I am pleased to share some new research from our authors of this issue of Current World Environment journal. This issue is covering wide range of studies in the form of review articles, research papers and case studies reporting air and water pollution measurements, scenario analyses, trends analyses, biodiversity, extreme events and climate change impacts. This issue of the journal has some very important papers e.g. rainwater harvesting in Ghana, heavy metal pollution in the Black Sea, bacterial pollution in the sediment of Padma River in Bangladesh, ground water level trends in Uttar Pradesh state of India etc. I hope that you find these contributions very useful.

I have selected the theme of this Editorial on the importance of controlling ambient air PM$_1$ concentrations for preventing human health problems due to air pollution. Recalling back in 90's, when most of atmospheric aerosol studies used to report total suspended particulate matter (TSPM) which included particles upto 25 µm or even larger. Then after a decade or so, it was realized that the PM$_{10}$ levels matter, not the TSPM levels for health implications. The PM$_{10}$ particles are also known as respirable sized particulate matter (RSPM). Very soon, researchers established that the coarser particles including PM$_{10}$ do not have significant health effects as compared to PM$_{2.5}$ aerosols. In this regard, a large number of studies have been reported but it is not possible to cite all these studies in this brief article. Regulatory bodies have also defined ambient standard limits of PM$_{2.5}$.

However, with the advancement of our knowledge, the latest research findings reveal that it is not the PM$_{2.5}$, but PM$_1$ which has close relation with human health. The PM$_1$ basically comprises anthropogenically derived particles directly penetrating into the blood system having harmful effects on our respiratory and cardiovascular systems. Therefore, in order to assess the health impacts of particulates, we need to consider only PM$_1$ and not the PM$_{2.5}$. Around 70-80% fraction of PM$_{2.5}$ has been reported due to PM$_1$ aerosols. Infact, smaller and smaller particles (<1µm) pass through the blood barriers in the lungs. This allows their entry into blood stream having severe health implications. The damage depends on its chemical content.
The PM$_1$ particles consist of toxic and harmful chemical components such as black carbon, organic carbon, heavy metals, persistent organic pollutants (POPs). According to a report, PM$_1$ has higher mass fraction of carbonaceous aerosols as compared to PM$_{2.5}$. Lim et al., found that PM$_1$ and PM$_{2.5}$ had OC mass fraction as 23.0% and 22.9% while EC mass fractions was 10.4% and 9.8% respectively at ABC super Observatory at Goshan. The heavy metal fractions have also been reported higher in PM$_1$ in other studies worldwide. However, the chemical components such as Ca and Mg which are mainly contributed by the crustal sources such as suspension of soil dust, road dust and construction dust, have lower fractions in PM$_1$ as compared to PM$_{2.5}$ aerosols. These characteristics of PM$_1$ suggest their distinctive identification for harmful sources.

According to a study by Lee et al., PM$_1$ particles have been found to be associated with nitrate driven haze pollution in Beijing and Xinxiang in the North China Plain region. This study highlights that very high levels of PM$_1$ nitrate, even higher than the European and North American sites need to be controlled by reducing reactive nitrogen species such as NH$_3$ and NO$_x$ emissions. Situation during crop residue burning might be similar due to the formation of secondary aerosols. Generally, sulphate aerosols also predominate in the PM$_1$ range. These have significant impacts on visibility and radiative forcing too. However, more research is needed to understand the impacts of PM$_1$ on agricultural crops in different agricultural zones.

Therefore, we need to quantify PM$_1$, its carbonaceous fraction, organic fraction and metallic fraction etc. Accordingly, we need to conduct toxicological and epidemiological research to develop new air quality criteria and related limits. This raises an urgent need to develop certified standards for the accurate chemical analysis of PM$_1$. Probably, PM$_1$ concentrations and its chemical characteristics will be more relevant parameters for global comparisons and ranking air quality status of different cities worldwide. Moreover, it will reduce the bias generated by the crustal fraction especially for the sites of dusty regions such as African, middle-east and south Asian. Considering the fact that PM$_1$ is more important to prevent human health hazards, investing in PM$_{2.5}$ monitoring stations will prove meaningless effort of the regulatory bodies. Also, we need to focus more upon emission control than the measurements. Hence, we need not to have too many sites, rather we should operate limited number of sites and produce good quality data having reliability in public. The location and the number of sites can be decided accordingly with the aim to captur PM$_1$ levels due to local source variation, seasonal variation, trans-boundary and long range transport of pollution etc.

References