



Research Article

ISSN : 0975-7384  
CODEN(USA) : JCPRC5

## The current status and sources of PM<sub>2.5</sub> in Tangshan, China

Ying Han\*, Xiao Liu, Shikuan Liu and Li Chang

College of Architectural and Civil Engineering, Hebei United University, Tangshan, Hebei, China

### ABSTRACT

Fine particle mass (particulate matter  $\leq 2.5 \mu\text{m}$ ; PM<sub>2.5</sub>), which is primarily from combustion source. In this study, it was reviewed that the hazard of PM<sub>2.5</sub>. And then it was shown the sources of PM<sub>2.5</sub> in Tangshan urban district. In addition, it is analyzed the data of several day's PM<sub>2.5</sub> in Tangshan urban district. The pictures showed that the visibility along with the change of PM<sub>2.5</sub> concentration. These results indicate that the concentration of PM<sub>2.5</sub> obviously changed by the local and synoptic meteorological data as the sources of PM<sub>2.5</sub> were not decreasing.

**Key words:** Pollution, Particulate matter 2.5, Tangshan, Hazard, Status

### INTRODUCTION

With economic acceleration and the process of urbanization, the environment in the cities of China is getting worse and worse. Even the situation causes problems such as visibility, health, climate change and so on. One kind of all the pollutants attracted most people's attention is particulate matter (PM). PM or particulates are tiny pieces of solid or liquid matter associated with the atmosphere. They are suspended in the atmosphere as atmospheric aerosol.

Now the index of PM<sub>2.5</sub> has been monitored by the Chinese government, which makes a great progress for Chinese environmental protection. Before that, the hazard was not paid attention by the public. Researches of PM<sub>10</sub> and PM<sub>2.5</sub> have been done in Europe and America last century.

Particles less than 10 micrometers in diameter (PM<sub>10</sub>) pose a health concern because they can be inhaled into and accumulate in the respiratory system. Particles less than 2.5 micrometers in diameter (PM<sub>2.5</sub>) are referred to as "fine" particles and are believed to pose the largest health risks. Because of their small size (less than one-seventh the average width of a human hair as shown in Fig.1), fine particles can lodge deeply into the lungs.

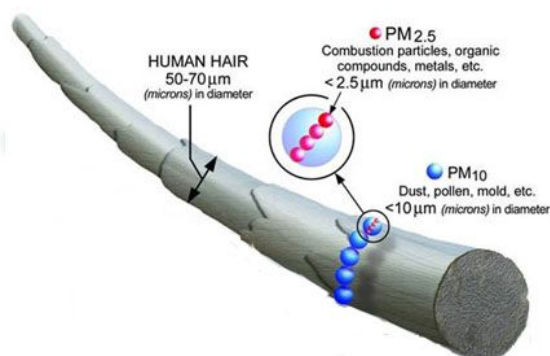


Fig.1 Size of PM<sub>2.5</sub>

The increased levels of fine particles in the air as a result of anthropogenic particulate air pollution is consistently

and independently related to the most serious effects, including lung cancer [1] and other cardiopulmonary mortality [2]. The large number of deaths [3] and other health problems associated with particulate pollution was first demonstrated in the early 1970s [4] and has been reproduced many times since. PM pollution is estimated to cause 22,000-52,000 deaths per year in the United States (from 2000) [5].

A study published in the Journal of the American Medical Association indicates that PM<sub>2.5</sub> leads to high plaque deposits in arteries, causing vascular inflammation and atherosclerosis — a hardening of the arteries that reduces elasticity, which can lead to heart attacks and other cardiovascular problems [6]. The World Health Organization (WHO) estimates that "... fine particulate air pollution (PM<sub>2.5</sub>), causes about 3% of mortality from cardiopulmonary disease, about 5% of mortality from cancer of the trachea, bronchus, and lung, and about 1% of mortality from acute respiratory infections in children under 5 years worldwide." A study concluded that traffic exhaust is the single most serious preventable cause of heart attack in the general public, the cause of 7.4% of all attacks [7].

#### SOURCES OF PM<sub>2.5</sub>

Tangshan is a largely industrial prefecture-level city in northeastern Hebei province. There are nearly 10 steel companies in Tangshan city, such as Tangshan Iron and Steel Co., Ltd. In addition, there are 366 district heating station and more than 80 million automobiles in Tangshan urban district. All of these are sources of particulate matter including PM<sub>10</sub> and PM<sub>2.5</sub>.

It is shown that the secondary inorganic components were the major contributors to particulate matter [8]. The anthropogenic emissions sources, such as vehicle emission, coal and biomass burning should be controlled to decrease the concentration of PM<sub>2.5</sub>.

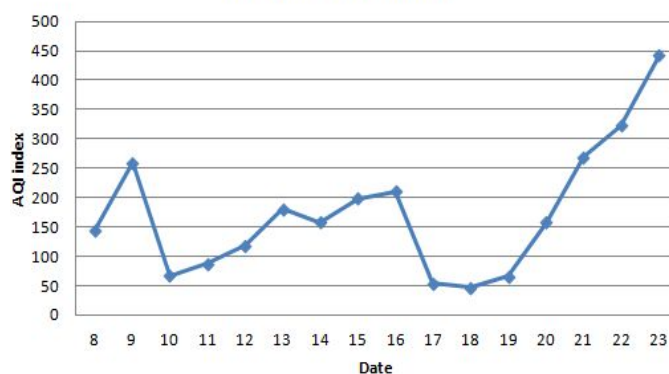
#### STATUS OF PM<sub>2.5</sub>

Typical daily PM<sub>2.5</sub> data were obtained for urban district monitoring sites. Daily meteorological data were collected for the same time period. They are shown as follows:

**Table 1 Meteorological Data**

Date	Average Temperature (°C)	Wind (deg.)	Precipitation (mm)
11.18	6.9	3-4	4.7
11.19	2.4	3-4	0.7
11.20	-1.0	3-4	0.0
11.21	0.1	3-4	0.0
11.22	3.9	3-4	0.0
11.23	-1.2	3-4	0.0
11.24	-3.5	4-5	0.0
11.25	-0.2	3-4	0.0

**PM2.5 AQI index**



**Fig.2 PM<sub>2.5</sub> AQI index during 15 days**

Table 1 and fig.2 shows that the concentration of PM<sub>2.5</sub> decreased sharply by the influence of the precipitation.

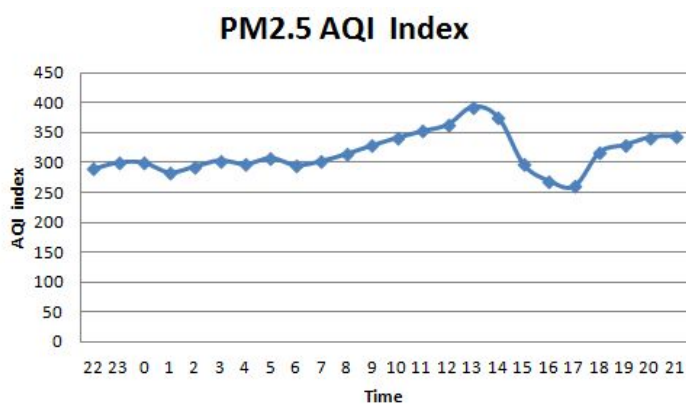


Fig.3 PM<sub>2.5</sub> AQI index on Nov.22th



Fig.4 Bird's eye in Tangshan on Nov.22th

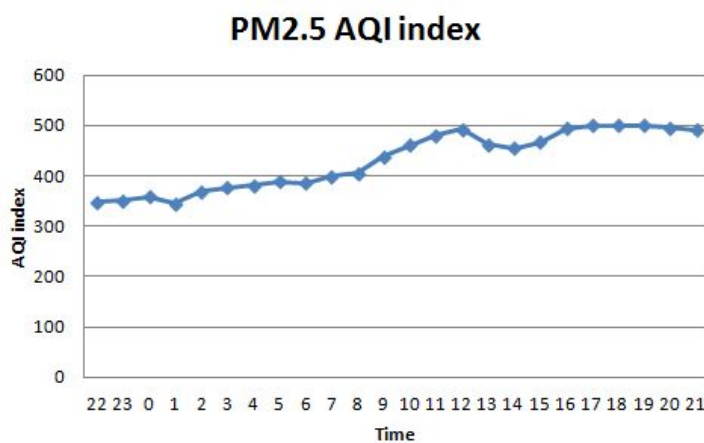
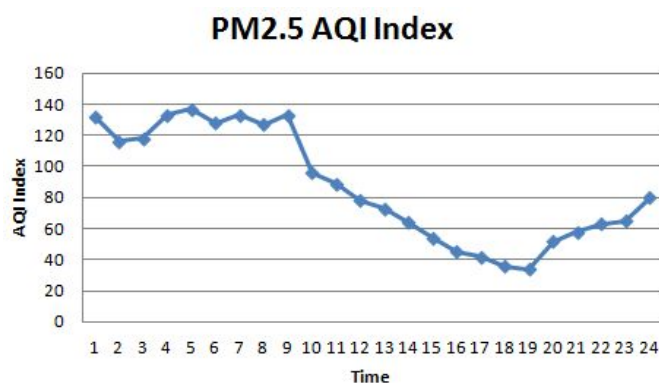


Fig.5 PM<sub>2.5</sub> AQI index on Nov.23th



Fig.6 Bird's eye view in Tangshan on Nov.23th



**Fig.7 PM<sub>2.5</sub> AQI index on Nov.25<sup>th</sup>**



**Fig.8 Bird's eye view in Tangshan on Nov.25<sup>th</sup>**

From these figures above, it is indicated that the degree of visibility along with concentration of PM<sub>2.5</sub>. The concentration on Nov. 25<sup>th</sup> declined to 34 AQI index at 19 o'clock shown in Fig.7. The reason is that there is precipitation on Nov. 24<sup>th</sup> and also higher wind degree.

### CONCLUSION

PM<sub>2.5</sub> concentration and local and synoptic meteorological data were examined for Tangshan urban district. Results of the analysis can be summarized as follows. PM<sub>2.5</sub> concentrations are very high in winter in Tangshan urban district. There was close relation of visibility with PM<sub>2.5</sub> concentration in the haze weather. Local weather conditions on days with high PM<sub>2.5</sub> concentrations are generally characterized as warmer, less windy and with less precipitation.

The results suggest that close monitoring of PM<sub>2.5</sub> conditions in Tangshan urban district should be continued and perhaps expanded to include other pollutants that tend to be prevalent in higher concentrations under similar weather conditions as presented in this study. Meanwhile, it is necessary to strengthen the greening and reinforce the management of the construction sites.

### REFERENCES

- [1] Ole Raaschou-Nielsen *et al.*. *The Lancet Oncology*. **2013**, 14(9):813-822.
- [2] Aaron J. Cohen. *J. Toxicol. Environ. Health*. **2005**, 68 (13-14): 1301-1307.
- [3] Nogueira JB.. *National Institute of Environmental Health Sciences*. **2009**, 28(6):715-733.
- [4] Lave, Lester B, Eugene P. Seskin.. *Journal of the American Statistical Association*. **1973**, 68: 342.
- [5] Mokdad, Ali H. *J. Amer. Med. Assoc.* **2004**, 291 (10): 1238-1245.
- [6] Pope, C Arden *et al.*. *J. Amer. Med. Assoc.* **2002**, 287 (9): 1132-1141.
- [7] Nawrot, Tim S; Laura Perez, Nino Künzli, Elke Munters, Benoit Nemery. *The Lancet*. **2011**, 377 (9767): 732-740.
- [8] Miao Hong-yan, Wen Tian-xue, Wang Li, Li Xing-ru, Wang Yue-si. *Environmental Science*. **2013**, 34(4): 1224-1231.