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QUALITY OF MOTOR OILS ON THE MARKET OF B&H AND SCG

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S u m m a r y

By researching the markets of motor oils, on the territory of B&H and Serbia and Montenegro (SCG), there was determined presence of over fifty brands. Besides motor oils of domestic and renowned world manufacturers, there are present also products of some less known manufacturers from all over the world.

After performed extensive laboratory testings, of about sixty samples of commercial products, purchased in the retail network of these countries, it was determined that the quality of large number of the tested samples is not in accordance with the declared one.

The largest number of tested samples of motor oils does not meet requirements of viscosity at low temperatures for declared grade of viscosity in accordance with SAE J 300 classification. Also, values of volatility, in accordance with NOACK - test are very often above maximum allowed values.

Full openness of the market of these countries and non-existence of appropriate legislation, are favouring this situation in this area.

Key words: *motor oils, requested quality, characteristics of oils.*

1. INTRODUCTION

Constant development of automobile industry reflects on the manufacturers of lubricants in a form of new and more stringent requirements, all with the aim to improve efficiency of lubricants. In that constant race between requirements of the constructors of engines and motor vehicles on one and improvement of quality on the other side, have been created many variants both in accordance with viscosity grades and in accordance with performance properties which creates difficulties when selecting the lubricant. With the cars there are constant improvements of the technology and operating characteristics by which is, among other things, striving to prolong the duration of replacement of lubricants. From the automobile lubricants of newer generation is required along with meeting increasingly more stringent requirements of application operating characteristics also the reduced emission of polluting components. These requests are reflected in reduction of viscosity of motor oils, as well as properties of reduced volatility, determined by NOACK – test, as well as limitation of content of some elements (S, Cl, P). Considering that an average driver knows very little about lubricants, so the lubricants are often bought in accordance with a commercial name, and not in accordance with prescribed quality, which have influence operation and life cycle of the engines and motor vehicles.

During market research on the territory of Bosnia and Herzegovina, and Serbia and Montenegro it was determined that there are over fifty brands of motor oils. In these territories are present motor oils of domestic and world manufacturers, as well as products of some less known manufacturers from all over the world. Disorder on the market, lack or impreciseness of legislation, lack of efficient carrying out of existing regulations in all phases of trade of motor oils reflect the market situation in these countries. On the market situation in these countries in the field of motor oil great influence have:

- Economic power of the population,
- Situation of the car fleet (age of motor vehicles),
- Operation of domestic refineries with reduced capacity, and
- General situation of the morals in the society.

It is clear that with the consumers arises problem of how to choose an adequate motor oil for their vehicle. In order to help the consumer, i.e. to create a realistic picture on the market in the field of motor oils in Rafinerija ulja a.d. Modriča have been done extensive laboratory analyses of several dozens of samples of fresh motor oil of different brands purchased in the retail network of these countries.

In this paper will be presented results of the laboratory testings in order to make the clearest insight whether and to what degree the samples tested fulfill the declaration given by the manufacturer, as well as if there existed forgeries of some motor oils brands.

2. EXPERIMENTAL PART

Modern motor oils are complex solutions of base oils and additives, and they serve for lubrication of all movable elements of the engine, therefore they have to meet certain operating conditions.

Motor oils must have at high temperatures sufficiently high viscosity to achieve satisfactory lubrication and to seal well between the piston and the cylinder. On the contrary, at low temperatures viscosity should be sufficiently low to enable easy and safe start of the engine. Because of high temperatures which are present in the engine, i.e. in the zone of piston rings 200 to 250^{0}C, and in the crankcase of the engine 100 to 150^{0}C motor oil must have high oxidation stability. Oil has a task to prevent formation of coke and sludge deposits and varnished in the engine, and to prevent wear of contact surfaces of the elements which are in contact with each other. For lubrication of bearings and the crankshaft is important viscosity of the oil, for lubrication of the distributor valve, camshaft and lifting valve which happens in the area of border lubrication, the role is taken over by anti-wear additives whose action is based on physical adsorption and chemical reaction with contact metal surfaces. In order to maintain cleanliness of working areas as well as to neutralize acid and corrosive products of combustion and to maintain sooth and other residues in suspension, detergents and dispersants are added to the oil. Oil should prevent formation of "cold sludge", which is formed in under-cooled engine in the conditions of "stop-go" in city driving.

Laboratory testings were done on 57 samples of motor oils, of different viscous grades, intended for passenger and commercial vehicles. Of the total number of tested samples 26 was of domestic production, and 31 were samples of more or less renowned world lubricants manufacturers. Processing of results of the analyzed samples of motor oils of different brands purchased on the market of B&H and SCG was done in accordance with viscous grade, i.e. purpose of the oil (for passenger and commercial vehicles).

Samples were tested for the following characteristics: kinematic viscosity in accordance with method ISO 3104, viscosity index in accordance with method ISO 2909, pour point in accordance with method ISO 3016, ignition point in accordance with method ISO 2592, density at 15^{0}C in accordance with method ASTM D 5002, foaming tendency (foaming stability) in accordance with method ASTM D 892, total base number (TBN) was tested in accordance with method ISO 3771 and neutralization number (TAN) in accordance with method ISO 6619, dynamic viscosity at low temperatures (CCS V - 20^{0}C) in accordance with method ASTM D 2602, metals content (Zn, Ca, Mg) in accordance with method ASTM D 5863, IR - spectrometry in accordance with method CEI IEC 590, evaporation loss (NOACK - test) in accordance with method DIN 51581, coke content in accordance with method ISO 6615, ash content in accordance with method ISO 3987 and corrosiveness in accordance with method ASTM D130, and oxidation stability in accordance with method IP - 48.

Motor oils for passenger car should meet the requirements of the car or engine manufacturer. With the development of car industry mineral motor oils are less and less presents, i.e. for enginer of the newer generation in accordance with manufacturers´ recommendations are used polysynthetic and synthetic oils motor oils.

Motor oils for commercial vehicles are applied in vehicles for cargo, buses and agricultural machines. Lately is required higher reliability and drive safety of the engine, smaller consumption of fuel, prolonged interval between changes of oil, and all this with better environmental protection.

Oils for gasoline and diesel engines in passé-nger vehicles of viscous grade SAE 15W - 40

Eighteen samples of motor oils, of different brands, viscous grade SAE 15W – 40 were submitted to laboratory testings of these six were of domestic and twelve of foreign production. Of these analyzed samples in twelve of them (66,6%) was determined that the technical characteristics were in accordance with declared, in six (33,4%) of the samples technical characteristics were not in accordance with declared. In five samples (27,8%) one, and in one sample (5,6%) two characteristics were not in accordance with declared. Figure 1. shows in the form of graphic dependency ratio of number of samples (in percentage) whose characteristics were in accordance, and whose characteristics were not in accordance with declared.

Oils for gasoline and diesel engines of passenger vehicles with viscous grade SAE 10W – 40

Seven samples of motor oils of different brands, viscous grade SAE 10W – 40 was subjected to laboratory testings, of which two were of domestic and five o foreign production. Of the analyzed samples in three (42,9%) was determined that the technical characteristics were in accordance with declared and in four samples (57,1%) technical characteristics were not in accordance with declared. In three samples (42,9%) one, and in one sample (14,3%) two characteristics were not in accordance with declared. Figure 2. shows in the form of graphic dependency ration of number of samples (in percentage) whose characteristics were in accordance with and whose characteristics were not in accordance with declared.

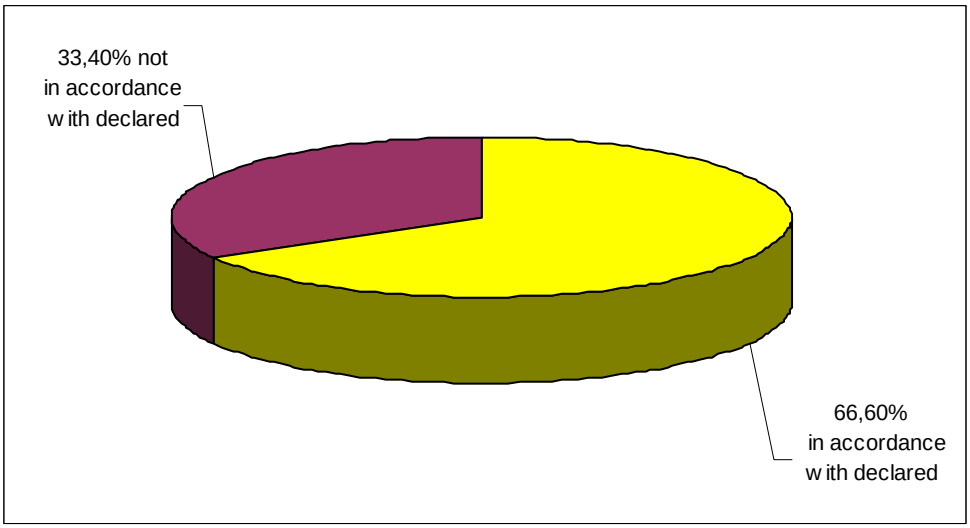

Figure 1: *Graphic presentation of deviations from declared quality of motor oil SAE 15W-40*

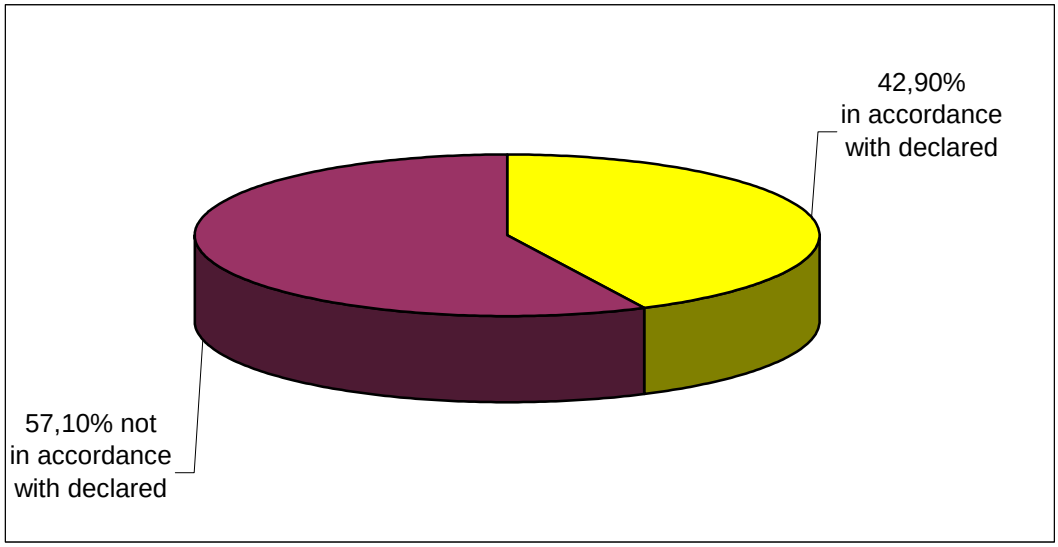

Figure 2: *Graphic presentation of deviations from declared quality of motor oil SAE 10W-40*

Oils for gasoline and diesel engines of passénger vehicles of viscous grade SAE 5W – 40

Eleven samples of motor oils, of different brands, viscous grade SAE 5W – 40 were subjected to laboratory testings, of these two were of domestic and nine of foreign production. Of the analyze samples in four (36,4%) was determined that the technical characteristics were in accordance with declared, and in seven samples (63,6%) one of the characteristics was not in accordance with declared. In six samples (54,5%) one and in one sample (9,1%) two characteristics were not in accordance with declared. Figure 3. shows in the form of graphic dependency ration of number of samples (in percentage) whose characteristics were in accordance and whose characteristics were not in accordance with declared.

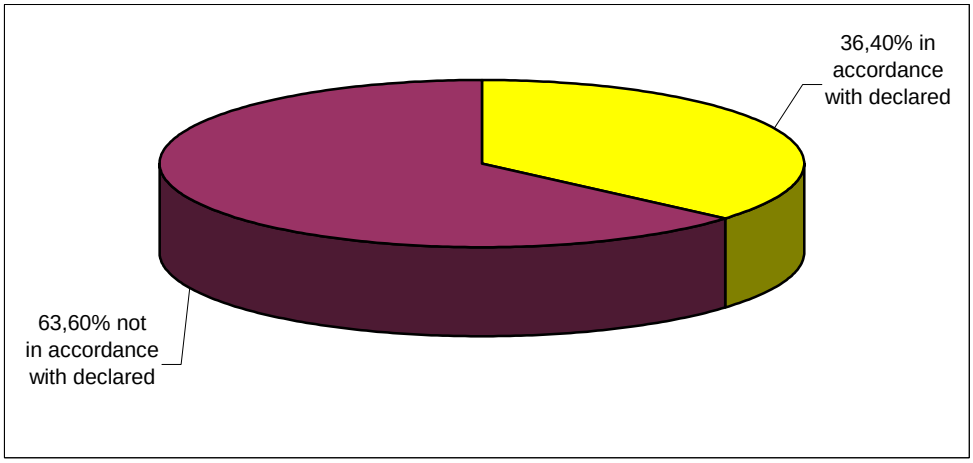

Figure 3: *Graphic presentation of deviations from declared quality of motor oils SAE 5W-40*

Oils for gasoline and diesel engines of commercial vehicles of viscous grade SAE 15W-40

Nine samples, of different brands, of viscous grade SAE 15W – 40 were subjected to laboratory testings, of which three were of domestic and six of foreign production. Of the analyzed samples in four (44,3%) was determined that the technical characteristics were in accordance with declared and in five samples (55,7%) technical characteristics were not in accordance with declared. In three samples (33,3%) one, and in one sample (11,2%) two characteristics were not in accordance with declared. Also, in one sample

(11,2%) three characteristics were not in accordance with declared. Figure 7. shows in the form of graphic dependency ratio of number of samples (in percentage) whose characteristics were in accordance and whose characteristics were not in accordance with declared.

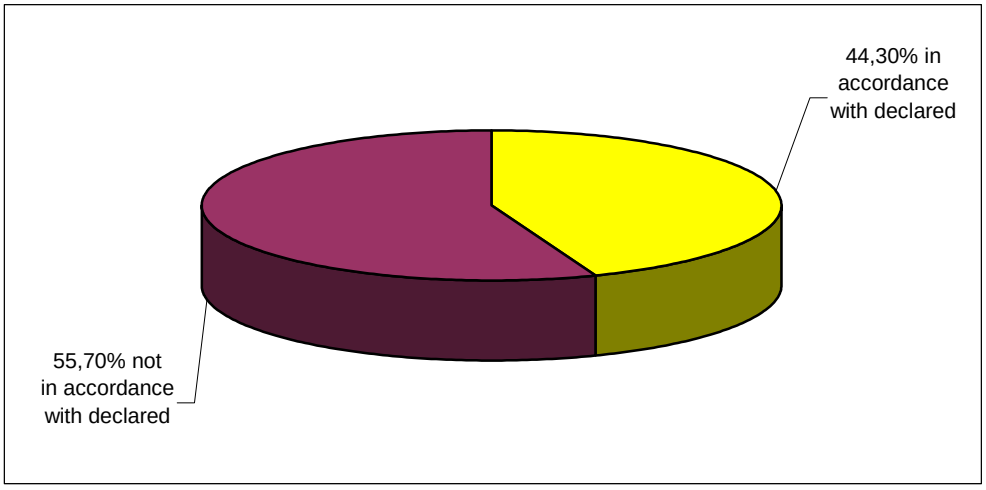

Figure 4: *Graphic presentation of deviations from declared quality of motor oil SAE 15W-40*

Laboratory testings of samples of motor oils of renowned brands have discovered a large number of forgeries on the markets of these countries. These forgeries consisted mostly of base oil SN 500 and SN 600 and very low percentage of additives, and some did not have even the additives. In table 1. are given results of laboratory analysis of some of the characteristics of motor oils for gasoline and diesel engines of viscous grade SAE 20W – 60 which show clearly that these are forgeries.

Table 1. Results of laboratory analysis of motor oil of viscous grade SAE 20W – 60

O.	Characteristics	-1	-2	-3	-4	-5	-6	-7
.	Viscosity at 40^0C,[mm^2/s]	5,05	8,98	5,33	4,87	6,44	30,11	7,45
.	Viscosity at 100^0C, [mm^2/s]	1,12	0,11	,88	,60	,94	2,94	1,42
.	Viscosity Index, [-]	02	3	4	9	3	1	04
.	Ignition point, [^{0}C]	62	52	54	58	54	60	54
.	TBN, [mgKOH/g]	,20	,68	,84	,74	,01	,92	,29
.	Pour point, [^{0}C]	17	11	10	12	9	12	16

According to the declaration of the manufacturer the value of total base number (TBN) is in the interval from 6,5 to 7,0 mgKOH/g, while based on the results from table 1. this value was significantly lower that declared. Also, data which indicate that these are forgeries are viscosity index and viscosity at 100^0C. Declared value of viscosity at 100^0C is from 21,9 to 23,0 mm^2/s, and in these samples it is in the interval from 9,0 to 12,0 mm^2/s. Indicators which also indicated that these are forgeries are ignition point and pour point.

In table 2. Are given results of the laboratory analysis of motor oil for passenger vehicles with viscous grade SAE 10W – 40 of different feeds and one renowned domestic lubricants manufacturer.

Table 2. Results of laboratory analysis of motor oil for passenger vehicle with viscous grade SAE 10W – 40

NO-.	Characteristics	UI-1	UI-2	UI-3	UI-4	UI-5	UI-6
1.	Viscosity at 40^0C, [mm^2/s]	95,89	94,22	95,37	92,91	94,62	92,35
2.	Viscosity at 100^0C, [mm^2/s]	14,58	14,43	14,65	14,61	14,52	14,49
3.	Viscosity Index, [-]	158	159	160	164	167	163
4.	Ignition point, [^{0}C]	242	246	244	242	238	236
4	TBN, [mgKOH/g]	9,93	7,88	8,55	9,16	8,74	9,24
5	Pour point, [^{0}C]	33	-35	-31	-30	-30	-32
6	Density 15^0C, [kg/m^3]	865,3	863,6	865,7	856,9	856,3	857,7
7.	Foaming tendency/ stability, [ml] -Phase I, 24^0C -Phase II, 94^0C -Phase III, 24^0C	 0/0 0/0 0/0	 0/0 0/0 0/0	 0/0 0/0 0/0	 0/0 0/0 0/0	 0/0 0/0 0/0	 0/0 0/0 0/0

From table 2. is clearly visible that the technical characteristics obtained by laboratory analysis of the samples of motor oil SAE 10W – 40 are in accordance with declared by the manufacturers. Also, it can be seen that there is continuity in quality, i.e. in declared characteristics.

From the total number of analyzed samples of domestic production in 16 samples (61,5%) all technical characteristics were in accordance with declared, and in 10 samples (38,5%) some of the characteristics were not in accordance with declared. Regarding motor oils of foreign brands the situation is the following: technical characteristics in 13 samples (41,9%) were in accordance with declared, and in 18 samples (58,1%) some of the technical characteristics were not in accordance with declared.

Of the total number of the analyzed samples of motor oils purchased at the market of SCG and B&H in 28 samples all technical characteristics were in accordance with declared or in percentage (49,1%) and in 15 samples (26,3%) one of the characteristics was not in accordance with declared, in 6 samples (10,5 %) two characteristics were not in accordance with declared, and in one sample (1,7%) three characteristics were not in accordance with declaration of the manufacturer of motor oil. In seven samples (12,3%) was found that technical characteristics were not in accordance with declared, i.e. that they were forgeries.

During laboratory analysis was determined which of the technical characteristics of motor oils independently of the brand were not in accordance with declared. Characteristics which were not in accordance with declared are: dynamic viscosity at low temperature (CCS) in 9 samples, foaming tendency (foaming stability) in 7 samples, evaporation loss (NOACK - test) and pour point in 4 samples, wear test in two samples and total base number (TBN) and oxidation stability in one sample. In motor oils of foreign brands the technical characteristics which most often were not in accordance with declared are dynamic viscosity at low temperature (CCS) and foaming tendency (foaming stability), and in domestic brands these are evaporation loss (NOACK – test) and foaming tendency (foaming stability).

3. CONCLUSION

Quality of motor oils is not problem just of manufacturers and owners of motor vehicles, i.e. lubricants manufacturers, but also of the whole community where of great importance is the role of customs services and inspection authorities.

Besides problem of how to choose adequate lubricant owners of motor vehicles are faced with additional problem of whether the technical characteristics are in accordance with declared, i.e. whether they are forgeries of some brands of motor oils. On the market of SCG and B&H it is necessary to take series of actions on the control of quality of motor oils which are in the retail network.

This paper should show realistic situation in the area of motor oils on the market of SCG and B&H, all with the intention to protect the end-user.

In general quality of motor oils on the market of these countries is not satisfactory and presence of forgeries of both domestic and foreign brands is a bid problem.

4. LITERATURE

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