Comparison of Air Pollution Measurement (Zuun Ail area)

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Results of 2012-2013 PM2.5 and PM2.5-10 aerosol pollution study of Ulaanbaatar city, Mongolia is been presented. PM2.5 and PM2.5-10 aerosol fractions have been measured three times a week at the Zuun ail of Ulaanbaatar city. Weight of the samples and Black Carbon were determined at the Nuclear Research Center (NRC), National University of Mongolia. Element analyses have been performed at the NRC using XRF analysis. It includes Na, Mg, Al, Si, P,S, Cl, K,Ca, Ti, V,Cr,Co, Ni, Zn, Cu, As, Br, Sr, Ba, I, Hg, Pb. Average concentration of PM2.5-10 is 319 μg/m3, PM2.5 is 154 μg/m3 in the year.

Keywords: PM2.5, PM10, aerosols, particles characterization

I. INTRODUCTION

Air pollution has major health impacts on people living in Ulaanbaatar. The World Health Organization (WHO) listed the air pollution in Ulaanbaatar (Mongolia) among the top 5 cities with the worst air quality in the world. Air pollution is not only issue for Mongolia, air pollution level exceeds the of WHO recommendation in many countries, especially Asian countries [1]. The excessively high particulate matter concentrations, especially in the winter and the ger areas, increase the incidence of heart and lung diseases, and lead to premature deaths. Improving air quality management in Ulaanbaatar and reducing pollution concentrations would prevent illnesses, save lives and avoid enormous health costs. In order to get a sound information basis for a strategy to improve air quality in Ulaanbaatar, the World bank in partnership with Mongolian counterparts launched an "Air Monitoring and Health Impact baseline" (AMHIB)study in 2008. The AMHIB study also includes analyses of the sources of the pollution concentrations, and cost benefit analyses of measures to reduce this level.

Particulate Matter is microscopic solid or liquid matter suspended in the atmosphere. The negative effects of Particulate Matter on health are related to the particle size. PM10 is particulate matter with a diameter lower than 10 μm; these PM are inhalable and contribute to nonfatal heart attacks, reduced lung function, asthma, coughing, difficulty breathing and premature death from heart or lung disease. Particulate matter with diameters less than 10 μm, but greater than 2.5 μm, are called coarse particles. Fine particles PM2.5, have diameters smaller than 2.5 μm. These particles are generally emitted through combustion and contribute to reduced visibility in addition to the heart and lung problems associated with all particulate matter smaller than 10 μm.

According to World Bank Report (2008) Zuun Ail area was the most polluted area of the Ulaanbaatar. So our team's main purpose of this study was to measure PM air pollution at the Zuun ail site, to determine chemical elements into the PM2.5; PM2.5-10 samples, identification and apportionment of pollution sources and health impact study, to compare with measurements of 2008-2009 at same sites.

II. SAMPLING AND SITE

Working group was using GENT sampler unit for this study, the GENT stacked filter unit with a coarse and fine 47mm nuclepore filters. Coarse filters have a pore size 8μm and coated Apiezon Type L grease to provide a tacky surface that prevents particle rebound and consequent sample loss [5]. The second filter collecting fine particles has a pore size 0.4μm. Average flow rate 16 l/min (14-18 l/min) was used the GENT Sampler. Sampling site: Ulaanbaatar city Zuun ail (Latitude-47055'58.34, Longtitude-106055'19.64).

Working group was continuously sampling the air three times a week, routinely Monday, Thursday and Saturday. Sampler was setup at a height 3m above ground level. The population density in the sampling site is medium and near to road and dwelling houses (Ger) area in the North part of city. Wind direction (mainly) for UB city this site is N and NW in the whole seasons. Samples were generally collected up-to 24 hour period from morning of next day.

III. RESULT AND DISCUSSION

In this paper we have included data of coarse and fine particle samples collected during 2012.9-2013.6. Nuclepore filters were measured for determination of mass concentrations using microbalance before and after collection of samples. Then the Smoke Stain Reflectometer was used for the determination of Black Carbon (BC) in the samples. Samples were analyzed for elemental

concentrations by XRF analysis. The PM2.5 and PM10 concentration time series were shown in Fig.1.

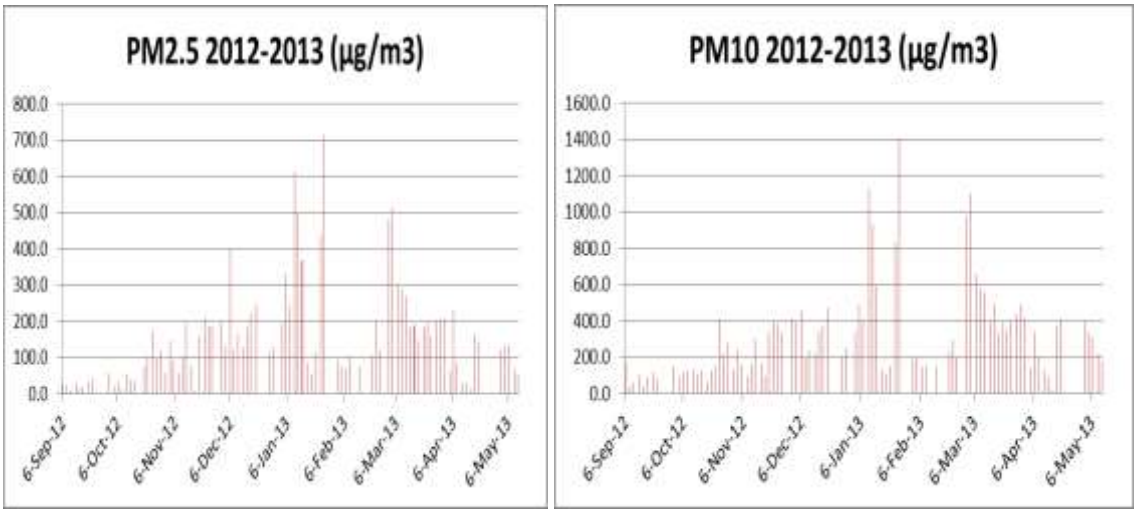

Fig.1. PM concentration time series

The monthly average mass concentrations are shown in the Fig.2.

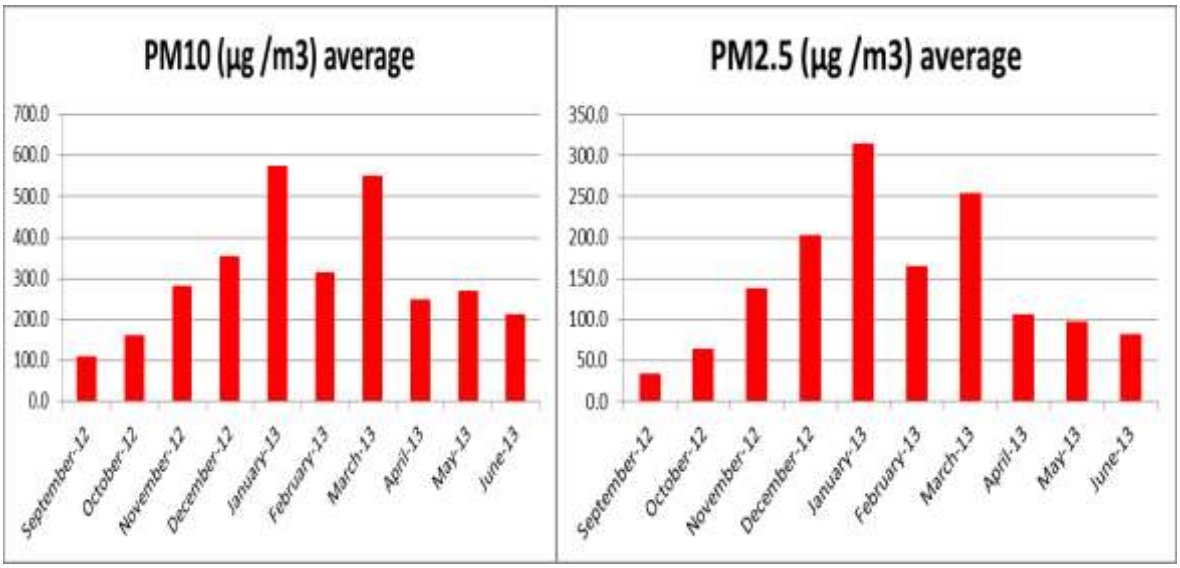

Fig.2. Monthly average

The monthly average total concentrations of fine and coarse particles in the cold seasons at sampling site is much higher than ambient air quality standard of Mongolia (year average PM10-50 µg/m^3). Results show that particle mass concentration is decreasing in the green period, due to more humidity and hot heating and increasing in the cold period, due to heating and dust rise-up from ground into the air[3]. Comparison PM2008-2009 vs 2012-2013 at Zuun ail site are shown in Fig.3.

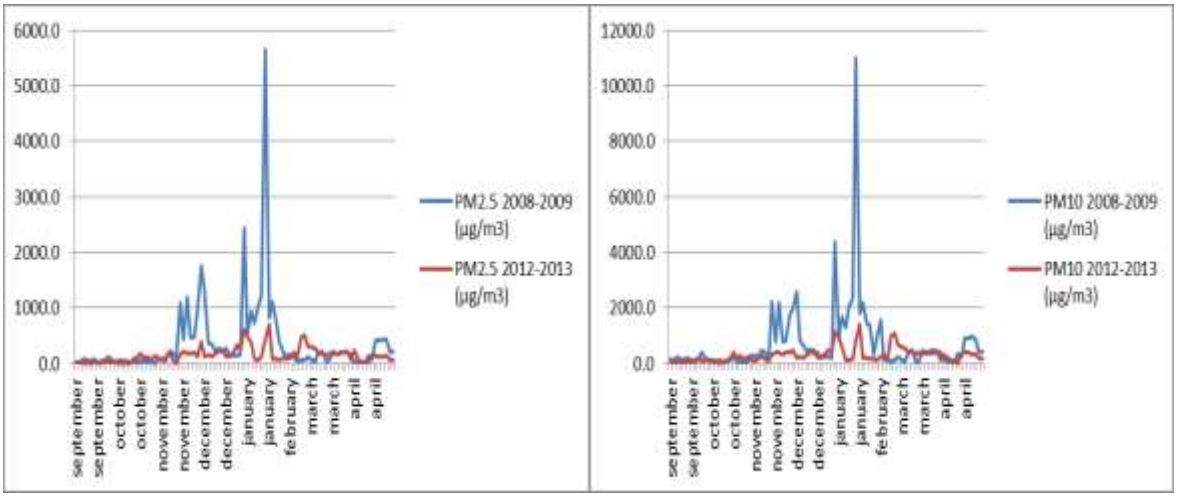

Fig.3. Comparison PM 2008-2009 vs 2012-2013 at Zuun ail site

Table.1 Indicated ranges for annual average PM concentration comparison in Zuun ail site

Year	**PM10 µg/m^3**	**PM2.5 µg/m^3**	**Exceedance (PM2.5): Ratio to AQSs**	
			Mongolian:	**WHO**
2008-2009	558	296	12	30
2012-2013	319	154	6	15

The black carbon concentration is shown in the Fig.4.

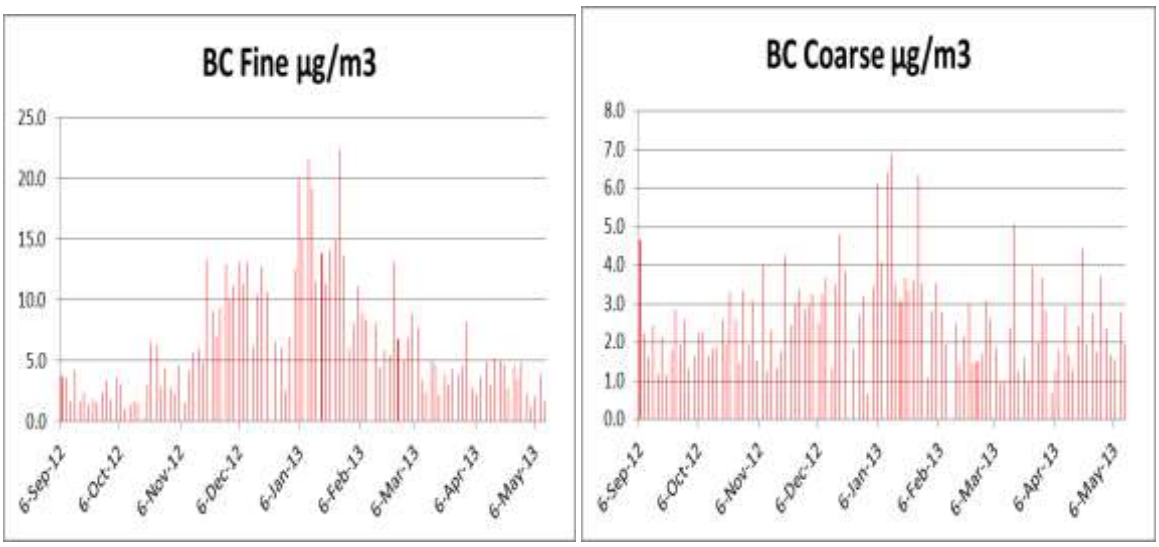

Fig.4. BC concentration

The comparison monthly average BC concentration 2008-2009 vs 2012-2013 at Zuun ail site shown in the Fig.5.

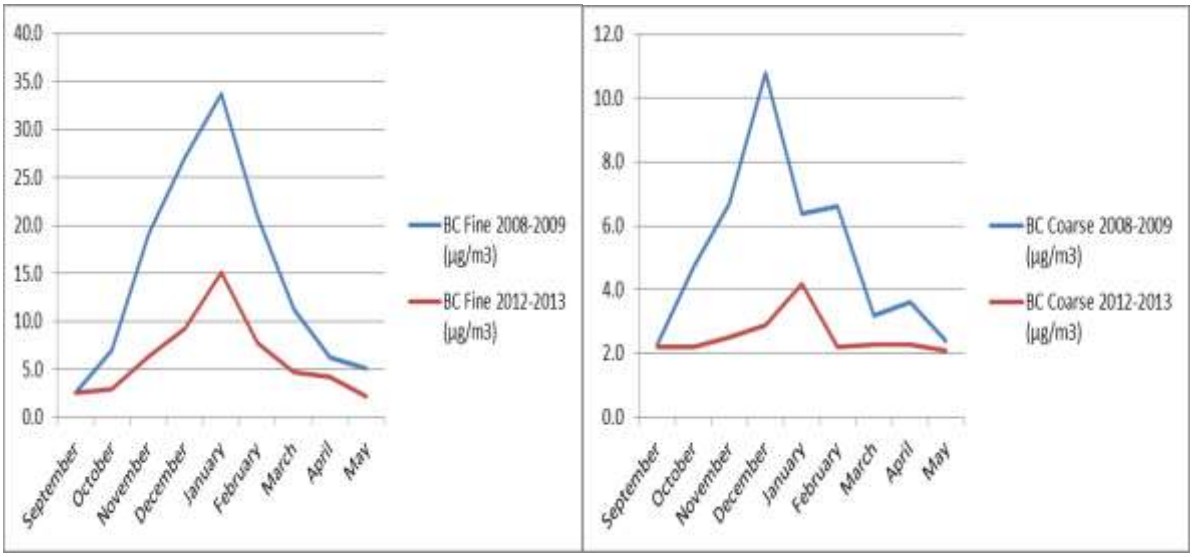

Fig.5. Comparison of BC

IV. CONCLUSION

By our team's previous study, 87% of Ulaanbaatar air pollution (PM2.5) caused by raw coal combustion in households stove for heating. Government of Mongolia and Ulaanbaatar city authorities have taken a number of measures to solve the air pollution problems such as subsidizing improved coal stoves (producing less smog), cleaner fuels such as semi-coke (also thought to produce less smog), Heat Only Boiler reconstruction work, converting ger district area to apartment district and development of paved road near to Zuun Ail area.

V. SUMMARY

Working group has done round year measurement at the Zuun Ail Testing Point and collected 132 samples of PM2.5 and PM2.5-10. All samples are analyzed by XRF and BC is determined into all those samples. Measurement result shows that, in 2012/2013, PM2.5 and PM10 emission is reduced 2 times than 2008/2009 at Zuun Ail due to GoM's activities to solve air pollution disaster.

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