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# A Review: Case Study on Particulate Matter at Construction Site of Kochi

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**ABSTRACT:** Here in this paper an effort has been made to monitor the particulate matter in the construction site of Kochi city. The construction industry of India is an important indicator of development across various related sectors. The growth rate of construction industry across India was estimated to be 5.65 percent from year 2015 to 2020, up from about 2.95 percent from year 2010 to 2015. One of the major pollutant released from land clearing to building structure are PM<sub>2.5</sub>, PM<sub>10</sub>, SO<sub>2</sub>, NO<sub>2</sub>, etc. Out of which PM<sub>10</sub> and PM<sub>2.5</sub> are the most harmful due to their small size. PM<sub>2.5</sub> refers to particulate matter with diameter of 2.5 mm whereas PM<sub>10</sub> refers to particulate matter with diameter 10mm. If inhaled both the pollutants are very harmful for the body and can cause serious health issues. The comparative study on various cities using graphs plotted from data's obtained. Remedial measures are suggested to reduce the generation of various pollutants which cause health problems.

### I. INTRODUCTION

Air is an element which is free to inhale by all living creatures. But imagine the condition when it is polluted 95% with pollutants emitted from various industries, factories etc. However these are discussed on a regular basis but haven't brought into full control. The discharge from industries as well as factories contain, many toxic substances that can pollute the environment and cause serious health issues when inhaled or consumed. One of the major causes of air pollution is resulting from construction activities. In these review paper we will discuss the type and source of activity which happens to be the cause of major pollutant release.

### II. PM<sub>2.5</sub> POLLUTED CITIES

According to the WHO'S results on almost 1600 cities in 91 countries, out of which 124 Indian cities and included 8 cities from Kerala. Out of the 8 cities rank 1 is awarded to Pathanamthitta with PM<sub>10</sub> as 23 and PM<sub>2.5</sub> as 10. However the cities Kollam, Alappuzha, Trivandrum, Kottayam, Kozhikode, Kochi, Thrissur are quite high too. The state pollution control board are using adequate techniques to measure the ambient air quality. There are two methods of measurement ie: manual and automatic method. The monitoring is done on 30 stations that is spread across the state. RSPM ( Respirable suspended particulate matter) values at Kannur and Nagampadam exceeded the limit by 60 microgram per cubic meter in 2015.

### III. CONSTRUCTION IN VYTTILA

Among the various cities in Kerala, Vytilla has a hike on its development sector. The leap in population occurred with in the period 2013-2017 due to the construction of metro. However after the construction the upsurge in pollutants should have been reduced as people prefer rely more on metro rather than own vehicle. But the rate of pollution

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increased due to the construction of flyover in Vytilla city. As a remedial measure the authorities suggested to sprinkle water to reduce the dust level. One of the monitoring station is located at mobility hub vytilla. This region is the most busiest bus station in kerala. The kerala state is divided into 3 major zones typically industrial, commercial and residential.

## IV. PARTICULATE MATTER FROM

During construction there are various sources through which the emission of particulate matter occurs. Earthwork, rock cutting, transportation of construction raw materials are the initial cause of pollution with particulate matter. However through the next phase of construction like grinding, drilling, welding, blasting and soldering of metals leads to the expel of PM. These are taking place for the joining and making of support structures like beam, column, slab etc. these produce large quantities of very fine debris, silt, and solid waste from the site. During the final phase of construction the paint and adhesives used for finishing the surface of structure cause pollution to land as well as they are brought in plastic containers and bottles. Another major concern is that during the progress of construction the site is blocked causing hindrance to traffic and large no of vehicles are parked back to back. A car burns the most fuel while accelerating to get up to a speed. The continuous boosting and barking will pump more pollutants into the atmosphere. A stop and go activity occurs constantly.

## V. PARTICULATE MATTER AND ITS

The particles whose size is less than 10 micrometers of diameter causes serious problems, because these particles can intrude in to our lungs or even can enter our bloodstream. The workers or residents near or at the construction site are seriously exposed to PM, may get health effects due to its emission. Various science related studies suggests that prolong exposure to this creates several problems such as asthma, irregular heartbeat, heart attacks etc. Which can ultimately lead to premature death. Across several countries PM2.5 causes haze or reduced visibility. Particles which are under 2.5 micrometer commonly called as fine particles are most dangerous out of the list.

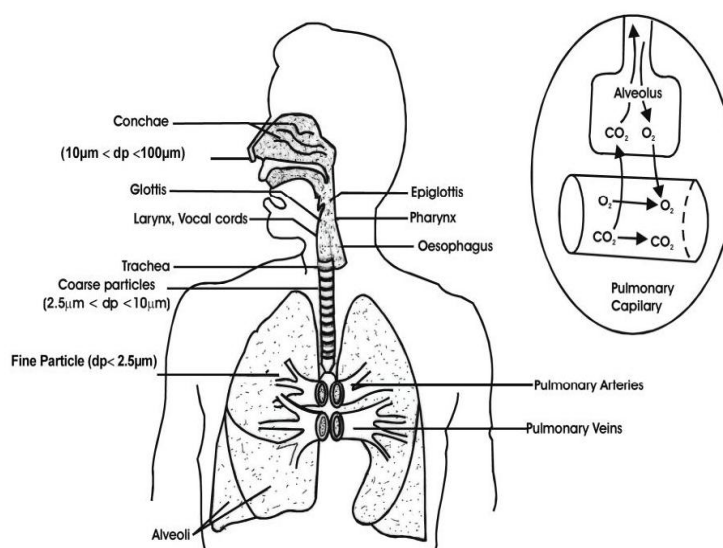


Fig. 1. The respiratory system detailing the penetration of particulate matter

( source: Stern et al. 1984, effects of particulate matter on human health: a review L. A Jimoda )

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## VI. INFLUENCING FACTORS OF BUILDING

At the construction site, the conditions are very complex and the dust emissions are due to several factors. The weather condition has an important role on the concentration and emission of particulate matter. Construction dust positively correlates with wind speed, relative humidity and negatively correlates with temperature. The values of construction related activities such as drilling and cutting are five and fifteen times higher than background values or are at its peak level. The selection of monitoring indicators could not completely show the pollution of building construction site. It has been found that every construction site has adopted their own dust proof measures such as wall spray, sprinkling water on the road inside the construction compound etc.

## VII. METHODS

There are two types of air quality monitoring methods.

Manual method – laboratory procedures

Automatic method – continuous ambient air quality monitoring system

### MANUAL METHOD

The air sample in manual method is collected using Whatman filter paper PM 2.5. The various Pollutants detected using manual methods are PM10, PM2.5, benzene, SO<sub>2</sub>, NO<sub>2</sub> etc.



Fig. 2. Manual monitoring machines at Vytilla, Ernakulam , Kerala

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## AUTOMATIC METHOD

Ambient air quality monitoring system is used in automatic method.



Fig. 3. Automatic machine at MG Road Ernakulam, kerala

## VIII. ASSESSMENT OF AIR POLLUTANTS

Vytilla , Ernakulam South and MG road are among the most polluted places in kochi. The air that is inhaled from these places could be the reasons for several breathing and allergic problems. Kerala state pollution control board KSPCB officials declared that the construction activity and high vehicular ratio are certain reasons for the high pollution levels.

The real-time monitoring of air pollution levels is only seen in vytilla station. The sources here could be of cement godowns, road repair etc, generates aerosols. These particles remain in the air for several years.

## IX. DATAS AND GRAPHS

According to the PM10 level data's from Vytilla city during 2017 and 2019, graphs have been plotted to determine the highest and lowest levels. It has been found that there is an increase in pm 10 levels during 2019 as compared to 2017 due to a number of reasons. The main root cause is the ongoing construction of flyover in Vytilla city. However the metro stations at Vytilla was opened on 2019 September and technically speaking the pollution levels was expected to decrease as people tend to rely more on metro rather than own vehicles. But the construction of flyover and metro extensions towards Petta city almost overrode the expected decrease in population levels.

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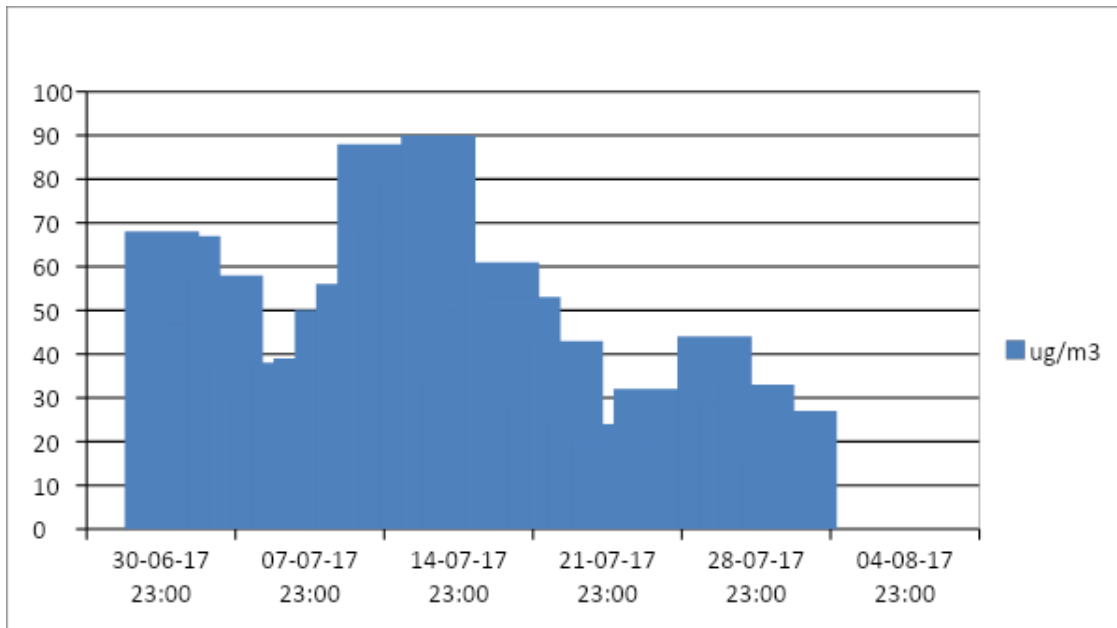


Fig. 4. Graph plotted based on the data of pollution levels of PM10 in vytilla

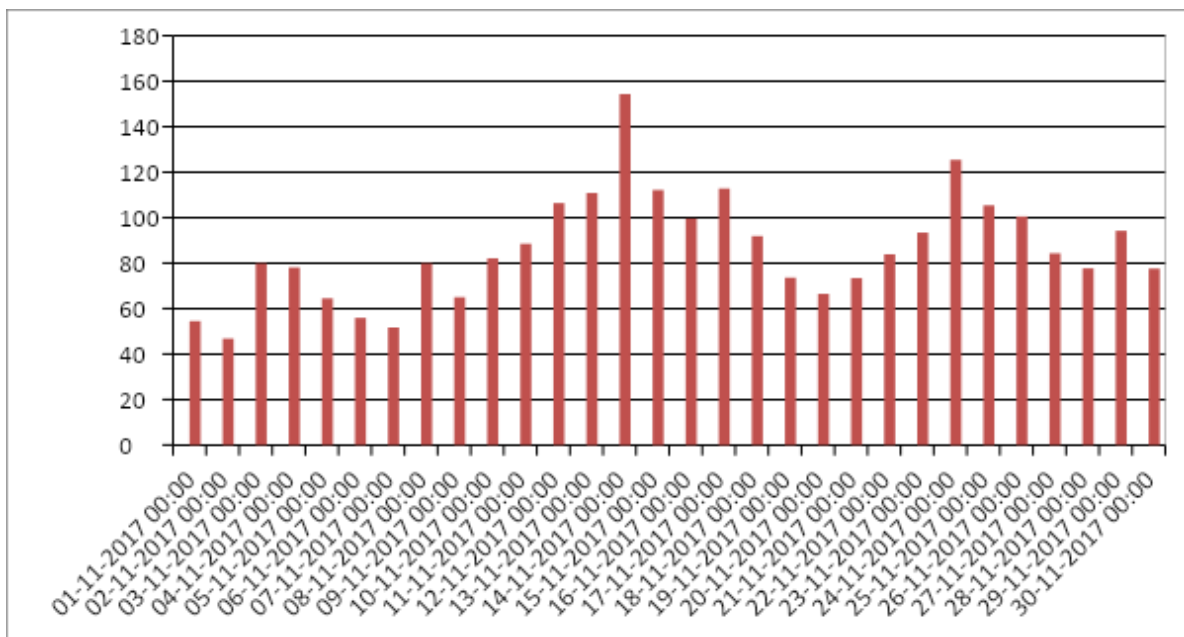


Fig. 5. Graph plotted based on the data of pollution levels of PM10 in MG Road, November 2017.

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## X. DISCUSSIONS

This paper discusses that the particulate matter PM<sub>2.5</sub> is very harmful, which seriously affects health and our environment or can often lead to climate variations. The various activities in the construction site such as excavation, heavy equipment operations leads to the generation of PM in these construction sites. The situation becomes difficult as this particulate matter prevails in the atmosphere for several days or years. Through this the prime reason for its emission could not be controlled as well as its time of stay could not be determined. The country should follow the standards and guidelines provided to reduce the emission of these so called particulate matter. Apart from this the machines installed at various industrial, residential, and commercial sites must monitor the daily or yearly emission of the particulate matter in to the atmosphere. Whoever violates the guidelines provided by the government are strictly punished.

## XI. REMEDIAL MEASURES TO REDUCE PM

The government officials and the construction organizations access the work activities and technologies that are involved in the construction projects during and after construction. The emission of particulate matter from construction site is often reduced by water or through various chemical dust suppressants. The fugitive dust from various activities such as site preparation, storage piles, materials handling and transfer, unpaved roads etc, can be avoided by applying water or dust suppressants. The dust evolution from at least one of the construction site can be avoided by applying water. The water to mitigate the generation of PM can be provided through trucks, hoses, water pulls, sprinklers, fire hydrants etc.

There are a wide varieties of dust suppressants nowadays available to suppress fugitive construction dust from these construction sites. These dust suppressants are much more expensive than water, they are also more effective to reduce dust emissions and are often applied much less frequently. Some of the dust suppressants include the following:

(1). Agglomerating chemicals, (2). Liquid polymer emulsion, (3). Cementious products, (4). Petroleum based products, and (5). Chloride salt.



Fig. 6. picture showing chemical suppressant

(source: <http://encryptedtbn0.gstatic.com/images?q=tbn%3AANd9GcSpOGS859tZ9owrbMICzlsFKTWuyzJg0B2txdm7uGyzogqZe> )

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## XIII. CONCLUSION

The various air pollution problems, that are induced by high-speed urbanization, rapid economic growth, and explosive motorization across various cities of Kerala creates direct threat to long term economic sustainability and social benefit. In large cities of Kerala, the air pollution problems creates major problem.

About one-third of the monitored cities did not reached the National Ambient Air Quality standards. The major pollutant that affects the urban air quality is particulate matter. Nevertheless, the rapid growth of the economy and energy consumption did not bring the same speed increase of air pollutants emission and air quality degradation.

The construction site should monitor the emission of particulate matter through a proper scheduled construction time management at the site. Construction vehicles could be the one reason behind the dust emission. Therefore the dust proof measures such as cleaning the in and out of the vehicle and sprinkling water on the construction road and site are very necessary.

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