

## Household Cooking Emissions Monitoring At Mikkere Village In Mandya District

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**Abstract** – Indoor air pollution is considered to be one of the major environmental risks in India. Indoor air pollution emitted from residential building said to be major concern in rural areas. Actually, Indoor air contamination has not been given a lot of significance, eventhough individuals spend around 80-90 %[4]. In indoor, IAP are gases, fumes and particulates. These materials incorporate bio-pressurized canned products, particles, Volatile natural carbons (VOC's), natural and inorganic fumes. The simplified indoor air pollution is made using the questionnaire that was prepared related to type of stoves, type of fuel used in kitchen setup, behavioural pattern of cooking member and various other factors loke ventilation, insulation and building construction design, which plays a major role in the persistence of particulate matter in indoor. Indoor particulate matter emission are responsible for health hazards such as respiratory diseases, Asthma and elevated hospital visits to study the magnitude of indoor air pollution in rural areas, particularly the concentration of particulate matter, a simplified measuring instrument called SKC personal air sampler is used.

**Key Words:** Indoor air pollution, Particulate matter, SKC personal air sampler.

### 1.INTRODUCTION

The indoor air poisons (IAP) structures a significant bit of the absolute introduction of inhabitants to different toxins in family units. . IAP are particulates, fumes and gases. These materials incorporate bio-mist concentrates, particles, Volatile natural carbons (VOC's), natural and inorganic fumes. The presentation - reaction of these pollutants in household relies upon the age rate, the surrounding fixation, the volume of the indoor condition, blending proficiency of the indoor space and the decaying rate of the contaminants. Amongst the five essentials of life viz., air, water, food, shelter and cloth, air is the most important one for human beings. Though, air is abundantly available, it invariably contains pollutants/contaminants. There are evidences that show poor indoor air quality poses a serious threat to human health. Bio pressurized canned products cause an assortment of respiratory sicknesses, running from unfavorably susceptible rhinitis, asthma to irresistible infections, for example, histoplasmosis, balstomycosis and aspergillosis. The health effects due to exposure to particulates depend on particle size, life span and dose. In some conditions, exposure to very short duration can cause adverse health effects. VOC's has a potential to cause health effects in three folds; irritations effects, systematic effects and toxic effects due to chronic exposure. Inorganic gases like NO<sub>2</sub>, SO<sub>2</sub> and Ozone mainly affect the respiratory system while organic gases like CO, CO<sub>2</sub> and CFC's can cause headache and affect

the pulmonary functions. Biomass powers burning in inadequately ventilated kitchens and utilizing ineffectively working stoves radiates high convergences of respirable particulates, gases, for example, carbon monoxide, sulfur dioxide, and nitrogen oxides; and lethal mixes, for example, benzene and formaldehyde.

### **1.1 Scope of the Project work**

In developing countries, IAP included with heating of solid fuels in households is of prime concern, as it contributes to the important form of health hazards to the exposed populations. It is calculated that around 2 billion folks worldwide are subjected to high concentrations of particulate matter and fumes that are 20 times greater than health the rules for typical urban outdoor concentrations. This is subjected to open fires along with fuels like coal or biomass for cooking and other activities.

Majorly, the stove will be kept on floor, including major risk of accident and forming the unhygienic condition by deteriorating the air quality. Further, these stoves are usually not included with the chimney to keep away them. In such house units, the most affected are kids, elderly men and women who spends more time indoors.

India is having the second highest burden of per capita including the respiratory illness in the world that contributes for about 1/9<sup>th</sup> of National Burden of Disease (NBD).

A number of research studies have been carried out to investigate the contribution of PM, lung cancer, and other diseases. keeping ambient concentrations as backups for personal exposure. It is obvious that, there lies a weak combination between individual exposures and major concentrations, because people stay away majority of the time inside house.

#### **1.1.1 Main Project Objective**

The major aim of this research study is to know and analyse the effectt of different house unit fuels used and its emission inside the house of rural area.

#### **1.1.2 Specific objectives**

- 1.To inventorize types and quality of fuel used in rural area for cooking and domestic purposes.
- 2.Selection of households' indoor points and ventilation aspects for data collection and monitoring.
- 3.Quantitative and qualitative assessment of gaseous emissions for indoor from different fuels.
- 4.Statistical regression analysis for correlation assessment.
- 5.Exposure risk assessment evaluation studies and developing a relationship between pulmonary diseases, particulate and gaseous emissions.

## **2.METHODOLOGY**

### **2.1 Fuels Used in Households**

Household fuel is a necessity and need to compromise essential consumption such as food, heating and lighting. People will opt that fuel for these activities even not considering the pollution potential when it is cheaper. It was a recognized fact that only ambient air pollution causes health impact, but today even indoor air pollution caused

due to use of solid household fuels is the leading sector that has severe impact on human health (Gupta et al., 2006). There is also another problem faced due to combustion of household fuels are contribution of carbon dioxide for global warming. With these consequences, there is necessity to consider the factors that leads to choice of household fuels. The price of the fuel is the first factor that affects the choice of fuel both in urban and rural localities. Second factor is the accessibility of the fuel to people. Cleaner fuel demands verified address or permanent address of the consumer, poor people not give preference to such fuels, as solid fuels viz., wood, dung cakes, charcoal, crop residues and coal, are cheap and easily accessible. Hence, most of poorer urban and rural population chooses solid fuels as household energy.

## 2.2 Information on Study area

In the present work, Hanakere town of Mandya city is considered as the investigation territory. It is spread over a region of 128.42 Km<sup>2</sup> Mean Sea Level (elevation) of Mandya city is 765m, Latitude is 12.3024° N and Longitude is 76.6386° E. shows the examination territory alongside testing areas.

## 2.3 Selection of Sampling stations

The testing stations were considered in and around parts of MANDYA city for five unique energizes i.e., Kerosene, Biomass, Cowdung cakes, Coal and LPG in various families. Table 4.2 shows the details of sampling stations.

## 2.4 Air sampling equipment

Indoor and encompassing examining of PM were completed at the same time for a times pan of 2 hours before cooking, during cooking and in the way of cooking in indoor areas of various family units and 8hr inspecting for surrounding condition, individually. The hardware utilized for the indoor air examining are Handy sampler (APM 821) Personal Air Sampler (APS2).



Fig. Personal Air Sampler

## 2.5 Determination of the Pollutants Concentration

Principle of operation: The contaminated air is drawn by small diaphragm pump through the sample collector placed near the breathing zone. The pump can aspirate at least 1m<sup>3</sup> of air in eight hours. Thus ensuring that an adequate amount of the contaminant is collected for analysis and ensuring that even for the most toxic substances statistically significant number of particles is collected. The battery capacity will give an eight hour run with most sample collectors.

Procedure of sampling is as follows:

1. Initially flow rate of 2.5 L/min is fixed in the pump
2. The conditioned, pre - weighed filter paper of 37mm diameter is placed in the filter cassette of the cyclone head.
3. The sampler is switched on and sampling time is fixed for two hours before, during and after cooking period.
4. Then the filter paper is weighed for the final weight Using the following equations indoor concentration of PM is found,.
5. Volume of air sampled,  $V = (Q/1000) * T$  (4.1)
6. Concentration of Particulate Matter,  $C = (\text{Final weight of filter paper} - \text{Initial weight}) / V$  (4.2)

Where, T = Time period in hours Q = Flow rate in m<sup>3</sup>/min

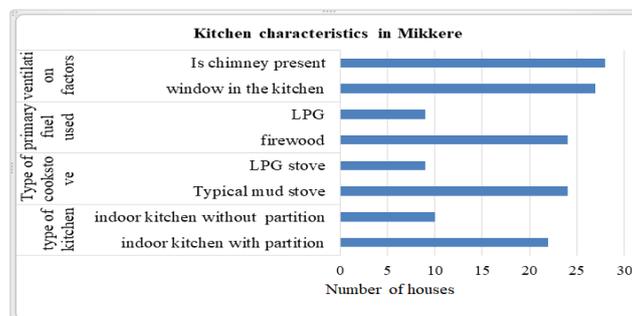
Volume of air sampled,  $V = Q * T$  (4.3)

Concentration of respirable dust,  $C = (\text{Final weight of filter paper} - \text{Initial weight}) / V$  (4.4)

Q = flow rate in m<sup>3</sup>/min

## 3. RESULTS

### 3.1 Various parameters of kitchen obtained from questionnaire survey:



**Table1-Representing various parameters of kitchen obtained from questionnaire survey:**

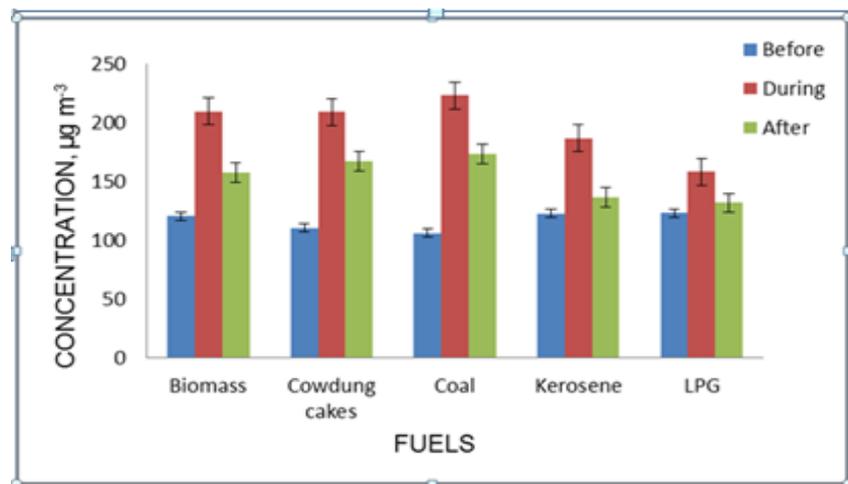
**3.2 Calculation of particulate matter concentration:**

**PM<sub>2.5</sub> concentration of Mikkere biomass sample:**

Village	Sample	Initial weight(gm)	Final weight(gm)	Particulate matter concentration( $\mu\text{g}/\text{m}^3$ )
Mikkere	1	0.0623	0.065	750
	2	0.0564	0.058	444.44

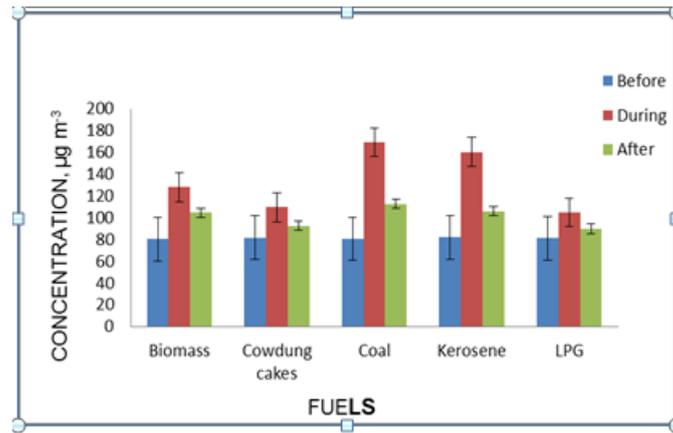
**3.3 Nitrogen Dioxide (NO<sub>2</sub>)Concentration:**

NO<sub>2</sub> concentration have shown an average reduction of 25% after 2hr of cooking. The initial concentration before cooking was found to be in the range of 106 - 123  $\mu\text{g}/\text{m}^3$ .



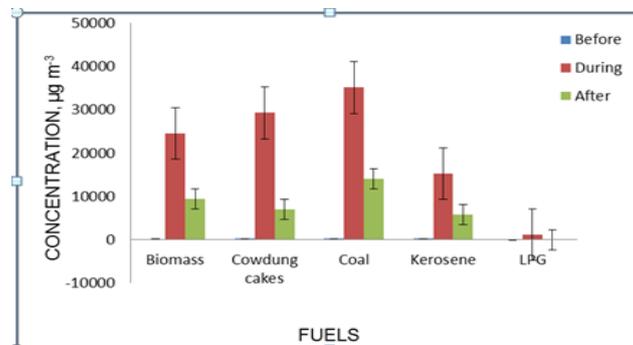
**3.4 Sulphur Dioxide (SO<sub>2</sub>)Concentration:**

The initial concentration before cooking was found to be in the range of 80 - 81  $\mu\text{g}/\text{m}^3$ . These concentration were found to be similar in households using different fuels.



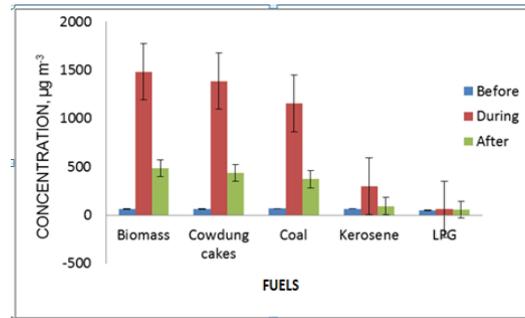
### 3.5 Carbon Monoxide (CO) Concentration:

The indoor concentration profiles of monitored CO for households using different fuels are plotted in Figure 5.4. From the figure, it is observed that kerosene have emitted around 50% less than CO concentration emitted by biomass, cowdung and coal. Biomass, cowdung and coal have emitted CO concentration of 25,000, 29,000 and 35,000  $\mu\text{g m}^{-3}$  respectively. While, CO concentration of emitted by kerosene and LPG were found to be 15,000 and 1000  $\mu\text{g m}^{-3}$ . the monitored concentration of CO pertaining to LPG were very minimal and found to be 1100  $\mu\text{g m}^{-3}$  during cooking activity. The CO concentrations were below detection level in the households using LPG after 2hr of cooking activity.



### 3.6 Respirable Suspended Particulate Matter (RSPM) Concentration:

The household where cowdung was used RSPM concentration were slightly lower than that of biomass and coal used households during cooking and after cooking, indoor concentration were found to be similar to that of RSPM emitted by coal around 1139  $\mu\text{g m}^{-3}$  during cooking while, it has reduced about 62% after 2hr of cooking activity.



### 3.7 Determination of Particulate Matter(PM):

Particulate Matter (PM)/Particulates is the term made used for a wide scope of particles that are sufficiently little to be conveyed by the air and in this manner they can be taken in by individuals. These particles can be strong or fluid, or a blend of both. The size of particles may go from 0.005µm to 100µm in breadth. PM10 are particles that are of 10µm or less in width. PM2.5 are particles of size 2.5 µm or less in proportional circular width. The better particulates has the capability of making the best danger human wellbeing on the grounds that these can travel most profound into the lungs[3].

Indoor particulate issue is a blend of issues like residue (Carbon) transmitted by burning sources, small fluid or strong particles in mist concentrates, contagious spores, dust and a poison discharged by microscopic organisms (endotoxin).

## 4.Conclusions

1. Based on the studies disbursed, the observations created within the gift analysis and synthesis of the scientific info, the subsequent conclusions square measure drawn, Fuels used for domestic change of state in discriminatory order is LPG, Kerosene, Biomass, Cowdung cakes and Coal and also the amount of fuel used varied reckoning on no. of occupants and quality of fuel used. 2. The occupants square measure exposed terribly high pollutants level for nearly

2 .Hours of average change of state amount. it had been ascertained that even when change of state conjointly concentration of involved pollutants remains to in higher vary compared to standards. This confirms that the occupants square measure exposed to pollutants not solely throughout cycle even when finishing change of state activity.

3. NO<sub>2</sub> is a crucial waste material emitted by most of the fuels. Exposure to high concentration of this pollutants ends up in lower acute metastasis infections and also the CO emitting sources were found to be cowdung cakes.

4. The occupants exposed to CO emission were reportage health implications associated with vessel diseases. The grouping of RSPM having mechanics size however 1m, which may be spherulites[2]. These spherulites were a great deal of in focus all through burning of biomass in contrast with kerosine. The outcomes zone unit showed the nearness of spherules. These might likewise cross the air hindrance inside the metastasis tract, which can cause wellbeing impacts like aggravation and interior organ disturbance.

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