

Preliminary study on physical and chemical properties of dust

*Yuan Luo¹, Siyu Chen¹

1. Lanzhou university

Dust aerosol is an important part of atmospheric aerosol, which affects the climate system through direct, indirect and semi-direct effects. The aerosol of dust can be divided into natural dust and man-made dust according to the source. Natural dust mainly comes from the desert, gobi desert and other bare surface. Anthropogenic dust is the part of dust that is directly or indirectly brought into the atmosphere by human activities.

The size of dust particles is an important factor that determines the suspension, transfer, deposition and life of particles. At the same time, the dust particles are easy to absorb bacteria, heavy metal pollutants, sulfate and organic pollutants during the transmission process, which are harmful to human health. In this study, we collected 400 samples from a variety of surfaces to further study the effects of different land cover and human activities on the properties of sand dust, and to provide a research basis for the differences between man-made sand dust and natural sand dust and the impact of such differences on man-made sand dust.

Particle size analysis the Malvern Mastersizer 2000 laser particle size analyzer was used for experimental related operations. The measuring range of the machine is 0.02~2000 μm , and the related operations such as testing, basic analysis, cleaning and so on can be well completed by using the Mastersizer 2000 software accompanying the machine. Element and mineral analysis was performed using an X-ray fluorescence spectrometer, Magic PW2403, and sample preprocessing was performed using a grinder and press.

The mean value of median particle size was shown as urban (151.25 μm) > desert (121.91 μm) > farmland (21.07 μm). The peak of grain size distribution curve is also shown as urban > desert > farmland, among which the bimodal distribution of urban road dust reflects the multi-source of road dust. On the one hand, human activities such as industry, transportation and agriculture produce large amounts of man-made dust. On the other hand, natural dust is transported over long distances to densely populated urban areas with high anthropogenic pollution emissions, and new anthropogenic dust is generated by mixing with local materials. According to the movement characteristics of different particle sizes of surface particles under the action of wind and their influence on human health, road dust particle sizes were classified according to the classification standards of atmospheric particles. The most concerned inhalable particles with particle size less than 10 μm had the highest content in the farmland samples (31%), followed by the urban road samples (9%) and the desert samples (3%).

The study on the mineral composition of dust shows that natural dust is more different from manmade dust in SiO_2 , CaO and Fe_2O_3 . Compared with Taklimakan desert, Beijing and Lanzhou, the content of SiO_2 and CaO in Tengger desert is higher and CaO content is lower. The content of SiO_2 in natural dust is higher, while the content of Fe_2O_3 in man-made dust is higher. In terms of heavy metal analysis, Lanzhou is more polluted than Beijing, and Zn, Cr and Cu are more polluted.

In conclusion, particle size is shown as urban > desert > farmland. The content of SiO_2 in natural dust is high, and the pollution of manmade dust by heavy metal is obvious.

Keywords: anthropogenic dust, particle size distribution, heavy metal

