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AN ENVIRONMENTAL STUDY ON AIR QUALITY, WATER QUALITY AND SOLID WASTE ANALYSIS AT DHANIPUR MANDI

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Abstract: ***The study is concerned with the composite analysis for air quality, water quality and solid waste analysis at Dhanipur Mandi vegetable market, Aligarh. Aligarh is medium sized city located in fertile tract of Ganga-Yamuna doab in the western part of the Uttar Pradesh, India. It was found that the present study the site is more prone to adverse air impact because of higher concentration of PM10 and does not require any extent of treatment of water as concentration of most of water parameters fall within the permissible limit. Study site generated large amount of biodegradable solid waste, which can compost to recover energy.***

Keywords: PM, Water quality, Solid waste, Sample,

1. INTRODUCTION

Particulate matter (PM) is major growing environmental problem in the developed and developing countries of the world among the many other pollutants, the impacts of PM pollution on human health and ecology are the largest and its impacts in the urban and rural areas is studied and documented the most (Guttikunda S. 2007). Among all critical air pollutants, respirable suspended particulate matter (PM10) pollution is being awarded greater significance over the past decade. Along with vehicular traffic and meteorological phenomenon, construction works are the major source for release of PM10 in the atmosphere. It is a major source for acute, chronic and respiratory health problems. It produces short term as well as long term health problems in day to day life style.

Multiple studies confirms $PM_{2.5}$ and PM_{10} can affect lung growth and development in children and adolescents, number of medical visits, and hospital emergency admissions due to the asthma, respiratory symptoms, and upper and lower respiratory tract disorders (Brown et al. 2013; Linares and Diaz 2010; Praznikar and Praznikar 2012; WHO 2013).

Water is the most significant over abundant compound of the Earth. Water is life. No life can lie without water. Groundwater is employed for domestic and industrial facility and jointly for irrigation purpose (Bansal J. et al. 2018). The crisis of natural water resources and environmental deterioration (Gorelick and Zheng, 2015; Zhang et al. 2017). Groundwater plays a vital role in the survival and development of human beings, because it accounts for about one third of global fresh water and is currently the world's largest source of accessible fresh water (Siebert et al., 2010; Howard, 2015). However it was widely mismanaged and poorly protected due to increasing population, expanding agricultural irrigation area, and rapid industrial development worldwide (Zheng and Liu, 2013; Foster et al., 2013). In many parts of world, extraction of ground water exceeded groundwater recharge which has seriously affected the production of crops on a sustainable basis (Gleeson et al., 2010; Foster and Garduño, 2013). For improving the groundwater utilization and protecting groundwater from further pollution, a series of groundwater monitoring schemes have been established in many parts of the world (Jørgensen and Stokmarr, 2009).

Water plays an essential role in human life. Although statistics, the WHO reports that approximately 36% of urban and 65% of rural Indian were without access to safe drinking water. Fresh water is one the most important resources crucial for the survival of all the living beings. It is even more important for human being as they depend upon it for food production, industrial and waste disposal, as well as cultural requirement. Human and ecological use of ground water depends upon ambient water quality. The consequences of urbanization and industrialization leads to spoil the water for agricultural purposes ground water is explode in rural especially in those areas where the sources of water like dam and river or a canal is not considerable (Nagamani C. et al. 2015)

Fruit and vegetable wastes are produced in large quantities in market and constitute a major source of nuisance in municipal landfills because of their high biodegradability and create problems of safe disposal.

The study area is very prone to pollute the environment as numbers of people come to this place for selling and buying vegetables, cereals, fruits etc. As there are lots of vegetable is wastage, thrown directly to open land thus it becomes important to have qualitative analysis of this waste in selection of a suitable waste treatment scheme. Thousands of vehicles come to this place daily and it is necessary to monitor the air quality of this place. Since peoples come to this place and also live besides this place and they require potable water to drink. The potable water is sunk from ground water reservoir thus it becomes necessary to check the ground water quality.

2. INTERNATIONAL STANDARDS

Table 2.1: Air quality guideline for particulate matter.

Pollutant	**Time weighted average**	**Concentration (WHO)**	**Concentration (CPCB)**
$PM_{2.5}$	Annual mean 24-hours mean	10 µg/m^3 25 µg/m^3	40 µg/m^3 60 µg/m^3
PM_{10}	Annual mean 24-hours mean	20 µg/m^3 50 µg/m^3	60 µg/m^3 100 /m^3

Table 2.2: Drinking water quality guidelines.

Characteristics	**Acceptable limit (WHO)**	**Permissible limit (WHO)**	**Acceptable limit (BIS)**	**Permissible limit (BIS)**
pH value	7-8.5	6.5-9.2	6.5-8.5	No relaxation
Total dissolved solids, mg/l	500	1500	500	2000
Turbidity, NTU	5	25	1	5
Total hardness as calcium carbonate, mg/l	100	500	200	600
Sulphate (as SO_4^{--})	200	400	200	400
Chloride (as Cl^-)	200	600	250	1000
Iron (as Fe), mg/l	0.1	1	0.3	No relaxation
Total alkalinity as calcium carbonate, mg/l	-	-	200	600
Flouride (as F^-), mg/l	-	-	1	1.5
Nitrate (as NO_3^-), mg/l	-	-	45	No relaxation

3. STUDY AREA



Figure: 3.1

The study area 'Dhanipur Mandi' is a vegetable market adjacent to National Highway-91(NH-91) and 5km from Aligarh Bus stand, Aligarh, India. It is at a height 193m above mean sea level having geographical co-ordinates 27.87ºN, 78.10ºE. The samples were taken from the selected site in three different months (August, September and October respectively).

3.1. Map of Study Area

The following is the map of location and sampling points.

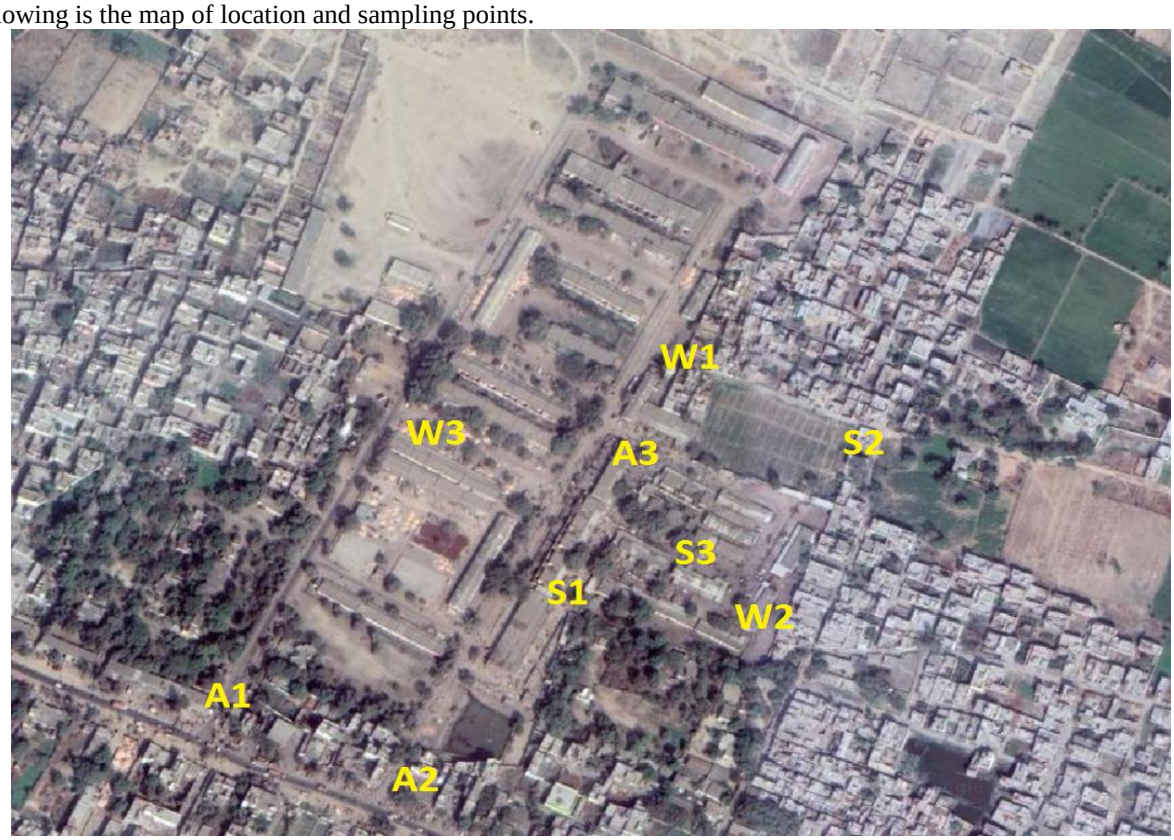


Figure: 3.2

Table 3.1: Details of Sampling Location

Abbreviation	Sample type	Location	Number of samples taken	Frequency of sample taken
A1	Air sample	Location-1	3	One month
A2	Air sample	Location-2	3	One month
A3	Air sample	Location-3	3	One month
W1	Water sample (tap water 1)	Location-1	3	One month
W2	Water sample (tap water 2)	Location-2	3	One month
W3	Water sample (ground water)	Location-3	3	One month
S1	Solid waste	Location-1	3	One month
S2	Solid waste	Location-2	3	One month
S3	Solid waste	Location-3	3	One month

4. MATERIALS AND METHODS

4.1. Air monitoring:

Air monitoring is done by following the Method-501, Air Sampling and Analysis, 3rd Edition, Lewis publishers Inc.
IS 5182 Part 23(2006) Method of Measurement of Air Pollution: Respirable Suspended Particulate Matter (PM_{10}) cyclonic flow technique.

4.2. Water quality monitoring:

Measurement of water quality parameters like pH, Total dissolved solids, Turbidity, Total alkalinity, Total hardness, Sulphate, Chloride, Iron, Fluoride and Nitrate content by HACH DR-5000 spectrophotometer, HACH pH sensor, and Titration method.

4.3. Solid waste analysis:

Solid waste analysis is carried out for density, ash content, volatile matter and fixed carbon by using electric weighing, silica crucible, desiccators, electric oven, and muffle furnace.
The moisture content of solid waste is found with the help of electric oven maintained at 105ºC for an hour,

% of Moisture content = $\frac{X2-X3}{X2-X1} \; x \; 100$

The volatile matter of solid waste is found with the help of muffle furnace maintained at 925ºC for 7 minutes,

% of Volatile matter = $\frac{X3-X4}{X2-X1} \; x \; 100$

Ash content of solid waste is found with the help of muffle furnace maintained at 725ºC for 30 minutes,

% of Ash content = $\frac{X5-X1}{X2-X1} \; x \; 100$

% of Fixed carbon = 100 – (% of moisture content + % of ash content + % of volatile matter)
Where,
X1 = weight of empty crucible
X2 = weight of crucible with solid waste sample
X3 = weight of crucible with solid waste sample after heating at 105ºC
X4 = weight of crucible with solid waste sample after heating at 925ºC
X5 = weight of crucible with solid waste after heating at 725ºC

5. RESULTS AND DISCUSSIONS

The composite study was conducted on about 3 samples of air, 9 samples of water and 12 samples of solid waste. The results of analysis can be seen in graphical manner as follows;

5.1. Air monitoring:

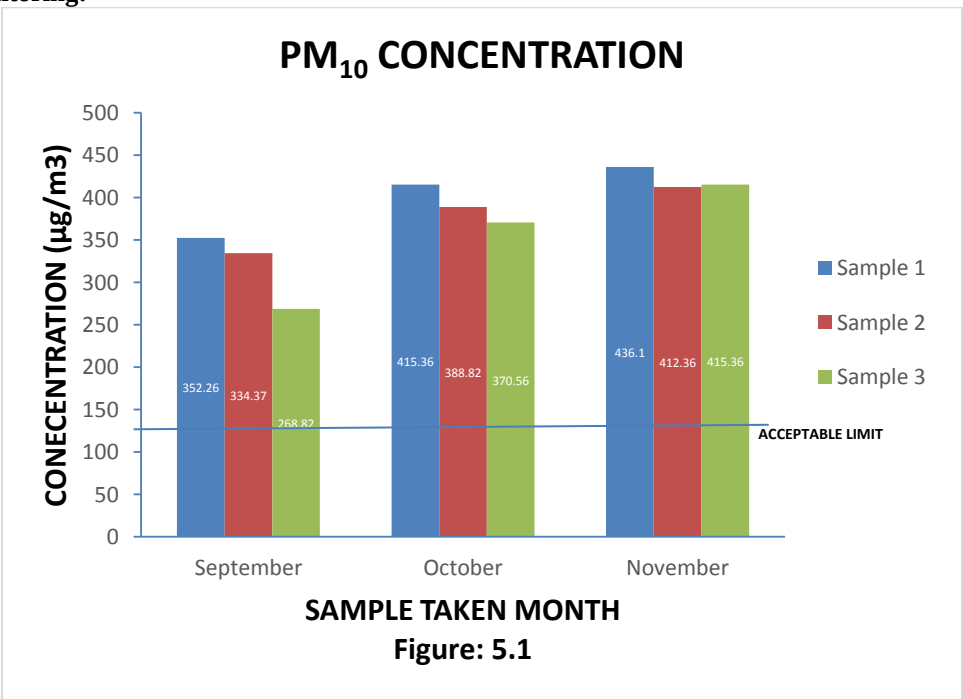


Figure: 5.1

Figure: 5.1 shows that the maximum and minimum concentrations of PM10 are 436.1 µg/m^3 and 268.82 µg/m^3 respectively which are much higher than the permissible limit i.e. 100µg/m^3

5.2. Water quality monitoring:

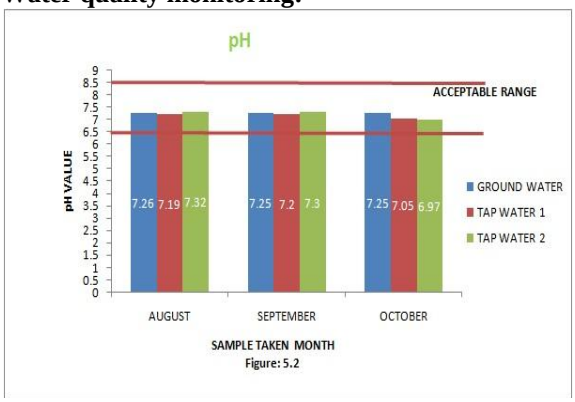


Figure: 5.2

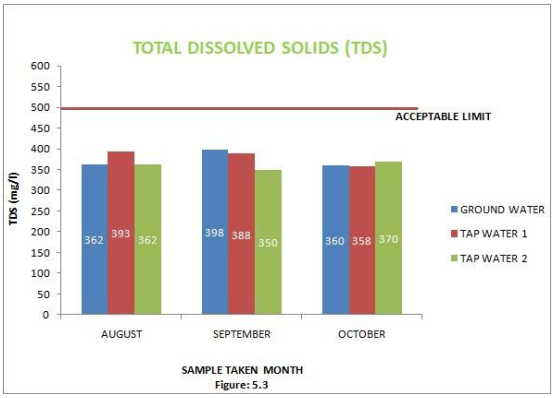


Figure: 5.3

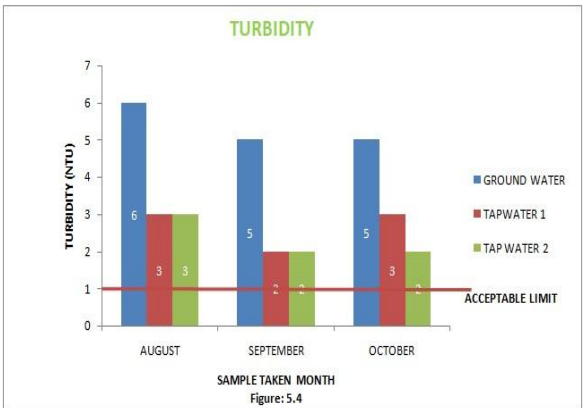


Figure: 5.4

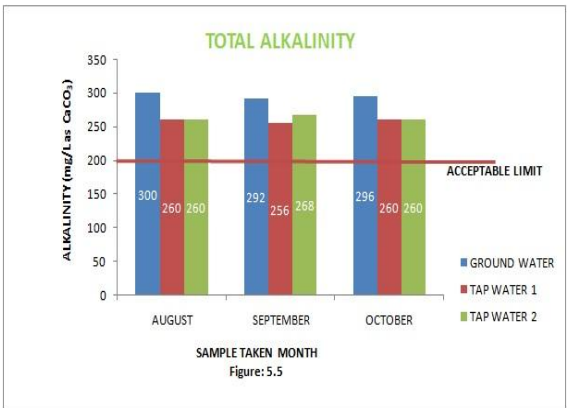


Figure: 5.5

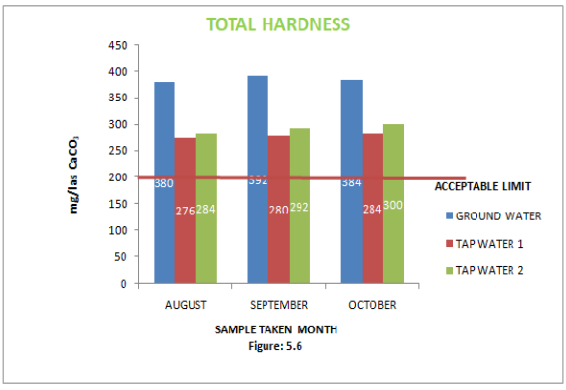


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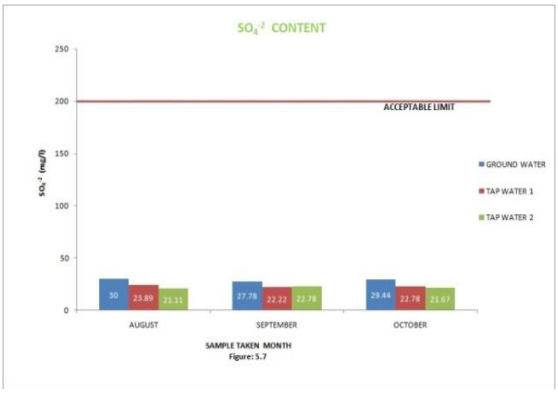


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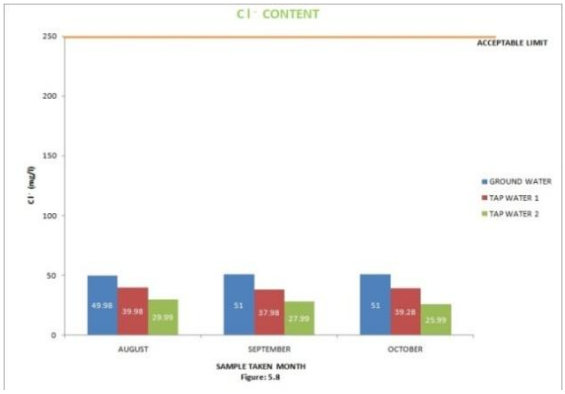


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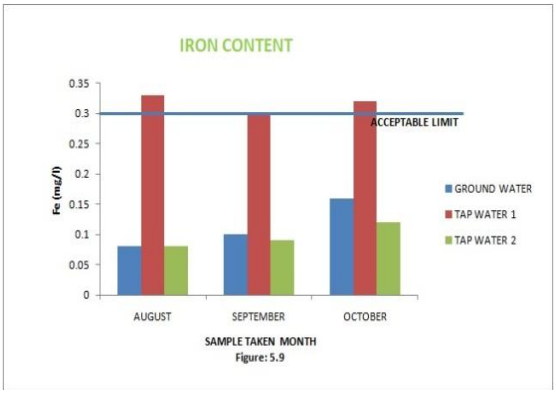


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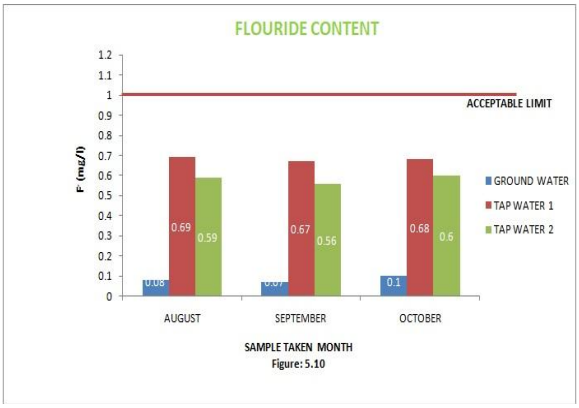


Figure: 5.10

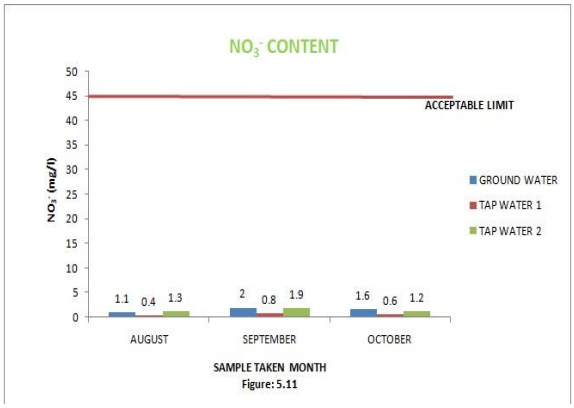


Figure: 5.11

Figure: 5.2 shows that pH values of all water samples which are fall within the acceptable limit for pH i.e. 6.5-8.5. Figure: 5.3 shows that TDS values of all water samples fall below the acceptable limit i.e. 500mg/l. Figure: 5.4 shows that the Turbidity of water samples are higher than that of acceptable limit i.e. 1 NTU. Figure: 5.5 shows that the values of Total Alkalinity of all water samples are more than that of acceptable limit i.e. 200mg/l. Figure: 5.6 shows that Total Hardness value of water samples are much higher than that of acceptable limit i.e. 200mg/l. Figure: 5.7 shows that Sulphate content of all water samples are much lower than that of acceptable limit i.e. 200mg/l. Figure: 5.8 shows that Chloride content of all water samples are much lower than that of acceptable limit i.e. 250mg/l. Figure: 5.9 shows that Iron content of ground water and tap water 2 samples fall below the acceptable limit and Iron content of tap water1 sample is slightly higher than the acceptable limit i.e. 0.3 mg/l. Figure: 5.10 shows that Fluoride content of all water samples are much lower than that of acceptable limit i.e. 1mg/l. Figure: 5.11 shows that Nitrate content of all water samples are much lower than that of acceptable limit i.e. 45mg/l.

5.3. Solid waste analysis:

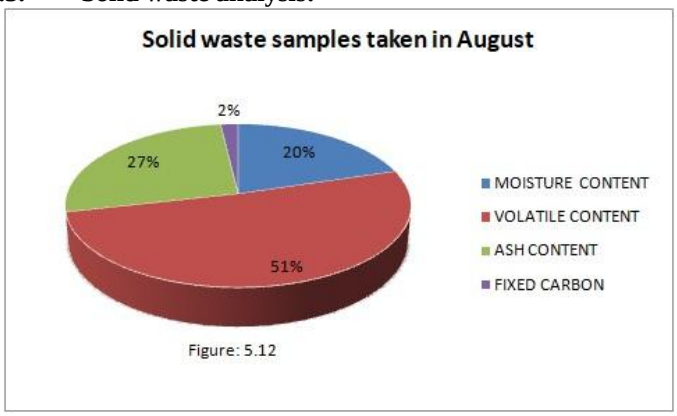


Figure: 5.12

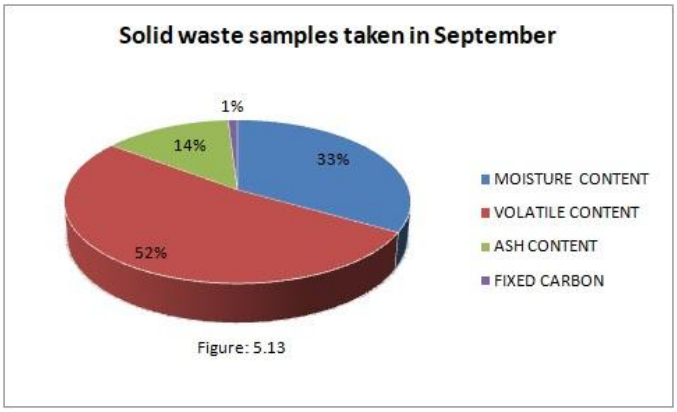


Figure: 5.13

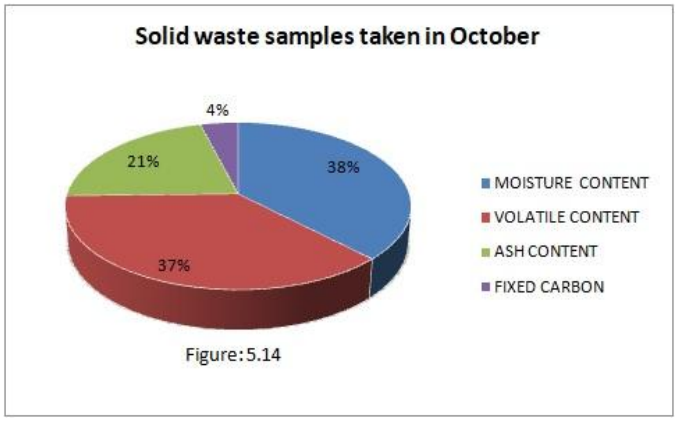


Figure: 5.14

Figure: 5.12 shows that in month of August solid waste samples contain average values of volatile matter, fixed carbon, moisture content and ash content are 51%, 2%, 20% and 27% respectively. Figure: 5.13 shows that in month of September solid waste samples contain average values of volatile matter, fixed carbon, moisture content and ash content are 52%, 1%,

33% and 14 respectively. Figure: 5.14 shows that on moth of October solid waste samples contain average values of volatile matter, fixed carbon, moisture content and ash content are 37%, 4%, 38% and 21% respectively.

6. CONCLUSION

The air average value of PM 10 of the site is found to be 374.11 µg/m^3 which is far more than that of standard limit given by WHO and CPCB. The air quality of study site is not good and it is harmful for both human being and animals living at the site.

Most of the water quality parameters fall below the acceptable limit given by WHO and CPCB and all of the water quality parameters fall below the permissible limit. The solid waste generated contains major portion of volatile content ant moisture content and very low amount of fixed carbon as well as ash content.

7. RECOMMENDATION

The mean value of PM10 concentration was found to be higher than that of the standards values given by the WHO and CPCB. There should be a sophisticated traffic and a parking management inside the study area premises so that air quality can be improved Water quality is quite good as almost all parameters fall below the permissible limit given by WHO and BIS (Bureau of Indian standards). A major part of solid waste generated contains higher biodegradability characteristics thus composting can be used to treat this solid waste and recovery of useful elements can be done without polluting the environment.

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