
Air Pollution and Associated Human Health Risks in Delhi: A Review**Pramod Kumar**

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Abstract

Delhi is the capital city of India and facing alarming air pollution due to different growing sectors, i.e. industry, transport and housing. Increasing the air pollutant emissions of sulfur oxides (SO_x), particulate matter (PM), carbon monoxide (CO), nitrogen oxides (NO_x), and hydrocarbons (HC) is a major concerning issue to society and authorities of Delhi. Due to increasing air pollution in Delhi, the city's residents are facing various respiratory problems. Therefore, the present study reviews the Delhi air pollution level and associated human health and sources of air pollution. The present study could be helpful for the local authorities and society of Delhi to understand the level of air pollution and health risks and take action to control the air pollutants level.

Keywords: Air quality, air pollutant, human health, source of pollution; review**INTRODUCTION:**

Deterioration in air quality of metropolitan cities due to human activities is a serious concern to society and policymakers. Around 900 million urban people across the globe face severe issues of high levels of ambient air pollutants [1]. In urban areas, air pollution is a severe threat to human health, and it can cause respiratory diseases, and sometimes it can be responsible for death [2]. Several researchers have reported the human health issue due to air pollution in urban areas around the globe [3-6].

Delhi city (India's capital) is a massive metropolitan and facing alarming air pollution due to the growing sectors, such as industry, transport and housing [7]. Rapid population growth trailed by intensive development in infrastructure in Delhi led to heightened demand for energy from different sectors (i.e. domestic, transport, and industrial). It is increasing the air pollutant emissions of sulfur oxides (SO_x), particulate matter (PM), carbon monoxide (CO), nitrogen oxides (NO_x), hydrocarbons (HC) and others [8]. Moreover, in Delhi, ~5.6 million in-use vehicles population was estimated for mid-2010 and ~7,000 industrial units [9]. Nagpure et al. [2] reported that the human health risks (e.g. mortality/morbidity) had increased by 100% from 1991 to 2010 due to air pollution in the National Capital Territory of Delhi (NCT Delhi). Therefore, the present research aims to summarise the status of air pollution and its impact on human health using existing literature to provide outline information to society and policymakers.

2. Air pollution status and primary source in Delhi

In Delhi, the air pollution problem is critical to society and local authorities. The estimated air pollution load was around 3000 metric tons of air impurities released daily in the Delhi environment. Vehicular emission was the major contributor to air pollution in Delhi, followed by coal-based thermal power plants [10]. Moreover, the small-scale industries of Delhi also contribute to air pollution in the area, along with other industrial units [10]. Guttikunda [7] has reported the annual ambient PM₁₀ average concentration of 260 µg/m³ in Delhi. This value from studied nine stations in Delhi from 2001 to 2010. The ambient PM₁₀ average concentration (260 µg/m³) was more than four times higher than the National Annual Standard (60 µg/m³) and thirteen-time higher than the World Health Organisation (WHO) guidelines (20 µg/m³) [7]. Also, it reported that the air pollution level in Delhi was worst during the winter months compared to other months. The concentration was at least double the annual average due to increased emissions from heating and meteorological circumstances in the area [8]. Jain and Khare [11] have reported that the percentage contribution of pollutants in the Delhi city in which CO and HC were contributed 62% and 24%, followed by NO_x (12%), sulfur oxides SO_x (1%) and PM (1%), respectively. The primary sources of these pollutants were vehicular emissions (about 72%), followed by both large-scale and small-scale industries of the region [11-12].

Goyal et al. [13] have reported that the annual mean levels of suspended particulate matter (SPM) were 280–420 and 300–450 $\mu\text{g}/\text{m}^3$ at residential and industrial sites in Delhi. These values were above the Central Pollution Control Board (CPCB) standards (140 and 350 $\mu\text{g}/\text{m}^3$) and much higher than WHO guidelines of (60-90 $\mu\text{g}/\text{m}^3$) during the study. The concentration of CO and NO_x was higher near traffic connections, mainly during morning and evening (peak traffic hours) in Delhi [14]. The literature suggests that Delhi's air quality is polluted and unhealthy for the society and required proper strategy to mitigate the pollution level in the city.

3. Health impact

Increasing air pollution in metro cities is a significant concern for residents because it contributes to various respiratory problems. Air pollution can affect the entire population of residents, but children are much more vulnerable [15]. Siddique et al. [15] did a study on children (age 9– 17 years) in Delhi to assess the air pollution impact on their Lung function and observed that Lung function was reduced in 43.5% of school children in the urban zone compared with 25.7% of the control group. The study by Siddique et al. [15] confirmed that the children of Delhi city were affected due to high levels of air pollution. A health risk (e.g. mortality/morbidity) due to air pollution had done by Nagpure et al. [2] in various districts of Delhi using the Ri– MAP model (risk of mortality/morbidity due to air pollution). They have observed that 100% growth in total mortality, cardiovascular mortality, and respiratory mortality from 1991 to 2010 in the National Capital Territory of Delhi. The numbers were About 8945, 3413,1302 and 12809 in 1991 and were 18229, 6374, 2701 and 26525 in 2010. Nagpure et al. [2] have suggested excess cases of mortality and morbidity in the several districts of megacity Delhi were due to higher ambient concentrations of SPM and NO_x . Moreover, several other issues, such as higher levels of chronic headache, skin irritation and eye irritation in Delhi due to the air pollution [10]. Kulshreshtha et al. [16] have reported that the high indoor airborne pollutants can cause respiratory problems for women and children of an urban slum in Delhi during the winter.

4. Conclusion

The literature review shows that Delhi city has a high level of air pollution, and it has a harmful effect on the human health of the city. The primary sources of air pollutants in Delhi were vehicular emissions, followed by both large-scale and small-scale industries. Therefore, the present study suggests that Delhi city is required advanced air pollution control techniques. Moreover, existing methods to control the air pollution level in the city is needed to be improved. Furthermore, an awareness program about air pollution and associated health risk, reduction of air pollution, air pollution law and others is essentially required in Delhi in different sectors, such as transport, construction, education, offices, housing society and others

Disclosure statement

No potential conflict of interest

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