Foreword

Atmospheric aerosols (AA) plays decisive role in many atmospheric processes (formation of clouds and precipitation, radiation heat exchange, changes of visibility). It affects the quality of environment, climate and chemistry of the atmosphere. Because of this, interest to the investigation of atmospheric aerosol is constantly growing. The properties of atmospheric aerosol are determined by size, concentration, chemical composition and structure of particles. The AA particle size range covers 5 orders of magnitude; concentrations range more than 10 orders. Chemical composition of atmospheric aerosol is very complicated; that is why its investigation requires a complex of methods, special instrumentation and modern analytical equipment. An example of the complex investigation of atmospheric aerosol can be international projects ACE-1 (1995) and ACE-2 (1997), performed in late 90-ies of the previous century. The projects were aimed at the investigation of interactions between marine and continental aerosol over the Atlantic ocean. A characteristic feature of these projects was the combination of efforts of different countries and application of the whole arsenal of methods, including the land-based, above-water, airborne and space observations, which allowed investigating spatial-temporal characteristics of the changes of disperse and chemical composition of AA. In 2001, a large international ACE-Asia project was launched. Its aim is to investigate the formation of continental aerosol in the Asian countries of the Pacific region.

Among the atmospheric aerosol of marine and continental types, the latter is less investigated yet. For example, according to the data of large-scale investigations of the contamination of the Arctic region, performed within an International Project «Arctic Haze», mass fraction of the contamination of this region connected with aerosol formed over the Urals, Siberia, and Kazakhstan is from 20 to 50 %. In spite of the substantial contribution from aerosol originating from Siberia into the global pollution of the atmosphere, the data on this aerosol are insufficient to provide a multi-aspect estimation of the effect of AA on the quality of the environment. This is due to specific features of the Siberian region. Along with the diversity of natural climatic zones, this region survives intensive development of industry and agriculture, which are sources of various types of aerosol. At the same time, there are territories in Siberia that are remote from strongly polluted industrial centres. These regions are considered to be the background ones, in which substantial part of aerosol is formed as a result of natural processes with small admixtures of pollutants. Cities and many regions of the south of Siberia are strongly polluted with heavy metals. The level of this pollution is noticeably more than that in the industrial countries of Europe and America. Local pollution of AA can produce substantial danger for the health of the population of these regions. In many cases, huge point sources of industrial pollution are sufficiently simple to study many aspects of environmental chemistry; so, important scientific results can be expected at minimal expenses.

One of the possible reasons of noticeable pollution of the south of Lake Baikal with heavy metals is atmospheric aerosol precipitation. The northern part of Lake Baikal remains non-polluted at present; the southern part is subjected to the action of industrial pollution from Baikal'sk, Irkutsk, Angarsk, Shelekhovo and Ulan-Ude. The analysis of the

characteristics of AA allows to estimate the contribution from atmospheric precipitation into the overall flux of heavy metals entering Lake Baikal, and to compare it with rivers' carry-off.

The investigations of AA in many sites of the world, performed for many years, demonstrate that a substantial part of atmospheric pollutants is composed of particles formed by aeolian erosion of land and at the oceanic surface. These particles are composed of dust and marine salts. As a rule, the content of other particles of natural and anthropogenic origin in AA is much smaller. Central Siberia lies several thousand kilometers off the sources of soil erosion aerosol. In winter, the land in Siberia is covered with snow, while water bodies, including oceans and seas, are ice-bound. Thus, this period is extremely favourable for the investigation of long-range transport of industrial pollution.

Substantial part of the territory of Siberia is covered with forest, which is a powerful source of biogenic aerosol: primary one (for example, plant pollen) and secondary one, formed as a result of emission of reactive gases which are converted into aerosol particles in chemical and photochemical processes. Forest fire is a powerful source of atmospheric aerosol in Siberia.

This issue of *Chemistry for Sustainable Development* presents the results of experimental and theoretical investigations performed by the participants of the Integration Project No. 64 of SB RAS "Aerosol of Siberia".

The goals of this Project are:

– investigation of the regularities of formation, transformation and transport of aerosol in Siberia at local, regional and global levels, in order to reveal its main sources and sinks;

– estimation of the effect of atmospheric aerosol on air quality, levels of the pollution of plants, soil and water, migrations rates of substances and elements in the environment;

– survey of the effect of atmospheric aerosol of different nature on atmospheric processes, human health, animal life, and climate.

Investigations on this Project are performed within five subject directories: 1) monitoring; 2) analytical measurements; 3) mathematical modeling; 4) laboratory and stand investigations; 5) databases and GIS technologies.

The Project participants are fifteen institutes of the SB RAS, as well as the Institute of Aerobiology of the State Scientific Centre for Virology and Biotechnology "Vector", and the Siberian State Geodesic Academy.

Editor,
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