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PARTICULATE MATTER SIZE DISTRIBUTION AND COMPONENT ANALYSIS IN BULENT ECEVIT UNIVESITY FARABI CAMPUS, ZONGULDAK, TURKEY

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Abstract

Air pollution by aerosol particles was evaluated in a site near BulentEcevitUniversityFarabi Campus in Zonguldak, TURKEY. The location was influenced by both road traffic emissions and domestic heating emissions. The experiment was done on January, 2015. Eight stage non-viable Andersen cascade ımpactor was used in the experiment. Collected particles were weighted and total particulate matter concentration was calculated 143$\mu g/m^3$ *which is acceppted as "critical" in air pollution control regulations in TURKEY. Eight stage values were converted to* PM_{10}, $PM_{2.5}$ *and* PM_1 *values. Aim of the work was to estimate the effect of airborne particles on human health. Collected particles were analysed in Epsilon 5 X-Ray Fluorescence (XRF) spectroneter and content of particle matter were calculated.*

Key words*:Particulate matter, Cascade impactor, XRF,Road traffic emissions, Domestic heating emissions.*

INTRODUCTION

Airborne particle associated problems, such as health problems (e.g.asthmaproblems; Anderson et al., 1992) and haze problems (e.g. visibility. impairment; Pryor et al., 1997) are typical environmental issues in urban cities. The chemical composition,health impact, and rate of deposition of these particles vary significantly with the size of particles. Also different aerosol emission sources tend to have different aerosol mass size ranges (Y.C. Chan et. Al.2005)

Concentrations of particulate matter in the ambient air are typically composed of complex mixtures of chemical species, originating from a wide range of natural sources and human activities. (Horikawaet al., 1991; Larsen and Larsen, 1998).

Several studies on the concentration of particulate matter have been reported in the literature (Lee et al., 1995; Sahu et al.,2001; Guo et al.,2003)

Zonguldak province has coal deposits. There are two thermal power plants, one iron and steel plant in Zonguldak region. Domestic heating and increasing number of vehicles features air pollution studies in Zonguldak region. It is thought that particulate matterconcentrations can be high in this region but only one study has been carried out at one point with an high volume air sampler. (Akyüz M, Çabuk H., 2008).

Particulate matter size and component anlysis in this region has not been studied and this will show the effective pollution sources.

MATERIALS AND METHODS

General Sampling Method

In this study The Andersen 1 ACFM Non-Viable Ambient Particle Sizing Sampler was used. The Andersen 1 ACFM Non-Viable Ambient Particle Sizing Sampler is a multi-stage, multi-orrifice cascade impactor which normally is used in the environmental working areas to measure the size distrubition and total concentration levels of all liquid and solid particulate matter.

A brief description of the operation of the sampling equipment follows;

1. Ambient gases enter the inlet cone and cascade through the succeeding orifice stages with higher orifice velocities form stage 0 to stage 7. Successively

smaller particles are inertially impacted onto the collection plates.

2. The clean gases are carried the vacuum tube and through the pump and exhausted.
3. A constant air sample flow of 1 ACFM is provided by a continuous duty, carbon-vane vacuum pump.
4. After sampling is completed, the sample time is recorded and tared collection platesand backup filter are removed for subsequent gravimetric and/or chemical determination.
5. Concentration levels are determined and the size distrubiton is plotted.

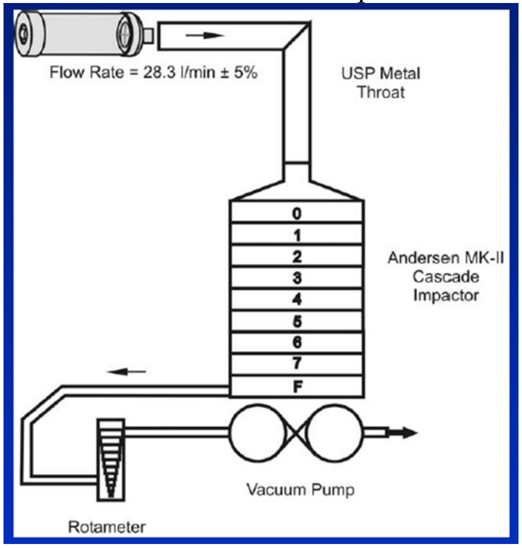

Figure 1. Working Principle of Cascade Impactor System

Study Area and Sampling

To determine particulate matter amount, sapling point was selected at Bulent Ecevit University Farabi Campus.

Figure 2. Sampling point

Sampling period was between 05 January 2015-12 January 2015 and 24 hours each day. Flow rate of the pump was 28,3 l/min.

Before sampling filters were conditioned. Filters were heated at 103 °C at incubator for 1 hour and then filters were taken to a desiccator for 2 days at 20°C /%50±2 humidity.and weighed.After conditioning sampling was done. After sampling, filters were transferred to laboratory.andtaken to a desiccator for 2 days at 20°C /%50±2 humidity.

Filters were weighed and amount of particulate matter was calculated.

Figure 3. Filter conditioning

RESULTS AND DISCUSSIONS

Table 1 shows the results of the weighted filters and concentration of particulate matter. Concentration of total particulate matter was calculated 143 µg/m^{3}which is acceppted as “critical” in air pollution control regulations in Turkey.

Collected particles were analysed in Epsilon 5 X-Ray Fluorescence (XRF) spectroneter and content of particle matter were determined. XR-F results were given at Table 2, Table 3 and Table 4 respectively.

CONCLUSIONS

Calculated values shows that particulate matter concentration in Bulent Ecevit University Farabi Campus is in critical levels.To determine the source of pollution studies will continue until summer. There ara 3 factors that effect the results; domestical heating, traffic emissions and thermal power plant for Zonguldak. Samplings will continue at 3 different location to determine sources.

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Table 1.Concentration of particulate matters

Campus Area 1		Campus Area 1							
Filter Weigh Before Sampling		Filter Weigh AfterSampling							
	a		b	a-b		dp (μm)	Stages	Weight %	Total %
K-1-1	0.2859	K-1-1	0.2868	0.0009	gr	> 9.0	Stage 0	14.75409836	14.75409836
K-1-2	0.285	K-1-2	0.2854	0.0004	gr	5.8-9.0	Stage 1	6.557377049	21.31147541
K-1-3	0.286	K-1-3	0.2864	0.0004	gr	4.7-5.8	Stage 2	6.557377049	27.86885246
K-1-4	0.2862	K-1-4	0.2868	0.0006	gr	3.3-4.7	Stage 3	9.836065574	37.70491803
K-1-5	0.2875	K-1-5	0.2878	0.0003	gr	2.1-3.3	Stage 4	4.918032787	42.62295082
K-1-6	0.2868	K-1-6	0.2878	0.001	gr	1.1-2.1	Stage 5	16.39344262	59.01639344
K-1-7	0.2858	K-1-7	0.2871	0.0013	gr	0.65-1.1	Stage 6	21.31147541	80.32786885
K-1-8	0.286	K-1-8	0.2869	0.0009	gr	0.43-0.65	Stage 7	14.75409836	95.08196721
K-1-9	0.2853	K-1-9	0.2856	0.0003	gr	< 0.43	F	4.918032787	100

Table 2.XR-F results for Sample Number 1 and 2

1 - 1

Compound	Corr.(cps/mA)	Conc.	Unit	Status
Na	1.073	7.046	%	Calibrated
Al	6.152	3.314	%	Calibrated
SiO2	133.279	79.245	%	Calibrated
S	0.204	227.510	ppm	Calibrated
Cl	2.270	1409.250	ppm	Calibrated
K	245.187	4.955	%	Calibrated
Ca	140.933	2.512	%	Calibrated
Ti	340.640	0.308	%	Calibrated
Fe	12.909	637.118	ppm	Calibrated
Ni	0.610	14.978	ppm	Calibrated
Zn	934.781	1.784	%	Calibrated
Rb	0.846	4.563	ppm	Calibrated
Sr	2.343	102.552	ppm	Calibrated
Zr	1.815	61.027	ppm	Calibrated
Pd	0.151	2.879	ppm	Calibrated
Ag	0.341	6.545	ppm	Calibrated
Ba	245.926	0.590	%	Calibrated
Sum		100.000	%	

1 - 2

Compound	Corr.(cps/mA)	Conc.	Unit	Status
Na	1.080	7.068	%	Calibrated
Al	5.985	3.215	%	Calibrated
SiO2	134.088	79.324	%	Calibrated
S	0.247	275.081	ppm	Calibrated
Cl	2.548	1576.302	ppm	Calibrated
K	246.106	4.957	%	Calibrated
Ca	140.575	2.497	%	Calibrated
Ti	33.239	0.300	%	Calibrated
Fe	12.562	617.590	ppm	Calibrated
Ni	0.565	13.813	ppm	Calibrated
Zn	936.476	1.780	%	Calibrated
Rb	0.688	3.695	ppm	Calibrated
Sr	2.376	103.567	ppm	Calibrated
Zr	1.896	63.522	ppm	Calibrated
Pd	0.150	2.848	ppm	Calibrated
Ag	0.403	7.701	ppm	Calibrated
Ba	248.294	0.594	%	Calibrated
Sum		100.000	%	

Table 3.XR-F resultsSample Number 4 and 6

1 - 4

Compound	Corr.(cps/mA)	Conc.	Unit	Status
Na	1.064	6.882	%	Calibrated
Al	6.238	3.363	%	Calibrated
SiO2	132.984	79.250	%	Calibrated
S	0.149	166.431	ppm	Calibrated
Cl	3.732	0.232	%	Calibrated
K	246.369	5.002	%	Calibrated
Ca	137.965	2.472	%	Calibrated
Ti	34.822	0.316	%	Calibrated
Fe	11.938	591.985	ppm	Calibrated
Ni	0.453	11.171	ppm	Calibrated
Zn	933.261	1.789	%	Calibrated
Rb	0.875	4.780	ppm	Calibrated
Sr	2.392	105.065	ppm	Calibrated
Zr	1.937	65.374	ppm	Calibrated
Pd	0.044	0.826	ppm	Calibrated
Ba	248.726	0.598	%	Calibrated
Sum		100.000	%	

1 - 6

Compound	Corr.(cps/mA)	Conc.	Unit	Status
Na	1.038	6.837	%	Calibrated
Al	6.165	3.324	%	Calibrated
SiO2	133.229	79.358	%	Calibrated
S	0.417	467.921	ppm	Calibrated
Cl	2.461	1534.336	ppm	Calibrated
K	248.170	5.040	%	Calibrated
Ca	137.902	2.473	%	Calibrated
Ti	34.324	0.312	%	Calibrated
Fe	11.977	594.294	ppm	Calibrated
Zn	930.307	1.784	%	Calibrated
Rb	0.741	4.015	ppm	Calibrated
Sr	2.355	103.518	ppm	Calibrated
Zr	1.904	64.295	ppm	Calibrated
Pd	0.158	3.020	ppm	Calibrated
Ag	0.371	7.133	ppm	Calibrated
Ba	246.894	0.594	%	Calibrated
Sum		100.000	%	

Table 4.XR-F resultsSample Number 8

1 - 8

Compound	Corr.(cps/mA)	Conc.	Unit	Status
Na	1.069	7.044	%	Calibrated
Al	5.770	3.120	%	Calibrated
SiO2	133.606	79.416	%	Calibrated
S	0.326	364.463	ppm	Calibrated
Cl	2.537	1579.355	ppm	Calibrated
K	246.221	4.992	%	Calibrated
Ca	137.734	2.464	%	Calibrated
Ti	32.618	0.296	%	Calibrated
Fe	12.039	595.603	ppm	Calibrated
Zn	939.048	1.796	%	Calibrated
Rb	0.748	4.020	ppm	Calibrated
Sr	2.493	109.429	ppm	Calibrated
Zr	1.836	61.934	ppm	Calibrated
Pd	0.197	3.748	ppm	Calibrated
Ag	0.452	8.693	ppm	Calibrated
Ba	249.385	0.600	%	Calibrated
Sum		100.000	%	

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