

On dispersion of solid particles into the atmospheric air of cities, caused by tire and road surface wear

In addition to the documents previously submitted by the Russian Federation: white papers GRPE-65-20, WP-29-160-39, WP-29-161-22, the Russian side continues to conduct research of urban air pollution causes, including air pollution by the products of road surface and tire wear, etc.

During the additional studies we measured mass and quantity of solid particles sized from 0.3 to 25 micron in the size ranges of 0.3, 0.5, 1.0, 5.0, 10.0, 25.0 microns using a Lighthouse Handheld 3016 (USA) particle counter.

The general view of the device and its user interface is shown in Figure 1, its main characteristics - in Table 1.



a)



b)

Figure 1 - Handheld Particle Counter
"Lighthouse Handheld 3016":

a - general view

b - user interface of the particle count mode

Table 1 - Main characteristics of the manual particle counter
Lighthouse Handheld 3016

Measurement Range	0.3 - 25 microns
Number of measurement ranges	6: 0.3, 0.5, 1, 5, 10 and 25 microns
Sampling rate (l/min)	2.83
The upper limit of measurement	4000000 particles per sample volume of 2.83 l in each measurement range
Measurement error	less than 5%

What you can see below are the results of a study of particulate matter contents in the air behind the drive wheels of a car, taken while driving along a two-lane street with two-way traffic.

Types of cars - front-wheel, rear-wheel drive. The cars had tires of the same size - 195/65 R15: Bridgestone B650 AQ (front wheel drive) and "Kama Euro 129" (rear wheel drive). Air sampling was carried out at a 5 cm distance behind the drive wheel along the vector of motion. Sampling Mode - 10 cycles of 30 seconds each. with a 10 second interval. The car traveled 12 km.

The results of measuring the amount of airborne particles in the contact area of the drive wheel and the road surface are shown in Figure 2.

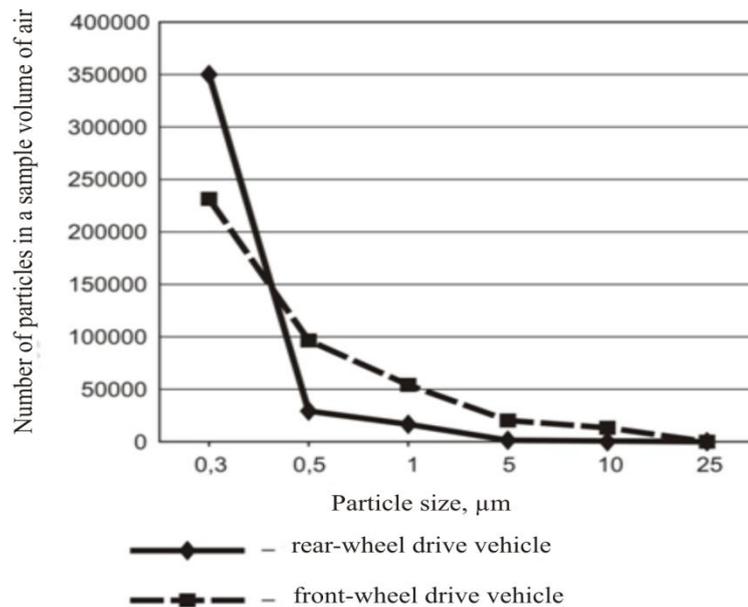


Figure 2 - The contents of airborne particulate matter (particles matters) in the contact area of the drive wheel and the road surface while the car is moving.

The data presented in Fig. 2 demonstrate that most of the airborne solid particles in the contact area of the drive wheel and the road surface fall into the size range between 0 and 1 micron.

Assessment of the impact of tire and road surface wear products, which are part of the airborne particulate matter above the road, on the drivers' and passengers' health under real operating conditions of motor vehicles was done by measurement of particulate matter in the air both inside and outside the vehicles. In particular, the measurements were carried out inside a

"Volkswagen Passat Variant" passenger car featuring a climate control system equipped with cabin air filters "MahleL A45" (Germany). The comparative data of the measurement of suspended solid particle content inside the car and in the outdoor air are shown in Fig. 3.

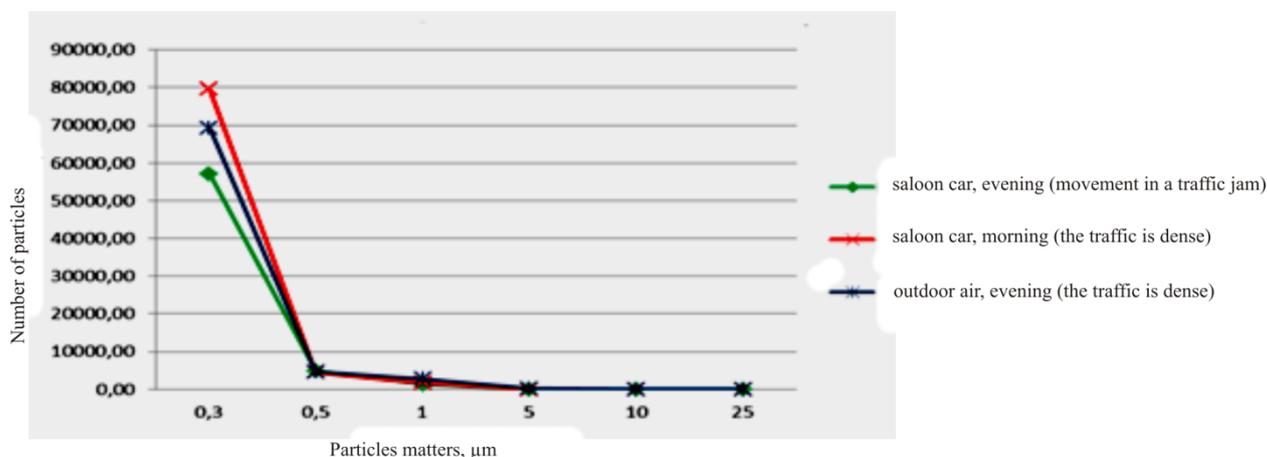


Figure 3 - The contents of particulate matter inside the car and in the outdoor air in urban driving conditions (heavy traffic)

High concentrations of particulate matter build up in the air above the road surface during vehicles' operation as a result of expulsion of solid particles with the exhaust gases, tire and pavement wear, background air pollution and other processes. The content of the products of tire wear in the air above the roads, observed in the documents previously submitted by the Russian delegation, reaches up to 60% of the total amount of solid airborne particles. The size of most of them is less than 1 micron - see Fig. 2, 3.

Due to the lack of regulatory requirements for the efficiency of cleaning the air inside the vehicles from particulates, insufficient performance of cabin air filters against particulates, their contents the air, especially particles smaller than 1 micron, under the real-life operation conditions is practically the same as in the ambient air (Fig. 3). As a result, in heavy traffic, traffic jams, tunnels, etc. their content in the air inside the vehicles often exceeds Russian sanitary standards (GOST R 51206-2004).

Consequently:

1. One of the major air pollutants, which pose greatest danger to the health of the population, in urban areas, and, especially, above the road surface, are the products of tire and road wear (up to 60%), which are smaller than 1 micron.
2. Car cabin filters efficiently clean the cabin air only from solid particles, including products of tire wear, which are larger than 5 - 10 microns, and have little effect against particles smaller than 1 micron.
3. The content of fine solid particles smaller than 1 micron in the cabin air is virtually identical to their content in the air above the roads.

The Russian side has evaluated the toxic properties of the tire and pavement wear products, which are part of the air that the population and, especially, drivers and passengers breathe.

The research proves, that the materials of new and used tires, as well as pavement, are potentially biohazardous as demonstrated by the death rate of laboratory animals. They violate the established sanitary requirements as shown by the summed toxicity index estimation method (MP № 01.018-07), customary in the Russian Federation.

Thus, normative work to limit the release of tire and road surface wear products is an urgent priority to ensure environmental safety of motor vehicles.
