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Chemistry of the atmosphere

This and the following issues of the Journal will deal with the ecological aspects of the chemistry of the atmosphere. Problems associated with air pollution by anthropogenic emissions and the products of their chemical reactions have, in the life time of one generation, turned from local into global problems. They threaten to create significant changes for life on earth. The gaseous and aerosol emissions of industry and motor transport, agricultural chemicals, and the products of reactions of initial emissions, are carried for great distances by air-streams. This causes a progressive rise in the amount of toxicants in the environment. This anthropogenic influence on the atmosphere leads to an increase in the greenhouse effect due to a rise in atmospheric CO_2 concentration. It also leads to a depletion of the ozone layer, owing to reactions involving freons. It is quite natural, therefore, that the physicochemical processes in the atmosphere have been comprehensively studied in recent years. Because atmospheric processes are so complicated, it follows that these studies were of a complex nature right from the start, and that specialists in various fields—meteorology, physics, chemistry, and mathematics—had to combine their efforts. The interdisciplinary nature of the problem is partly reflected in the character of the reviews put before the reader, though in the main they deal with chemical problems.

The review of K Ya Kondrat'ev is devoted to a problem that has become the focus of international interest. It deals with the impact which the changes in the chemical composition of the atmosphere have on climate. It contains general information on the main gaseous species in the atmosphere and their sources, as well as on the properties and role of atmospheric aerosols. The review of S G Zvenigorodski and V B Rozenshtein discusses the key role of radical reactions in chemical processes in the atmosphere induced by solar radiation. The review of J A Kerr sums up the results of the work of an international group of experts who developed kinetics databases for modelling atmospheric chemical processes. Examples of the application of kinetic data in mathematical modelling of chemical processes in the atmosphere are given in the paper by V V Penenko and G I Skubnevskaya. They discuss mathematical models describing the aggregate effect of the transport processes and chemical transformations that take place in the atmosphere.

The next three reviews reflect the heightened interest in the part played by the heterogeneous component in the chemistry of the atmosphere. In P Jaenike's review, which can be regarded as an introduction to the problem, a short summary is given of the current knowledge of all the diverse properties of aerosols in the atmosphere. The paper by S G Malakhov and E P Makhon'ko deals with the role of aerosols in the transport of toxic metals. Finally, in the review by Yu M Gershenzon and A P Purmal' the part that heterogeneous reations play in the chemistry of the atmosphere, in particular their effect on ozone content and acid rain, is analysed.

The development of detoxification methods for gaseous emissions in industry is one of the fundamental goals of contemporary chemistry. This is directly connected with the ecological aspects of the chemistry of the atmosphere. Yu M Matrosov and A S Noskov's review presents an analysis of the current state of this problem. Considerable prominence is given in this review to the newly developed catalytic nonstationary technique. In the paper on the same subject by Z R Ismagilov, M A Kerzhentsev and T L Susharina the principal emphasis is placed on the detailed discussion of catalytic techniques for reducing nitrogen oxide emission from fuel combustion.

Atmospheric processes may contribute significantly to the transport and transformation of complex toxic organic compounds. Unfortunately, material on this area of the chemistry of the atmosphere has not been included in the present issue. However, we believe that the chemical-analytical aspect of the problem of organic toxicants discussed in the reviews of A K Prokof'ev and L A Fedorov, and by B F Myasoedov, cover this subject to a great extent. They therefore compensate to a certain degree for the above-mentioned gap.

In conclusion, I would like to thank Soviet and foreign contributors for their enthusiastic response to the request of the editorial board for papers for this special issue of the Journal.

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