ADVANCES IN MONITORING OF AIR PARTICULATES OF ITANAGAR, ARUNACHAL PRADESH, USING FOLDSCOPE

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Abstract

Particulate matter, one of the air pollutants, is a mixture of small solid and liquid particles suspended in the air. These particulate matters can affect respiratory functions and cause irregular heartbeats. Very recently, a report from Greenpeace India says that as many as 1.2 million deaths take place every year due to air pollution in India and pointing fossil fuels as one of the main culprit for the deteriorating air quality across the country. Itanagar, the Capital of Arunachal Pradesh does not endowed with many industrial and factory set-ups, but automobile exhaust, forest fires and road dust is the main contributor to air pollution. Monitoring and identification of these particulates is the need of the hour in addressing some health issues related to air pollution. In this paper, progress of air particulates monitoring, using foldscope as tool from different locations of Itanagar were elaborated. Dimension of the area in slides used for this purpose is 1.6 cm x 0.8 cm, which we get in paper slide (coming along with the foldscope). All slides were placed at suitable and safe locations for collection of air particulates and were observed through foldscope after every 3-4 days during rainy days and after 2-3 days during dry/sunny days. The number of air particulates stuck on the marked portions were counted, tabulated and presented monthly-wise as average abundance in graphical form. The study period is from May 2018 to December 2018

Index terms: Air particulates, pollution, Itanagar, foldscope.

INTRODUCTION

Particulate matter, one of the air pollutants, is a microscopic mixture of small solid and liquid particles suspended in the atmosphere of the earth [1]. Sources of this particulate matter can be natural or anthropogeneic. It includes smoke, fumes, soot and other combustion by-products, but also natural particles such as windblown dust, sea salt, pollen and spores, primary particles coming directly out of exhaust stacks and tailpipes, and secondary particles such as suphates and nitrates which form from condensation of vaporized materials or from byproducts of the oxidation of gases in the atmosphere [2]. These particles come in many different size ranges such as coarse, fine and ultrafine and also vary in composition and origin [3]. Particulate matter are designated as **PMx**, where **P** stands for particulate and **M** stands for matter and **x** represents the size in micrometer. As such, it can be seen as $\mathbf{PM_{10}}$[4] – inhalable particles, with diameters that are generally 10 micrometers and smaller; and $\mathbf{PM_{2.5}}$[5] – fine inhalable diameters that are generally 2.5 micrometers and smaller. From here on **PM** will be used as short symbol for the word particulate matter. Particulate matter pollution and the ability of the PM to undergo complex chemical reactions is considered as one of the deadliest types of air pollution in India and on a global level [6] owing to increase in human activities, industrialization, power stations, automobiles and diesel generators, etc. Some are emitted directly from a source, such as construction sites, unpaved roads, fields, smokestacks or fires [7].

PM is a serious problem for human health, plants and to the entire climate [3]. Exposure to **PM** pollution can cause irritation of eyes, throat and nose, tightness in chest, difficulty in breathing and decrease in lung

function. A number of scientific studies have linked **PM** pollution to a variety of problems, such as premature death in people with heart or lung disease, non fatal heart attacks, irregular heart beat, asthma, increase susceptibility to viral and bacterial pathogens leading to pneumonia in vulnerable persons, etc[8-9]. The size of the **PM** is the main determinant of health effects [1]. **$PM_{2.5}$**, also called "fine" particles and are about $1/28^{th}$ the diameter of a human hair or smaller, are of the greatest health concern as they can pass through the nose and throat and can be absorbed deep inside the lungs, and can even enter the circulatory systems[10]. It has also been reported that a long-term exposure to **$PM_{2.5}$** may lead to plaque deposits in arteries, causing vascular inflammation and a hardening of the arteries which can eventually lead to heart attack and stroke[11].

According to recent report from Greenpeace India [12], as many as 1.2 million deaths take place every year due to air pollution in India and pointing fossil fuels as one of the main culprit for the deteriorating air quality across the country. The report was collected through the right to information to all state pollution control board and information obtained through online reports and assessment study of air quality in 168 cities across 24 states and union territories. Itanagar, the Capital of Arunachal Pradesh does not endowed with many industrial and factory set-ups, but automobile exhaust, forest fires and road dust is the main contributor to air pollution. In this study we used foldscope to monitor air particulates. To the best of our knowledge, monitoring of air particulates of Itanagar using microscope *(Foldscope* for the purpose here) will be the first time in the state of Arunachal Pradesh and it is the need of the hour in addressing some health issues related to air pollution.

OBJECTIVES

Objective of this research is to monitor air particulates in the stretch of National Highway NH415, from Chandranagar to Raj Bhavan tinali of Itanagar, the capital of Arunachal Pradesh, using foldscope as tool. The stretch of the road under study is given below.

Figure 1: Location map (from Google) of Itanagar showing the stretch of study sites, **A** to **B**

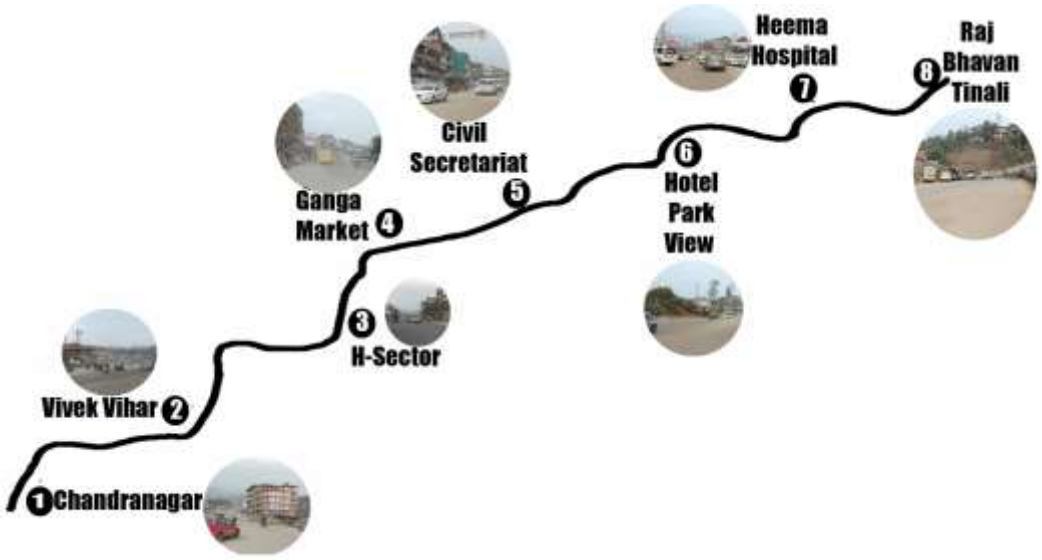
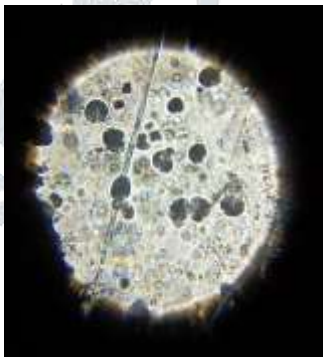


Figure 2: Sites for collection of air particulates along the NH415 from Chandranagar (**A**) to Raj Bhavan Tinali (**B**), of Itanagar, Arunachal Pradesh

METHODOLOGY

For the purpose of this study we use paper slides which came along with the unassembled foldscope. Dimension of the area in slides used for this purpose is 1.6 cm x 0.8 cm, which we get in paper slide (coming along with the foldscope).We paste a salotape on one side of the slide, stick to the holder and were placed at suitable and safe locations for collection of air particulates. After every 3-4 days during rainy days and after 2-3 days during dry/sunny days we collect these slides and cover with the salotape on the other side. It was then observed under foldscope having a magnification of 140x and resolution of 2 microns. The number of air particulates were counted and tabulated, and presented month-wise as average abundance in graphical form. A sample picture captured through foldscope for the purpose of counting the number of air particulates is shown below.

Dust Particles
Vivek Vihar, Itanagar, A.P.
(www.microcosmos.foldscope.com)
Posted by Likha Taje (TA)



OBSERVATIONS AND DISCUSSIONS

Presenting here is the advances of air particulates monitoring from May 2018 to December 2018, from different locations of the study sites. The number of air particulates stuck on the marked portions were counted, tabulated and presented monthly-wise as average abundance in graphical form.

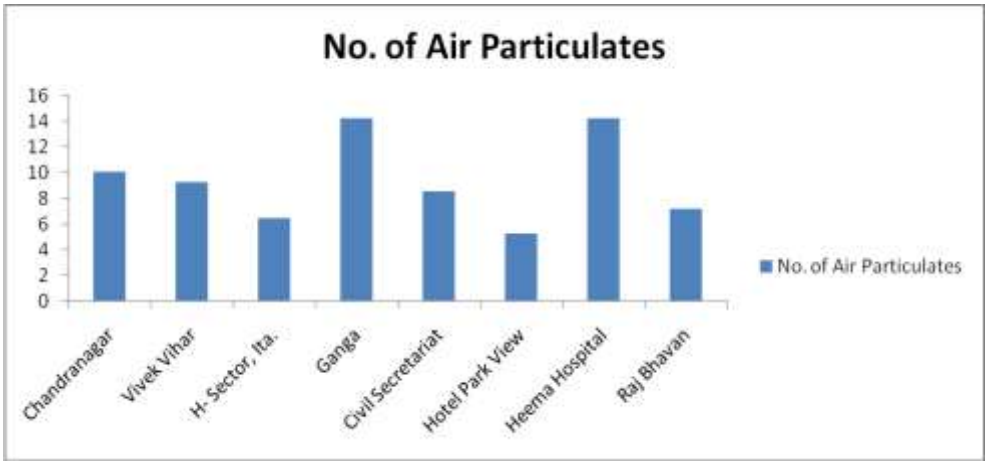


Figure 3: Presentation of average abundance of air particulates for May'18

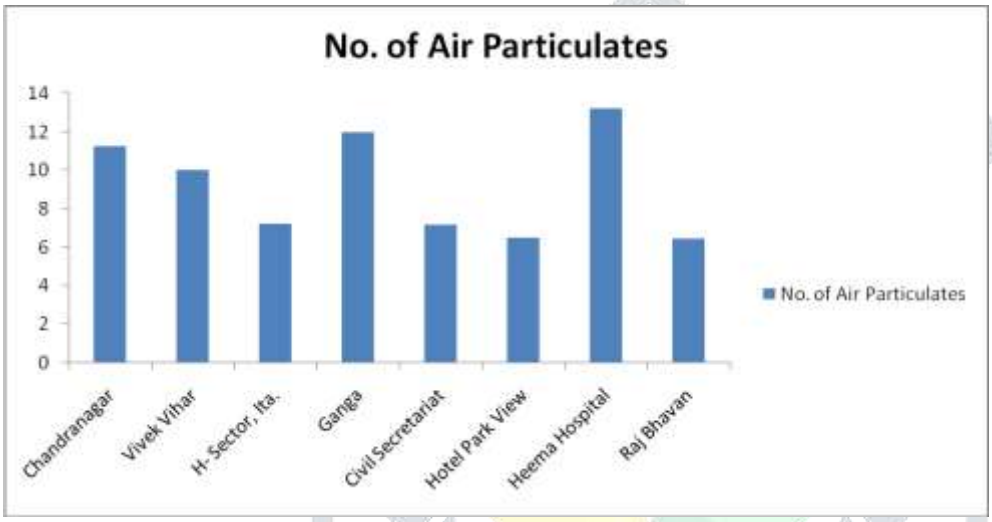


Figure 4: Presentation of average abundance of air particulates for June'18

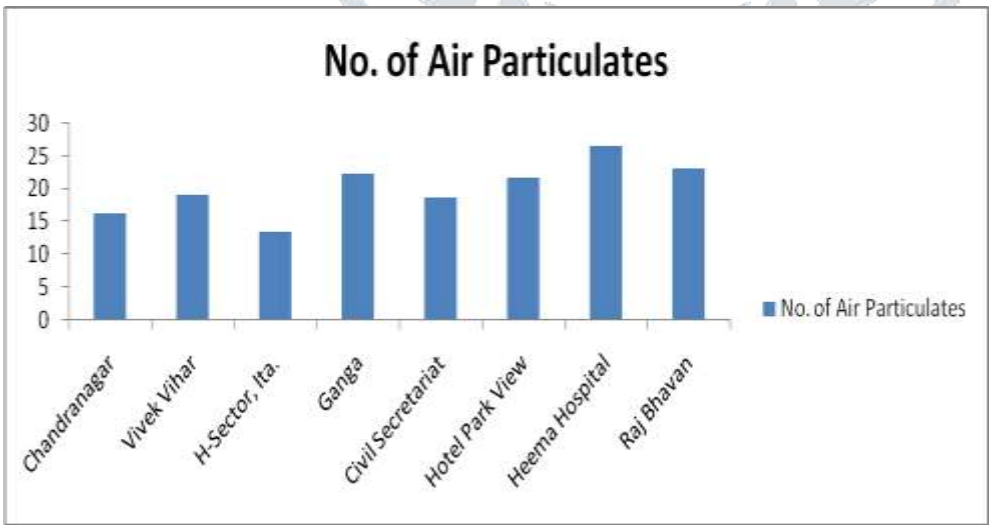


Figure 5: Presentation of average abundance of air particulates for July'18

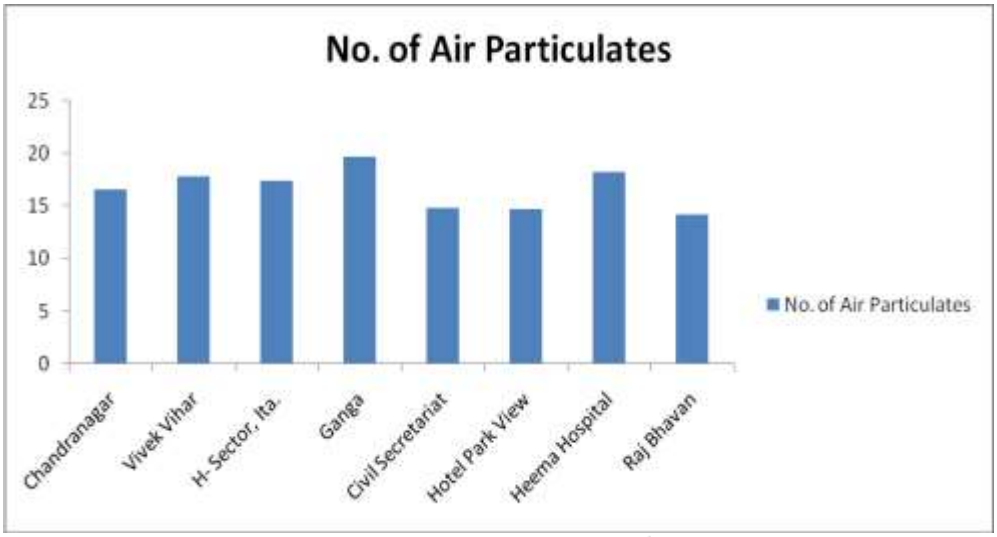


Figure 6: Presentation of average abundance of air particulates for August'18

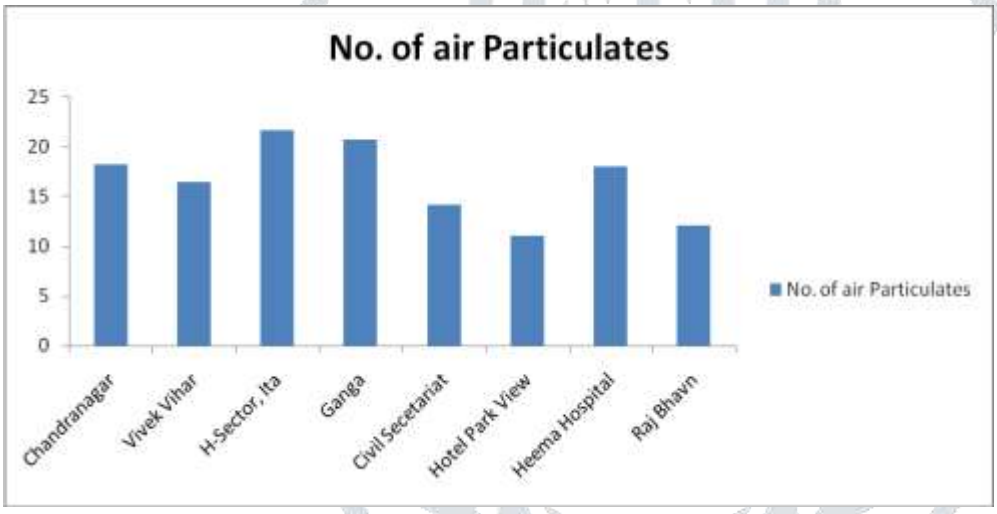


Figure 7: Presentation of average abundance of air particulates for September'18

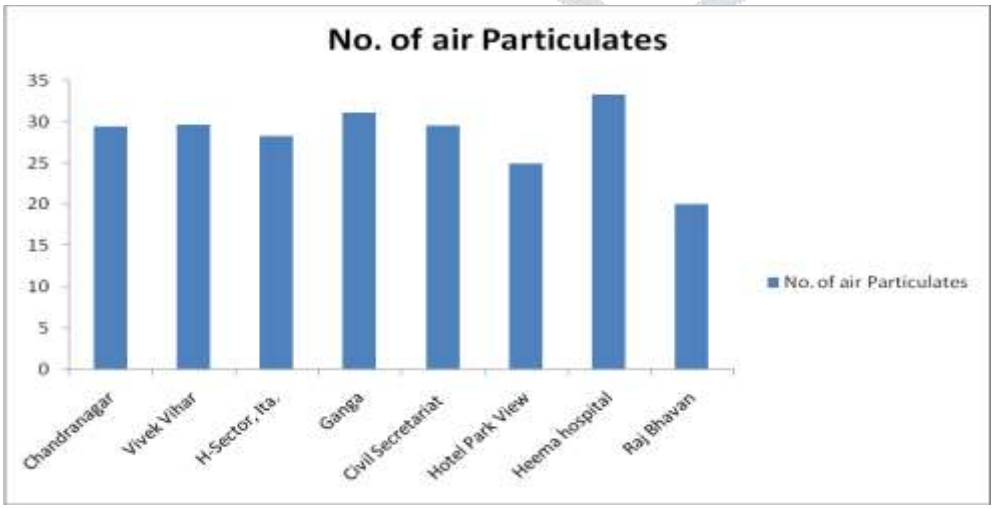


Figure 8: Presentation of average abundance of air particulates for October'18

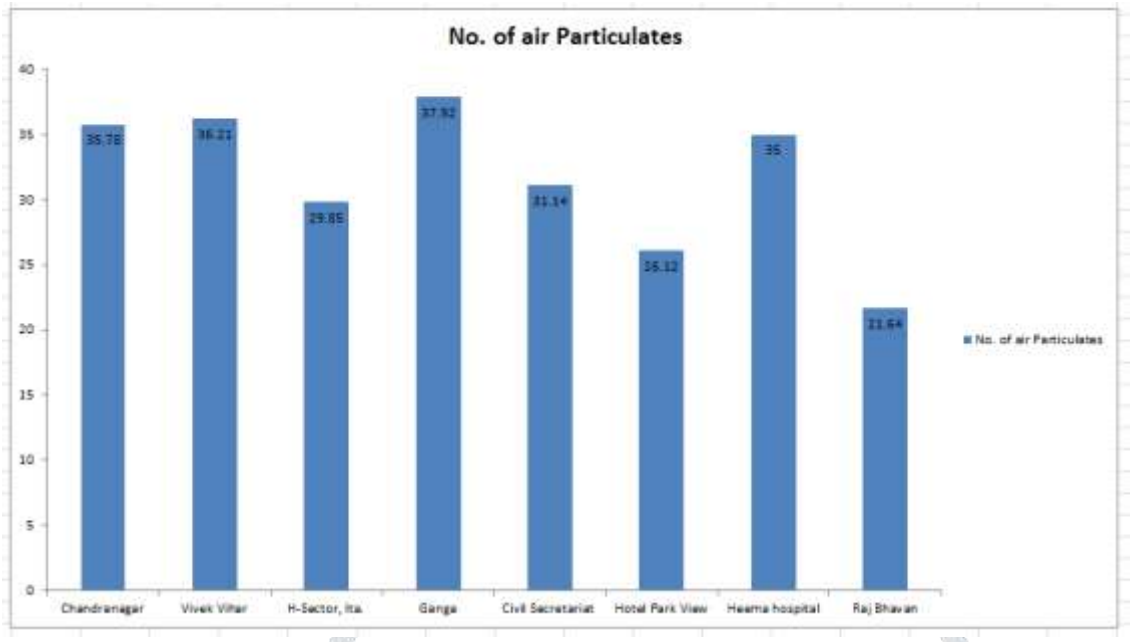


Figure 9: Presentation of average abundance of air particulates for November'18

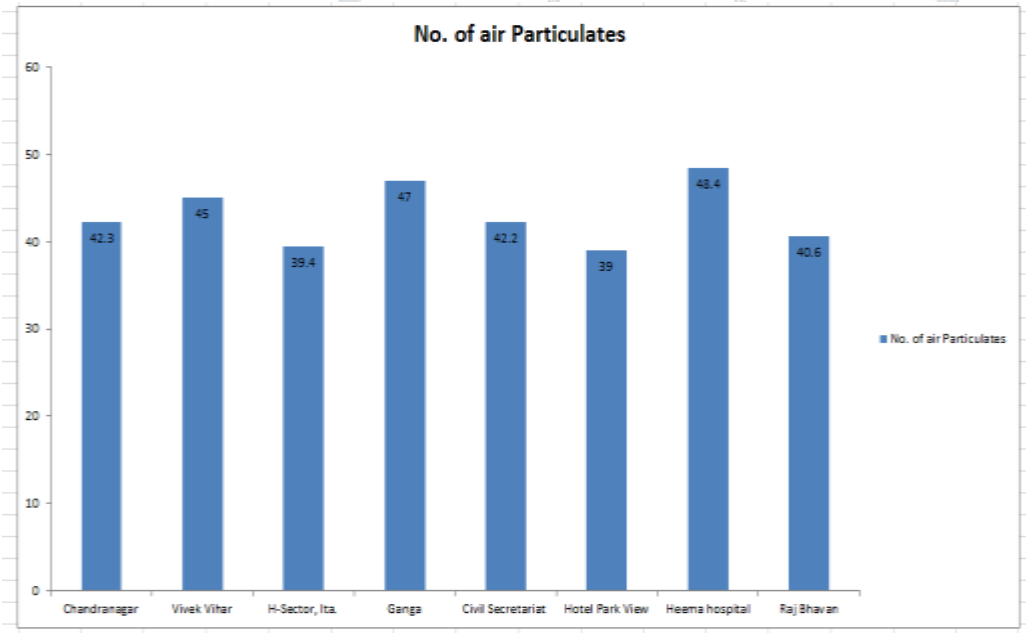


Figure 10: Presentation of average abundance of air particulates for December'18

Particulates collected through our slides were presented in average abundance and the ranges for each month, here from May'19 to December is shown below:

Month	May	June	July	Aug	Sept	Oct	Nov	Dec
Average abundance	6.5-14.25	6.5-13.25	13.92-26.57	14.21-19.71	11.07-20.71	20.07-33.28	21.64-39.92	39-48.4

It was found that the lowest in the range for the months (2018 May to December) is 6.5 and correspond to May and June. For May to September the average abundance ranges from 6.5-26.57. The value 26.57 corresponds to the higher end for the month of July. Low average abundance attributed to monsoon, and keep on increasing with ceasing monsoon. From October to December, there is a steep rise of 13.57 on the lower end and 21.83 on the higher side. The abundance range keep increasing from October to December attributing to onset of dry season in addition to vehicular pollution and the present earth cutting for four – lane expansion of the highway. This is also verifiable if one considers one of the collection points from May to December.

CONCLUDING REMARKS

As users of foldscope, this is the simplest, highly innovative and promising tool to explore science of our surroundings. One of the biggest contributors to air pollution, dust particles or particulates, which we find hard to see through our naked eye, can be explored effectively through foldscope. Variation on the pollution level from monsoon to winter season is clearly visible which a common man can also explore. Therefore, the objective of citizen science is also fulfilled here. Due to limitation of resolution of the foldscope, that is 2 micron, identification of different types of air particulates is not possible. However, with higher resolution lens, the study can go deeper.

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