



## Effect of Benzene and Xylene Concentration on Public Health in Ambient Air, in City of Firozabad, India

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ABSTRACT

This study aimed to assess exposure to benzene and Xylene (BX) compounds in commercial sectors of Firozabad city (India). Three commercial sectors from different regions were selected and monitored for ambient BX concentrations. Day-time and night-time sampling was done at three selected sites during working time and four emission sources to provides for analysis and analyzed by GC equipped with FID as mg/m<sup>3</sup> quantity is often found in environment samples. However, commercial sectors attendants, vehicle drivers and the public are exposed to the diesel and petrol fuel and fumes associated with them. Fuel attendants are exposed to diesel and petrol exhaust fumes, as well as emissions from fuel pumps on a daily basis, and are at risk to adverse health effects associated with inhalation of volatile organic compounds (VOCs) released. The VOCs released include benzene and Xylene (BX), which have a high level of toxicity. Studies relating to the concentrations of BX at commercial sectors.

The mean concentrations of BX at the commercial- Bauran Gali (B.G-CM.), Imperial glass Agra Road (IG-AR) and Jain Mandir commercial Complex (JM-CC). The highest mean concentration of benzene 45.04 µg/m<sup>3</sup> (JMCC) in Dec 2013/ lowest concentration 26.12 µg/m<sup>3</sup> (IG-AR) in February 2014, and the highest mean concentration of Xylene 39.09 µg/m<sup>3</sup> (JM-CC) in Dec 2013/ lowest concentration 22.04 µg/m<sup>3</sup> (IG-AR) in February 2014, were observed, respectively. Thus, an analysis of total volume dispensed, and ambient temperature at the commercial sectors, both affecting the concentrations of Benzene and Xylene released, was conducted. The risk of health effects from inhaling any chemical depends on how much is in the air, how long and how often a person breathes it in. Breathing in low levels of VOCs for long periods of time may increase some people's risk of health problems like- irritation of the skin, eyes, nose, throat, headaches, lack of muscle coordination, dizziness, confusion and Benzene causes both structural and numerical chromosomal aberrations in humans.

### KEYWORDS

Benzene, Xylene and VOCs.

### Introduction

The risk of health effects from inhaling any chemical depends on how much is in the air, how long and how often a person breathes it in. Breathing in low levels of VOCs for long periods of time may increase some people's risk of health problems. Several studies suggest that exposure to VOCs may make symptoms worse for people with asthma or who are particularly sensitive to chemicals. *These are much different exposures than occupational exposures.* Common examples of VOCs that may be present in our daily lives are: benzene, xylene, ethylene glycol, formaldehyde, methylene chloride, tetrachloroethylene, toluene, xylene, and 1,3-butadiene. It is important to remember that VOCs refer to a group of chemicals. Each chemical has its own toxicity and potential for causing different health effects. Benzene is highly volatile, and most exposure is through inhalation. Benzene is degraded rapidly in the upper atmosphere. Because of its solubility in water, a minor amount may be removed by rain to contaminate surface waters and soil. However, it is not persistent in surface water or soil, either volatilizing back to air or being degraded by bacteria. Although some of this exposure might be from building materials (paints, adhesives, etc.), most is from cigarette smoke in both homes and public spaces. No specific guideline value has been developed for air. Benzene is carcinogenic to humans, and no safe level of exposure can be recommended. For general guidance, the concentrations of airborne benzene associated with an excess lifetime risk of leukaemia of  $10^{-4}$ ,  $10^{-5}$  and  $10^{-6}$  are 17, 1.7 and 0.17 µg/m<sup>3</sup>, respectively. Benzene is a well-established cause of cancer in humans. The International Agency for Research on Cancer has classified benzene as *carcinogenic to humans* (Group 1).

Xylenes are a naturally occurring minor component of all petroleum products. Also, they are formed during combustion of organic materials. Man-made xylenes are primarily produced during refining of petroleum products. The major use of xylenes is as an additive to gasoline during blending to en-

hance the fuel's octane rating. Xylenes are widely used in the production of paints, varnishes and other coatings, pesticide formulations, vitamins, pharmaceuticals, printing inks, dyes, adhesives, sealants, cleaning agents, degreasing agents, paint removers, for chemical extractions and as feed stocks in chemical manufacturing. Such effects include: 1) irritation of the nose, throat and eyes; and 2) central nervous system (CNS) effects such as headache, nausea, dizziness, difficulty concentrating, impaired memory, slurred speech, lack of muscle coordination, fatigue, agitation, confusion, tremors, laboured breathing, impaired reaction time, alterations in equilibrium and body balance and sensitivity to noise.

This study aimed to assess exposure to benzene and xylene (BX) compounds in refueling stations of Firozabad city (India). Three refuelling stations from different regions were selected and monitored for ambient BX concentrations.

### Materials and Method

In order to assess the BX concentrations in the ambient air across the Firozabad city were completed. The sampling points were chosen because ambient BX concentration levels were expected to be different at the selected three sites (commercial) from November to February 2013-14.

### Study Site

BX was sampled in a different area in Firozabad, Uttar Pradesh, India. The sampling was conducted in the working place. Samples were collected for two times (in a month) during eight hours of normal working period time for in March, April, May and June 2009. The five selected sites used in this study represent commercial (Bauhran Gali - Chudi Market, Imperial Glass, Agra Road and Jain Mandir Commercial Complex).

### BTEX Measurement

In this research, real-time measurements of Benzene and

Xylene concentrations were performed using the programmable compound specific PID detector designed to provide instantaneous exposure monitoring of a specific organic gas. It monitors a specific gas by utilizing a gas separation tube and the photo-ionization detector (PID) with a 9.8 eV gas discharge lamp (range- 50 ppb to 200 ppb).

**Statistical analysis**

Collected data has been analyzed under SPSS 15 software and using One-sample t-test to compare concentration environmental and personal sampling air benzene, Toluene ethyl benzene and xylene by the threshold level recommended (TLV) by the American Conference of Governmental Industrial Hygienists (ACGIH).

**Result and Discussion**

BX are volatile compound and prominent toxic air pollutants which have been studied every selected site of commercial in Firozabad City. Generally, the principle method PID gas detector used for measurement of volatile air pollutants such as Benzene and Xylene (BX). The analysis results and obtained analyzed data represent in table and figure 1,1.

From the table 1, the mean concentrations of BTEX at the commercial- Bauran Gali (B.G.) Imperial glass Agra Road (IG-AR) and Jain Mandir commercial Complex (JMCC), the highest mean concentration of Benzene 45.04 µg/m<sup>3</sup> (JMCC) in Dec 2013/ lowest mean concentration of Benzene 26.12 µg/m<sup>3</sup> (IG-AR) in February 2014, the highest mean concentration of Xylene 39.09 µg/m<sup>3</sup> (JMCC) in Dec 2013/ lowest concentration of Xylene 22.04 µg/m<sup>3</sup> (IG-AR) in February 2014, and the mean concentration of benzene 32.12 µg/m<sup>3</sup> /the mean concentration of Xylene 26 µg/m<sup>3</sup> (BG-CM) in November to February 2013-14, were observed, respectively.

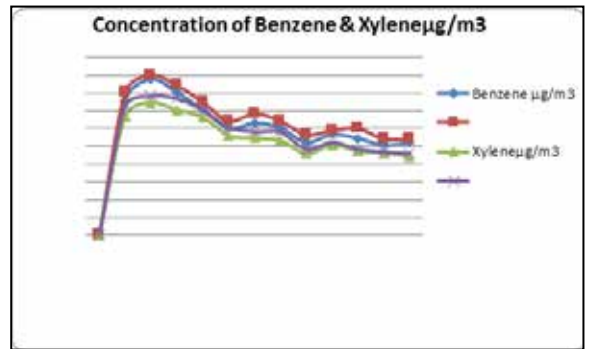
The concentration of Benzene and Xylene at the selected site Jain Mandir commercial Complex (JMCC), shows higher emission because the decisive source of atmospheric emissions of Benzene and Xylene is exhaust gases from petrol driven automobiles and paint shops situated in near about traffic point and the centre in the Firozabad city. The four month variation indicate a higher concentration of Benzene and Xylene during winter season. Benzene and Xylene level in winter season was higher because pollutants were more homogeneously distributed in winter. The concentration of the Benzene and Xylene were found to be quite high in the present study in winter season and their level could be threat to the health of the Firozabad city.

**Conclusion**

Ambient concentration of Benzene and Xylene, have been found to be appreciably high in Firozabad city. The mean concentrations of BX at the commercial- Bauran Gali (B.G.), Imperial glass Agra Road (IG-AR) and Jain Mandir commercial Complex (JMCC).The highest mean concentration of benzene 45.04 µg/m<sup>3</sup> (JMCC) in Dec 2014/ lowest concentration 26.12 µg/m<sup>3</sup> (IG-AR) in June 2014, and the highest mean concentration of Xylene 39.09 µg/m<sup>3</sup> (BG-CM) in Dec 2014/ lowest concentration 22.04 µg/m<sup>3</sup> (IG-AR) in July 2014, were observed, respectively. The probability of additional source of Benzene and Xylene indicates adulteration of the fuels which used in vehicles and released exhaust in an ambient air and paint shops because Benzene and used as a solvent in paint. The prevailing level of BX, may pose both cancer risk and non-cancer hazards for the health of general population as estimated at three sites.

Sites	Months	Benzene µg/m <sup>3</sup>		Xylene µg/m <sup>3</sup>	
		Morning	Evening	Morning	Evening
JM-CC	Nov.-2013	38.04	40.12	33.44	36.12
	Dec.-2013	43.92	45.04	37.34	39.09
	Jan.-2014	40.22	42.11	35.22	38.45
	Feb.-2014	35.23	37.44	33.21	35.22
BG-CM	Nov.-2013	30.11	32.13	28.08	30.45
	Dec.-2013	31.56	34.22	27.33	29.12
	Jan.-2014	30.23	32.11	26.67	29.01
	Feb.-2014	26.12	28.23	22.99	24.22
IG-AR	Nov.-2013	28.43	29.56	25.44	26.11
	Dec.-2013	27.22	30.01	23.65	24.22
	Jan.-2014	25.34	27.11	23.22	23.44
	Feb.-2014	26.12	27.01	22.04	23.01

**Table 1:Concentration of benzene and Xylene at different commercial sites**



**Figure1:Concentration of benzene and Xylene at different commercial sites**

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