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Report

Studies on the Environmental Status of the Heavy Metals of the Road Dust in Dhaka City

Contamination of the environment by heavy metals is a phenomenon of global importance today. Due to high concentration in the environment, heavy metals may enter the food chain from soils and result in health hazards. Accumulation in the street dust is one of the major way through which heavy metals may find their way into soils and subsequently living tissues of plants, animals and human beings [1]. Motorized transportation is one of the major sources of urban air pollution [2,3]. Bangladesh is a developing country in South Asia with a population of 130 million people. It is located between 20º42´ to 26º38´ north latitude and 88º01´ to 92º42´ east longitude. The Department of energy in the Ministry of environment and Forests is responsible for air quality standard has been implemented as part of the environmental conservation rules [4]. Dhaka has a population of 12 million and is known for its low air quality. The number of motorized vehicles in the city was relatively low for long time, but Dhaka has experienced an estimated yearly increase in motor vehicle traffic by almost 9% between 1992 and 1999 [5].

By 2001, the total number of motor vehicles in Dhaka city was 300000. Even after this increase ~60% of all journeys in the city were without motorized transport. They were mainly by walking, bicycle or man-drive rickshaws [6]. To tackle the problem of reduced air quality due to vehicle emissions, several steps have been taken. In 1999, leaded gasoline was banned nationally and catalytic converters are now mandatory for new cars. A particulate filter is mandatory on new diesel vehicles. In Dhaka city, 'baby taxis', which are three-wheel transport powered by two-stroke engines, have been banned since 2003 [7]. The aim of the study was to evaluate the present air quality in Dhaka city by measuring the trace elements content in the road dusts.

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Experimental

Sampling

Samples were collected from different roadside of Mothijeel, Shahabagh and Jatrabari areas in Dhaka city. They were collected during the dry season.

Mothijeel is a commercial and very busy traffic area. Many motorized vehicles are available in the street. The average speed of the vehicles is very low leading to the extensive emission of air pollutants.

Jatrabari is one of the most chaotic places and the prime gate of Dhaka to communicate with south, southeast and northeast divisions. As the uncounted number of vehicles ply to different destination from here, therefore the gas that is emerged from this vehicles is spreading the limit of heavy metal especially lead in the air of Jatrabari in every moment.

Shahabagh is one of the busiest traffic point of Dhaka City. Here two famous hospitals (Bangladesh Institute of Research and Rehabilitation for Diabetes, Endocrine and Metabolic Disorders, BIRDEM) Bangobandhu Shaikh Mujib Medical University (BSMMU), National museum, Ramna park, National children park, Hotel Sheraton are situated. Maximum vehicles of Dhaka and the adjacent cities ply by passing this point. The vehicles exhaust gas, which is significant for environmental pollution.

Preparation of stock solution.

The collected samples were sieved with two different sieves (425 μm and 600μm) to get samples of different sizes that is shown in Table 1. Then the samples were dried at 105 ºC in an oven for 24 hours. 3.0 g of SJ1 sample was taken in a beaker and 40 mL of 5.6 M (40%v/v) nitric acid was added to the sample. The beaker was kept in the water bath and heated on the electric hotplate to boil gently until acid evaporated. The beaker was removed from the hot plate and allowed to cool. Then the beaker was rinsed inside with a small volume of water and agitated carefully. Finally, the solution was filtered using acid filter paper and the solution was poured in the 100 mL volumetric flask and diluted up to the mark. The prepared solution is known as stock solution and then it was preserved in a

polyethylene bottle. Similarly, the stock solutions of all the samples were prepared and preserved.

Table 1. Samples of different locations with different sizes in Dhaka city

Location	Dust Size		
	> 600 µm	*600 to 425 µm*	*< 425 µm*
Jatrabari	SJ1	SJ2	SJ3
Mothijeel	SM1	SM2	SM3
Shahabagh	SS1	SS2	SS3

Reagents and Apparatus.

Nitric acid, lead nitrate, copper sulphate, Mohr's salt and zinc sulphate were purchased from E. Merck, India. The standard solutions of each metal were prepared as follows: Lead(II): 1.0, 2.0, 3.0, 4.0 and 5.0 ppm; Copper(II): 1.0, 2.0, 3.0, 4.0 and 5.0 ppm; Iron(III); 0.5, 1.0, 2.0, 4.0 and 6 ppm; Zinc(II): 1.0,2.0,3.0,4.0 and 5.0 ppm. De-ionized water was used through out the experiment. Atomic Absorption Spectrophotometer (AAS) (AA 680, Shimadzu, Japan) was used to analyze all the samples.

Results and Discussion

The arbitrary concentration of the heavy metals obtained in the dust samples collected at Shahbagh, Motijheel and Jatrabari in Dhaka city, Bangladesh are summarized in Table 2. Iron exhibited relatively high level in all the areas. The average estimated value of iron was 63.56 ppm. Although lead level was low in all the samples but it has significant effect on the environment as well as on human health. The concentration of copper and zinc lie within the concentration of iron and lead.

Table 2. Amount of metals in the different samples

Sample No.	Fe (ppm)	Cu (ppm)	Zn (ppm)	Pb (ppm)
SS1	71.52	4.85	2.88	0.78
SS2	65.78	1.17	2.54	0.64
SS3	58.75	6.70	2.46	1.22
SM1	66.60	1.30	2.50	0.95
SM2	55.31	5.86	2.89	0.84
SM3	56.82	2.96	2.84	2.26
SJ1	68.15	1.87	2.75	0.66
SJ2	55.31	9.29	1.98	0.40
SJ3	67.09	3.27	2.61	1.10

The variation of iron level was not dependent on the particle size but lead level was varied with particle size. The high level of iron in all the samples is justified. This is due to the high abundance of iron in the nature. On the other hand, lead level was dependent on dust particle size. The results indicated that smaller dust particles contained high level of lead. This phenomenon indicated that leaded gasoline are still used in Dhaka city. Vehicles still emitting exhaust gases that contained lead compounds. The lead compounds accumulate with particulate matters (PM) in the atmosphere. After that the PM gradually settled down on the earth surface. It is reported that lead level in the rural areas in Bangladesh was beyond the detection limit. Comparatively high lead level (2.264 ppm) was found at Motijheel (SM3). This could be the high traffic density at Motijheel area.

These results suggest probable common sources of lead and iron .The use of leaded petrol, tyre wears and emission from vehicular and roadside artisans activities may account for some of these metals present in the road dust. This result presented is a part of this study, which at a later time will consider the characteristics and the effects of the road dust on the environment.

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