SMOG SITUATION IN NOVOSIBIRSK IN OCTOBER 5 TO 11, 1997 (Pre-review of the data obtained)

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The results of atmospheric aerosol sampling on filters are presented along with the measurement results on the aerosol disperse composition, the coefficient of light scattering due to aerosol, concentrations of minor gases in the ground atmospheric layer. The results were obtained in the period of a severe smog occurred in Novosibirsk (October 5–11, 1997).

Early in October of 1997 severe smog conditions occurred in Novosibirsk region caused, according to preliminary analysis, by extensive forest and peat-bog fires. The most powerful fires, by the satellite data obtained via Internet,[1] were noticed in the Novosibirsk and Tomsk regions, the Altai region, and the Northern Kazakhstan. The synoptic situation in this period of smog was characterized by slightly cloudy weather, stable southern wind, high (for October) air temperature (+20 to +25°C), and abnormally low relative humidity down to 30%.

In the experiment, we have measured the disperse composition and particle number density of the atmospheric aerosol, the coefficient of aerosol light scattering, the concentration of ozone, sulfur and nitrogen oxides. Aerosol was sampled onto aerosol filters of the AFA–HA type.

RESULTS

It should be noted that in the period of smog there was practically no difference between day and night size spectra for fine-disperse particles (Fig. 1). Under relatively clear (without smog) conditions, homogeneous formation of new particles with the size up to 5–6 nm (see Fig. 1, curve *1*) could be observed in daylight. In smog, the size spectrum for particles of this fraction was mainly presented by only one mode of large particles (the average size about 120 nm and the mass concentration about 70 μg/m^3). The disperse composition of aerosol was typical of particles generated from the low-temperature pyrolysis of organic matter.

The ozone concentration during high pollution of the atmosphere with aerosol is characterized by relatively low average values, as well as random dips down to zero level and peaks up to 35 ppb (Fig. 2).

No diurnal variation was observed of the ozone concentration characteristic of a relatively clear atmosphere (i.e., daytime increase in the concentration).

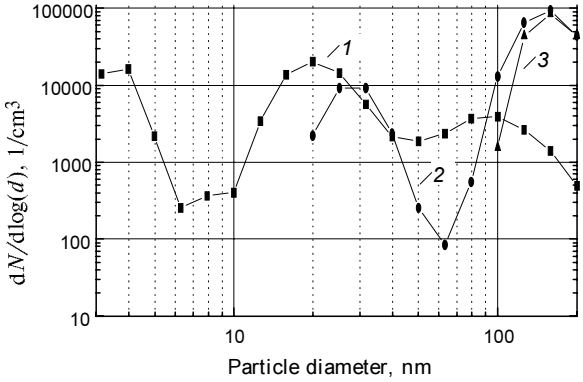

FIG. 1. Size spectra for the fine-disperse (the size smaller than 300 nm*) fraction of the atmospheric aerosol: the usual daytime spectrum (1), the smog nighttime spectrum (2), and the smog daytime spectrum.*

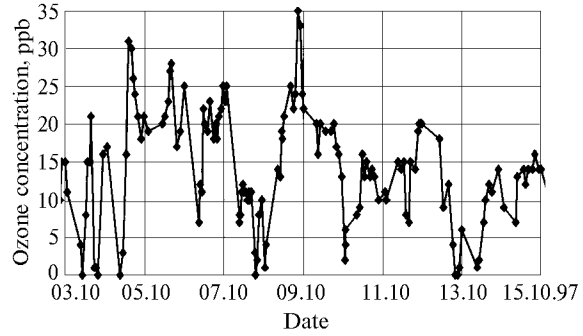

FIG. 2. Ozone concentration during the period of smog.

The aerosol coefficient of light scattering, observed during the smog period is plotted in Fig. 3. It is seen that the value of this coefficient during this period exceeded the background value typical for the city (October 12 to 15), on the average, by about a factor of ten and even 50 in the peak cases.

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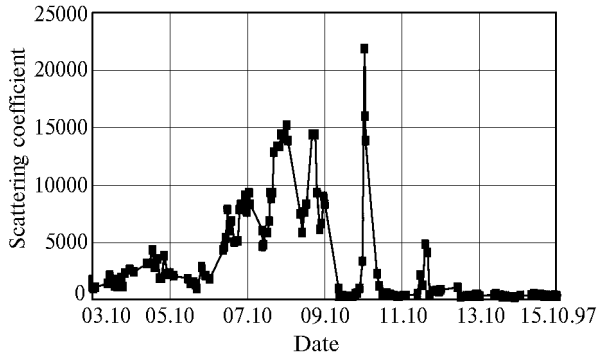

FIG. 3. The coefficient of aerosol light scattering during the smog period.

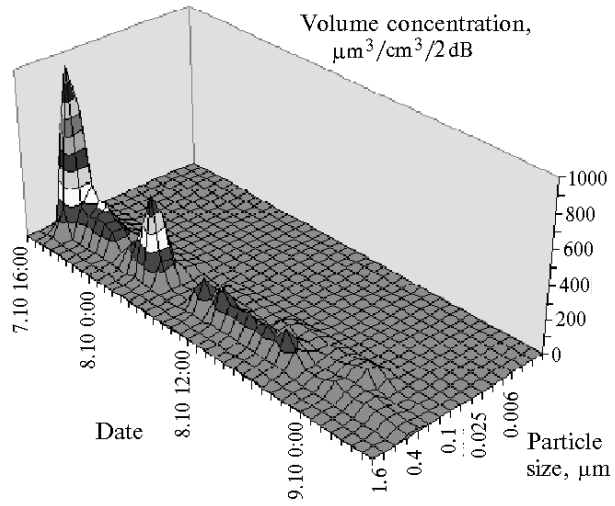

FIG. 4. Volume-distribution of aerosol particles in the period of smog.

In the period of particularly high pollution (October 6 to 10), the three peaks of smoke passage can be separated out: October 7, 8, and 10. The behavior of the aerosol coefficient of light scattering agrees well with the volume-distribution of aerosol particles (Fig. 4), which also clearly reflects the corresponding variations.

During the smog situation, on October 8–9, aerosol was sampled onto filters of the AFA–HA–20 type. Sampling was conducted on the roof of the Institute of Chemical Kinetics and Combustion SB RAS (the height of the second floor). Air volume of 104 ± 10 m^3 was blown through the filter with the average rate of 5.6 m^3/h. Comparing the filter mass before and after the exposure, we have estimated the mass concentration of atmospheric aerosol in air as 87 ± 14 μg/m^3. This value is far higher than the concentration measured in the period after the smog (Table I).

TABLE I. Mass concentration of the atmospheric aerosol estimated from sampling in Akademgorodok of the city of Novosibirsk.

Situation	Smog	Blowing	
Period of sampling	10.08.97 15:30 −10.09.97 9:00	10.09.97 9:30 −10.10.97 18:15	04.19.97 20:30 −04.20.97 11:50
Mass concentration, μg/m^3	87	42	20

The mass concentration of aerosol significantly increases during the smog events. Taking into account the data of the diffusion aerosol spectrometer, we can assume that this increase is mainly due to the respiratory fraction of aerosol particles (with the size of 0.1–0.6 μm).

Further analysis of the chemical composition of filters' content using a chromatograph has revealed six individual high-molecular organic compounds. Because of their very small concentration on the filter, we failed to determine them.

REFERENCES

1. Http: // nffc. infospace. ru /RUS/ fr 97_d_r.sht.