

## Assessment of the Toxic Metals in Airborne Particulate Matter Collected from Car Air Filters at Urban Area in Yangon

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**Abstract :** Car-engine air filters (CAFs) have been recently used as inexpensive alternative air sampling media for collection of airborne particulate matter (APM). CAFs were collected from five taxis in Yangon City between August-October 2017 (rainy season) and November 2017 – January 2018 (cold season). Car air filters (CAFs) from taxis could act as “moving” high volume air samplers and provide city integrated air concentrations with low variability for particle-bound contaminants. Four toxic heavy metals (Cd, Cu, Cr and Pb) in all samples were quantitatively determined by AAS technique. According to AAS data, Cu was found to be present in all APM samples for both seasons. Cd and Cr were found to be present in all samples in cold season. Cd was found in some samples (AF-2 and AF-3) in rainy season. Cr was not found in all samples in rainy season. Pb was found to be present in samples AF-3 for both seasons. These clues help to understand better the condition of atmosphere due to air pollution.

**Key Words :** Car-engine air filters (CAFs), air sampling media, airborne particulate matter, AAS.

### 1. INTRODUCTION:

The present-day atmosphere is quite different from the natural atmosphere that existed before the Industrial Revolution in terms of chemical composition. If the natural atmosphere is considered to be ‘clean’, then this means that clean air cannot be found anywhere in today’s atmosphere. Therefore, particulate air pollution (PAP) has become a matter of global concern, particularly in some of the world’s largest cities. With the rapid growth of urban population, number of vehicles and industries within Yangon Region has increased. Consequently, enhancing air-pollution might become an issue in the near future and threats of the residents. There may be potential hazards in the near future unless initiates preventive measures from now on. Therefore, it is necessary to monitor to what extent the environment is polluted or to assess to what extent the public is concerned about the issue. This study will give more information about air quality in Yangon Region and its effects on public health.

### 2. MATERIALS AND METHODS:

Airborne particulate matter (APM) samples were collected from car air filters (CAFs) of Toyota Caldina (2000), 1.5 CC engine volumes, city taxi. The APM samples were collected from August to October 2017 representing rainy season and November 2017 to January 2018 representing cold season. Five CAFs were collected from Toyota Caldina (2000) city taxis that circulate in the Yangon City. This area is composed of plenty of streets and main roads. These are considered to have heavy traffic. These streets and main roads are paved with asphalt and concrete. Heavy metal contents in airborne particulate matter samples were determined by Atomic Absorption Spectrophotometric method.

### 3. RESULTES AND DISCUSSION:

Table 1 shows the concentrations of heavy metals in APM samples by using AAS technique and Figures 1 to 4 depict the histogram of Cd, Cu, Cr and Pb contents in APM samples, respectively. According to AAS data, Cd contents in all APM samples in cold season were found to be higher than those in rainy season. Cu contents in all APM samples in cold season were found to be higher than in rainy season. Cr in all APM samples were found in cold season and not detected in rainy season. Pb contents in all APM samples (except AF-3) were not detected in both seasons. Concentrations of Pb in sample AF-3 were 0.464 mg L<sup>-1</sup> and 0.816 mg L<sup>-1</sup> during rainy season and cold season respectively. The elements Pb originated mainly from traffic, Pb usually reported as a leaded gasoline and diesel-powered vehicle emission products.

AF-3 samples were collected from taxis, operated with gasoline. Other samples were collected from taxis, operated with CNG. Therefore Pb was found to be present in AF-3 samples. The elements Mn and Cr were assigned to mostly crustal origin (rock and soil) and vehicular sources. The trace elements (Al, Fe, Ti, Zn, Mn, Cr, Cu, Ni, Pb) in APM may be caused by mechanical abrasion of metallic surface, industrial activities, building and road construction activities and coal and waste combustion. Other industrial sources include electroplating, fertilizer industry, re-

chargeable batteries, pipeline factory, gold refinery, steel industry and plating. Fe, Zn, Cu, Pb could have originated from clutch and brake ware of vehicles. Pb in the atmosphere has been from tobacco smoke. This is probably due to the fact that cold season is convenient for travelling as well as during the Christmas holidays, New Year holidays: people usually travel for business and recreation. So traffic density is high in cold season. Moreover construction works (building and road constructions activities) are higher in cold season than rainy season. Another reason is that APM flow away with rain water in rainy season and there is also possibility that some of these APM may have dissolved in rain water and downpour. Therefore heavy metal content in APM samples was found to be higher in cold season than rainy season.

**Table 1. Concentration of Heavy Metals in APM Samples Collected from CAFs of 5 Taxis at Urban Area in Yangon City during Rainy and Cold Seasons by using AAS Technique**

Sample	AF-1		AF-2		AF-3		AF-4		AF-5	
	Rainy	Cold	Rainy	Cold	Rainy	Cold	Rainy	Cold	Rainy	Cold
Cd	ND	0.042	0.452	1.094	0.023	0.054	ND	0.022	ND	0.015
Cu	0.057	0.089	0.175	0.632	0.093	0.153	0.046	0.674	0.075	0.135
Cr	ND	0.026	ND	0.045	ND	0.065	ND	0.326	ND	0.028
Pb	ND	ND	ND	ND	0.464	0.816	ND	ND	ND	ND

\* Season

\*\* Heavy metals (mg L<sup>-1</sup>)

ND Non-detected in mg L<sup>-1</sup> range

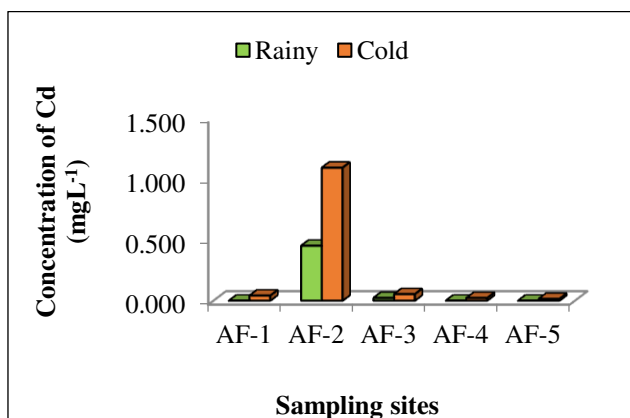


Figure 1. Histogram of Cd contents in APM samples collected from CAFs of 5 Taxis in Yangon City for Rainy and Cold seasons

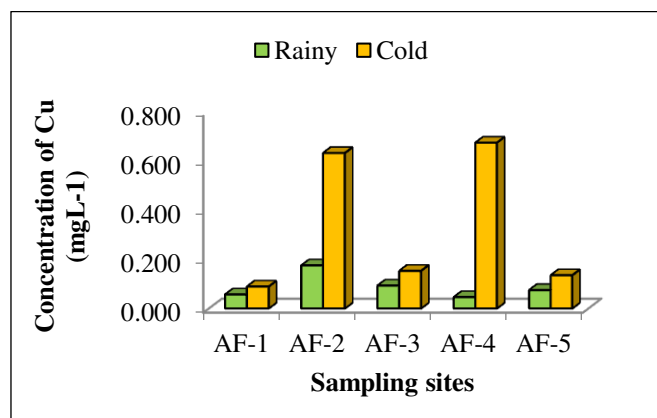


Figure 2. Histogram of Cu contents in APM samples collected from CAFs of 5 Taxis in Yangon City for Rainy and Cold seasons

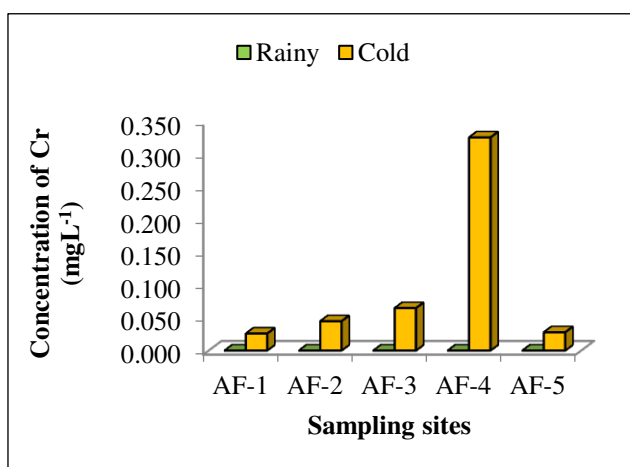


Figure 3. Histogram of Cr contents in APM samples collected from CAFs of 5 Taxis in Yangon City for Rainy and Cold seasons

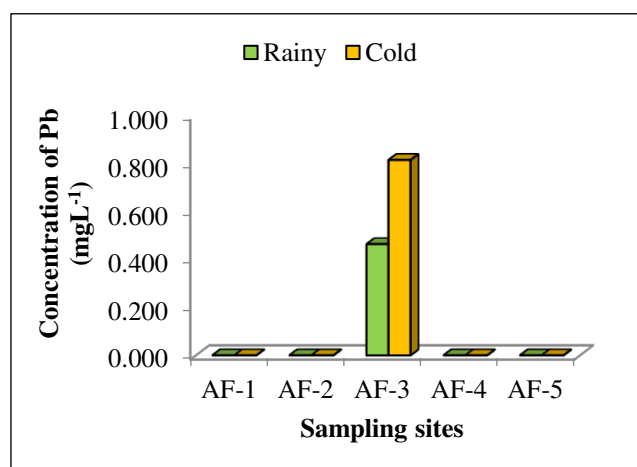


Figure 4. Histogram of Pb contents in APM samples collected from CAFs of 5 Taxis in Yangon City for Rainy and Cold seasons

#### 4. CONCLUSION:

In this research, CAFs from taxis could act as moving high volume air samplers. Heavy metals in APM were detected from CAFs of 5 taxis in Yangon City. Based on CAFs analysis, the concentrations of heavy metals were estimated. The average concentrations of heavy metals (Cd, Cu, Cr and Pb) in cold season were higher than in rainy season. This study will give more information about air quality in Yangon Region. This methodology is new and further improvement needs to be achieved.

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