Airborne particulate matter in Tehran's ambient air

Article *in* Journal of Environmental Health Science and Engineering · January 2021

DOI: 10.1007/s40201-020-00573-x

6 authors, including:

Philip K Hopke
Clarkson University
1,171 PUBLICATIONS **39,195** CITATIONS
SEE PROFILE

Abbas Shahsavani
Shahid Beheshti University of Medical Sciences
94 PUBLICATIONS **1,317** CITATIONS
SEE PROFILE

Mostafa Hadei
Tehran University of Medical Sciences
69 PUBLICATIONS **567** CITATIONS
SEE PROFILE

Majid Kermani
Iran University of Medical Sciences
235 PUBLICATIONS **1,510** CITATIONS
SEE PROFILE

Journal of Environmental Health Science and Engineering
https://doi.org/10.1007/s40201-020-00573-x

REVIEW ARTICLE

Airborne particulate matter in Tehran's ambient air

Javad Torkashvand[1,2] · Ahamd Jonidi Jafari[2] · Philip K. Hopke[3,4] · Abbas Shahsavani[5,6] · Mostafa Hadei[7] · Majid Kermani[1,2]

Received: 14 March 2020 / Accepted: 15 October 2020

Abstract

In recent decades, particulate matter (PM) concentrations in Tehran have exceeded the World Health Organization's (WHO) guideline on most days. In this study, a search protocol was defined by identifying the keywords, to carry out a systematic review of the concentrations and composition of PM in Tehran's ambient air. For this purpose, searches were done in Scopus, PubMed, and Web of Science in 2019. Among the founded articles (197 in Scopus, 61 in PubMed, and 153 in Web of Science). The results show that in Tehran, the annual average PM_{10} exceeded the WHO guidelines and for more than 50.0% of the days, the $PM_{2.5}$ concentration was more than WHO 24-h guidance value. The PM concentration in Tehran has two seasonal peaks due to poorer dispersion and suspension from dry land, respectively. Tehran has two daily PM peaks due to traffic and changes in boundary-layer heights; one just after midnight and the other during morning rush hour. Indoor concentrations of PM10 and PM2.5 in Tehran were 10.6 and 21.8 times higher than the corresponding values in ambient air. Tehran represents a unique case of problems of controlling PM because of its geographical setting, emission sources, and land use. This review provided a comprehensive assessment for decision makers to assist them in making appropriate policy decisions to improve the air quality. Considering factors such as diversity of resources, temporal and spatial variations, and urban location is essential in developing control plans. Also future studies should focus more on PM reduction plans.

Keywords Air pollution · Particulate matter · PM_{10} · $PM_{2.5}$ · Tehran

Introduction

In many megacities, rapid economic development coupled with population growth led to serious air pollution [1], and its deleterious effects on human health, visibility, climate, and the urban ecosystem [2–5]. Epidemiological studies have shown strong associations between air pollution and morbidity and mortality rates [6] such that air pollution is the fourth overall risk factor for human health. Globally, more than 80% of urban residents are exposed to air pollution level exceeding World Health Organization (WHO) guidelines [5]. These exposures lead to effects ranging from sub-clinical to premature mortality [3]. For example, 6.50 million premature deaths per year occur worldwide due to air pollution [5]. However, the effects of air pollution are dependent on pollution composition, duration of exposure, frequency of exposure, exposure concentrations, and toxic effects of specific constituents [3].

Particulate Matter (PM) has the highest impacts of any air pollutant on human health, and is associated with exacerbation of respiratory diseases (asthma and Chronic obstructive pulmonary disease (COPD)), allergies, respiratory infections, and cardiovascular diseases [1, 2, 5, 7–11]. PM with aerodynamic diameters ≤2.5 μm ($PM_{2.5}$) are strongly correlated with cardiovascular and respiratory effects while PM with diameters ≤10 μm (PM_{10}) have been generally associated with respiratory hospital admissions. Smaller PM such as PM1 and

✉ Majid Kermani
Kermani.m@iums.ac.ir; majidkermani@yahoo.com

1 Research Center for Environmental Health Technology, Iran University of Medical Sciences, Tehran, Iran

2 Department of Environmental Health Engineering, School of Public Health, Iran University of Medical Sciences, Tehran, IR, Iran

3 Center for Air Resources Engineering and Science, Clarkson University, Potsdam, NY, USA

4 Department of Public Health Sciences, University of Rochester School of Medicine and Dentistry, Rochester, NY, USA

5 Environmental and Occupational Hazards Control Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran

6 Department of Environmental Health Engineering, School of Public Health and Safety, Shahid Beheshti University of Medical Sciences, Tehran, Iran

7 Department of Environmental Health Engineering, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran

Published online: 07 January 2021