 min ( $h$ ); maximum time for investigation was 660 minutes ( $x$ ); the common number of experiments was seven ( $n=7$ ) and initial wear and tear is zero;  $x_0$  is the average term of investigation among the all patterns.

In the character of approximation for the all statistical data the square equation (parabola) was applied in these calculations. It can highly precisely describe the initial information. About this all curves “speak” the same.

All calculations and the chart were made using the computer programme MathCad-15. To make the mathematical control those results of investigation which had the “strange” maximum or extremely small meanings we applied the famous algorithm/criteria suggested by the next specialists, namely, professor V.I. Romanovsky (in Russia) and the foreign scientists Irvin and Grubbs. If the wrong meaning was discovered, it was deleted at once. Another special computer programme, named as Python, was applied too. The observed results show that hair can be effectively used in practice. It can effectively diminish the wear in many mobile pairs of friction.

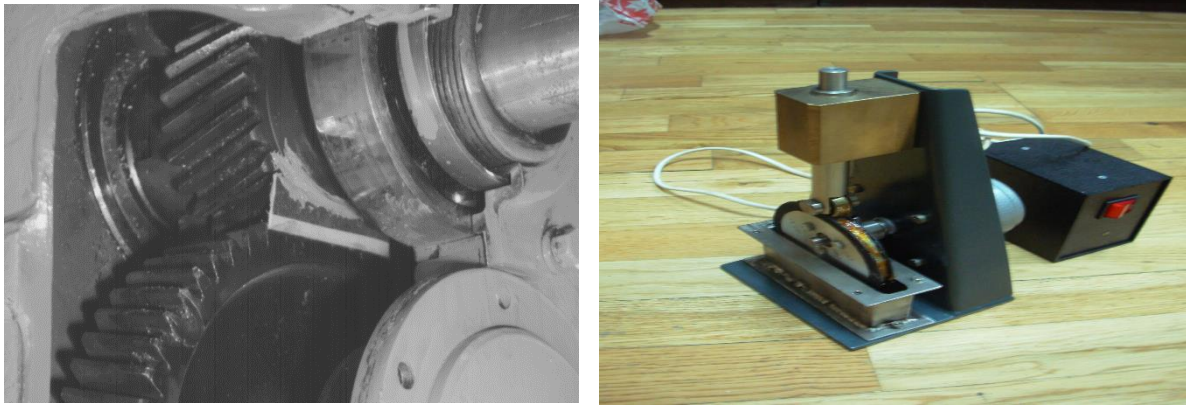
At last, there is another important observation. Organic lubricant doesn’t hold high temperature (more +60 °C). But in the case if the temperature is below zero (about – 65 °C), it is not any obstacle for such lubricant to use it in the operation. And the second moment: our organic lubricant has a very good adhesion!

#### 4. The last but one materials linked with the lubricant

There are very many pairs of friction among the machines, mechanisms and devices. In their mobile joints plastic lubricant during the operation can disappear because of the strong pressure in the contact takes place (in zone between off the rack-wheels, in cams, in guides and so forth). To protect plastic lubricant in a zone of contact if it can squeeze out to one side the effective way was applied by means of the resilient rings which were fastened to the definite places in the pairs of friction (Figure 4). The resilient rings can both to keep the lubricant during the operation and automatically give back it in the pair of friction. It helped to solve this problem and keep the plastic lubricant in a zone of friction for the different junctions constantly.

Note: the exterior diameter of the ring must be more than the outer diameter of the cogs peak (on 4 mm approximately).

This lubricant will be used automatically many times both for the rack-wheels and for the cams without any manual labour.

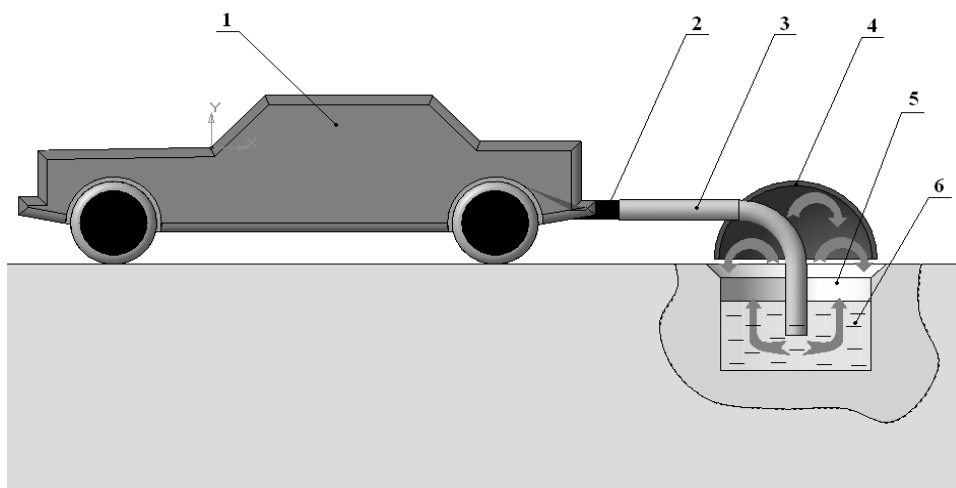


**Figure 4.** Examples of design with the resilient ring/rings for two mechanisms.

The finish result of wear and tear for these mechanisms shows that the velocity of deterioration became essentially less with the new suggested lubricant (about 12%).

## 5. Problem linked with the protection of our environment

Very many gases constantly fly out from the different pipes of industrial works, boiler-houses and from the exhaust pipes in the cars and lorries. Many specialists are working to solve this important task [5-18]. The new method to catch these gases and bad evaporations was suggested in here. Physical model is given in Figure 5 (it is the common method to catch gases).



**Figure 5.** Grouping objects to investigate the effectiveness to reduce the harmful influence of the exhaust gases which fly out with oil from the car pipe: 1 – vehicle; 2 – coupling; 3 – hose/branch pipe; 4 – canopy/roof over the reservoir with water; 5 – oil or another film which covers the surface of water; 6 – water inside the reservoir.



Gases by means of the pump were directed into the water reservoir where they lose their high temperature and cannot shoot up through the pipe into the fresh air. Some chemical elements will be dissolved into the water; others can settle on the bottom or float. But, unfortunately, some chemical components try to fly out from the water reservoir into the clean air. To liquidate this negative process at all there are two main ways for it. Firstly, above the water surface the light roof must be done. In this case, the condensed water with chemical elements and oil in the view as a drop or stream will fall into the warm water constantly.

In this experiment the water surface was covered with oil film which has different thickness  $x_i$ . The maximum thickness was 12 mm. It was enough to forbid for gases to fly out into the air. Another method to catch harmful gases and evaporations: use two united reservoirs with the gas-proof films.

## 6. Results

It seems to us, that there are very many wholesome information connected both with lubricants (shape, structure and type) and to save the environment and our health are represented in full including patents, namely:

- Many different properties connected with lubricants are described with examples;
- For the new organic lubricant the advantages and the unique properties for pair of the mobile friction are given too;
- The simplest resilient or plastic (not hard) rings help to save plastic lubricant in a zone of friction during the whole term of operation;
- It is another and the very important property which was discovered for the new organic lubricant which is connected with the very good adhesion to the surfaces of friction;
- The new method how to catch and delete the harmful and carcinogenic gases, including the exhausted gases from the motor vehicles, are described in here too.

## 7. Short discussion

The search of the resembling information among articles, papers, Internet, patents, technical books and so forth shows that nobody suggested the decision of the numerated above task like these authors made. Consequently, it is the possibility to assert that the described methods are really new. It can be additionally confirmed with all patents which we use in our investigation. Made physical model both to get, to write the stress on the pyramid and the new organic lubricant are really new. Moreover, the chart in which the wear process was described shows the positive effect linked with the small deterioration for the surfaces of friction. Many of demonstrated technical novelties were officially affirmed as the patents. Thus, all these technical novelties have the definite indisputable advantages to be realized widely in practice. At last, these achievements can guarantee the definite economical effect as well.

## 8. Conclusion

Important problem connected with different lubricants, gases and carcinogenic evaporations are solved. If the shape of the plastic lubricant (as a small ball, for example) will be made, it changes the stress in the upper layer of the surface which will be essentially diminished. Consequently, these results must be used in practice in the majority of machines and mechanisms. Suggested the new organic lubricant can work effectively in the different mechanical joints including devices. To reduce practically to the zero bad influence of the exhaust gases for the fresh air by means of the industrial oil on the water surface in the water reservoir and additional chemical elements dissolved into the water can be realized in practice very easy. Many industrial works and organizations and test laboratories will get good profit realizing these ways in practice.

## Conflicts of Interest

The authors declare no conflict of interest.



## References

- [1] Voinov K N *Organic lubricant* (RU Patent №2514434)
- [2] Voinov K N *Working principles to control of the adhesion for the liquid oil materials* (RU Patent №2582157)
- [3] Voinov K N *Working principles to gather the products of wear and tear in the liquid lubricant* (RU Patent №2584758)
- [4] Voinov K N, Nasr T, Hildayati A and Ghellab Y 2018 Non-linear versions to make the analysis of the statistical data *Transactions in Saint-Petersburg Electrical Engineering Sate University* **2** 67-72
- [5] Voinov K N 2016 *The way how to make the over-all cleaning for air basin against the production throwing from pipes* (RU Patent №2604816)
- [6] Voinov K N 2018 *The trap for the harmful evaporations and smells* (RU Patent №2656458)
- [7] Voinov K N, Hildayati A and Ghellab Y 2018 The reliability and over-all protection of the environment from the carcinogenic gases *Reliability* **2** 46-9
- [8] Voinov K N, Ghellab Y and Vasil'ev V A 2018 Method of the technical diagnostic for the environmental in the conditions if it is being polluted with the car gases *Modern Science: Actual Problems for Theory and Practice* **1** 11-4
- [9] Johnson C Y 2009 Poison gas may carry a medical benefit (Boston.com)
- [10] Merkisz J, Pielecha I, Pielecha J and Szukalski M 2011 Exhaust emission from combat vehicle engines during start and warm-up *Transport Problems* **6**(2) 121-6
- [11] Singer W, Schindler W and Linke M 2006 Particulate and smoke measurement on Euro 4 engines *Combustion Engines* **1**(124) 54-9
- [12] Painter D E 1994 *Air Pollution Technology* (Reston: Reston Publishing Company Inc.)
- [13] Hickey N, Boscarato I and Kaspar J 2012 Department of Chemical and Pharmaceutical Science, University of Trieste, Via L. Giorgieri 1, Trieste, Friuli Venezia Giulia, Italy, 2012
- [14] US EPA 2013 [www.epa.gov/air/toxicair/newtoxics.html](http://www.epa.gov/air/toxicair/newtoxics.html)
- [15] Adams M, van Aatdenne J, Kampbel E, Tista M and Zuber A 2012 *European Union emission inventory report 1990–2010 under the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP)* (EEA Technical Report No. 8/2012)
- [16] Pereda-Ayo B and González-Velasco J R 2013 *NOx Storage and Reduction for Diesel Engine Exhaust After treatment* (London: IntechOpen)
- [17] Zheng M and Banerjee S 2009 Diesel oxidation catalyst and particulate filter modeling in active–flow configurations *Appl. Therm. Eng.* **29** 3021–35
- [18] Hamada H and Haneda M 2012 A review of selective catalytic reduction of nitrogen oxides with hydrogen and carbon monoxide *Appl. Catal. A* **421-422** 1–13