MULTIWAVE LIDAR MEASURMENTS OF INDUSTRIAL AEROSOL EMISSIONS' CALCULATING AND MASS CONCENTRATION

Nikitin V.M., Borovlyov A.E., Ukolov Yu.A.
Belgorod State University
Belgorod, Russia

General atmosphere pollution increase and associated with it global changes of noosphere, energy balance in the Atmosphere-Earth system in peculiar, proved the actuality of applied fundamental research of chemical and physical properties and the structure of atmospheric aerosols and quantitative assessment of their role in the above mentioned processes. The aim of the research is the development of a method of estimation of different industrial enterprises' contribution to general pollution of the atmosphere over the territory of a large urban settlement. Meeting the goal objective was carried out on the basis of triple-wave (λ = 1064, 532 and 355 nm; laser radiation pulse duration on the 0,5 level is $\tau \leq$ 15-17 ns.; angular spread of laser ray in the 0,5 level doesn't exceed $\theta \leq 2$ ang. min) and polarizing laser sounding of visually observable aerosol plume at different distances from the mouth of the corresponding tubes which were from 50 to 100 m tall [1]. Lidar measurements were carried out in Belgorod in 2004-2006 years in the location unit of a range of enterprises connected with concrete production. The lidar was located at a distance not less than 2 km from the enterprises. The quantitative assessments of aerosol masses' integral parameters (volume density V [мсм^3/см^3], typical radius of the particle r_{32} [мсм] and specific surface area S [мкм^2/см^3]) were carried out by means of solving an inverse problem of aerosol optics on the data about the size of measured visual thickness of these masses for dry and damp dust condition (refraction index of n=1,55 – 0.005i, n=1,41 – 0.002i accordingly). The analysis of the results of the triple-wave subflow sounding of the aerosol (under the lower edge of the visually observable flow) shows that the typical particles' size r_{32} assessment varies from 0,6 to 1,3 mcm. It is in an adequate agreement with the results of the carried out direct microscopic measurements of the typical sizes of the particles of dust in the selected from the last aerosol filter test samples [1]. The estimation of trickling aerosol percentage in the industrial emissions was carried out by means of additional use of polarizing sounding indication for the three typical cases: clean atmosphere, visually observable aerosol flow coming out of the tube mouth and aerosol "mark" under the flow. The back scatter indications $P_{\parallel}$ (with the polarization parallel to the origin one) and $P_{\perp}$ (with the polarization orthogonal to the origin one) in relative units and also the magnitude of the depolarization degree indication of back scattering $d = P_{\perp} / P_{\parallel}$ were subject to the analysis. It was experimentally proved that in the centre of visually observable flow the aerosol represents, in general, condensed steam. Under the visually observed flow the polarizing sounding indicates the aerosol consisting of nonspherical particles of concrete dust. These results are typical of many measurements of depolarization degree of a solid aerosol and adequately agree with the results of test measurements d for concrete dust.

References

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