ENVIRONMENTAL IMPACT OF VOLATILE ORGANIC COMPOUNDS EMITTED FROM ASPHALT PAVEMENT

Submitted By

Rokya Ibrahim Khalifa Ibrahim

B.Sc. of Science (Chemistry), Faculty of Science, Sohag University, 2007

A Thesis Submitted in Partial Fulfillment
Of
The Requirement for the Master Degree
In
Environmental Sciences

Department of Environmental Basic Sciences
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APPROVAL SHEET

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Abstract

Hot mix(asphalt (HMA) is a major construction material used for paving roads, airport runways, and parking lots. During HMA preparation, a massive amount of volatile organic compounds (VOCs) is emitted from the hot asphalt mixtures, creating a potential health risk to on-site workers. This thesis presents the results of a study in which air samples were collected at multiple locations and time points of several projects during HMA pavement application and were subsequently characterized for their concentrations by using gas analyzer. After testing the VOCs samples the concentration increase from 130ppb to 1843ppb. that the majority increasing of VOCs was after asphalt pavements Although the individual concentrations of the identified chemicals were found to be below various exposure limits, their collective effect on human health remains unknown and may not be ignored.

KEYWORDS:

Asphalt; Volatile organic compounds (VOCs).

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List of Abbreviations

Definition	Acronym
1,4-dichlorobenzene	1,4-DCB
Anderson-Darling	A-D
Air exchange rate	AER
Akaike information criterion	AIC
Bayesian information criterion	BIC
Benzene, toluene, ethylbenzene, xylenes	BTEX
Cumulative distribution function	CDF
Carbon tetrachloride	CTC
Dirichlet process mixture	DPM
Expectation maximization	EM
Environmental Protection Agency	EPA
Environmental tobacco smoke	ETS
Generalized extreme value	GEV
Inter-quartile range	IQR
Kolmogorov-Smirnov	K-S
Kruskal-Wallis	K-W
Linear mixed-effects model	LMM
Mean absolute error	MAE
Methylene chloride	MC
Method detection limit	MDL
Mobile examination center	MEC
Multiple imputation	MI
Maximum likelihood estimate	MLE
Mean squared error	MSE
Methyl tert-butyl ether	MTBE
National Health and Nutrition Examination Survey	NHANES

Definition	Acronym
National Human Activity Pattern Survey	NHAPS
Office of Environmental Health Hazard Assessment	OEHHA
Polycyclic aromatic hydrocarbon	PAH
polybrominated diphenyl ether	PBDE
Tetrachloroethylene (or perchloroethylene)	PERC
Particulate matter ≤ 2.5 μm in aerodynamic diameter	PM2.5
Positive matrix factorization	PMF
Reduction in residual variance	R2
Reference concentration	RfC
Relationships of Indoor, Outdoor, and Personal Air	RIOPA
Schwarz Bayesian Information Criterion	SBC
Trichloroethylene	TCE
total volatile organic compound	TVOC
Unit risk factor	URF
Volatile organic compound	VOC
National Institute for Occupational Safety and Health	NIOSH

Introduction

Introduction

Hot mix (asphalt is a major construction material used for paving roads, airport runways, and parking lots. During HMA preparation, a massive amount of volatile organic compounds (VOCs) is emitted from the hot asphalt mixtures, creating a potential health risk to on-site workers The purpose of this research was to determine the origins of the majority of ambient VOCs detected in Giza government in March, August, October and December of 2017 in Maryoutia Street, El Zomor street, Orouba street and Feisal street respectively. a preliminary study was conducted to determine whether they were being emitted from an industrial point source, or if personal vehicles were the source of most of the ambient VOCs. Initial findings showed that the greatest amount of constant VOCs came from neither of these alleged sources. Samples taken from sites before and immediately after pavement.

After testing the VOCs from the four areas samples it was determined that the majority of increase of VOCs was after asphalt pavements, ruling out personal vehicles from school traffic as the major source.

Furthermore, (this research shows that newly applied asphalt may continue to release VOCs after the initial pour; making asphalt a very important factor to consider when testing for ozone precursor of Ozone formation is generally a photochemical reaction. In the stratosphere ultraviolet radiation in sunlight adds energy to a stable two-atom oxygen molecule, causing the bonds to break. This results in two unbound oxygen atoms with a free electron each. If one of these free oxygen atoms encounters a standard oxygen molecule, it may bind to produce a molecule with three oxygen atoms. This molecule is ozone The majority of ozone production in the troposphere however, occurs when sunlight