Experimental Evidence: How Yajna Can Reduce Cement Factory Pollution and Improves Immunity in Living Beings?

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Abstract- Too many cement factories around Jaggayyapet City, in Krishna District, Andhra Pradesh, India, are causing lots of air, water and soil pollution in all nearby cities. COVID active cases making the situation even worse. We conducted experimental Yajna, also known as medical smoke, proven vedic science methodology, in Jaggayyapet as an attempt to reduce the pollution caused by the nearby cement factories and increase immunity in living beings in the surround areas. We observed that $PM_{2.5}$ has fallen by about 31%, PM_{10} has fallen by about 41%, NO_x has fallen by about 23%, and CO has fallen by about 48% when compared to previous year (2018). We also observed that COVID actives cases have fallen by 19.4% in the neighboring districts surrounding Jaggayyapet.

Index Terms- Air Pollution, Cement Factories, COVID-19, Medical Smoke, Yajna

I. Introduction

Cement Industry is the second largest industry in India. According to Environmental Protection Agency (EPA, USA) [1], "The cement sector is the third largest industrial source of pollution, emitting more than 500,000 tons per year of Sulphur dioxide, Nitrogen dioxide, and Carbon monoxide". There are health and environmental effects of cement plant emissions. Research work of Radhapriya et al [2] shows that 33% of the plants were highly susceptible to adverse effects of SPM (Suspended Particulate Matter) produced by the cement industries and 15% were moderately tolerant. Sadhana et al [3] found that pollution by the cement dust has caused adverse effects on the photosynthetic pigments in the plants that were within 15 kilometers from the cement industry. About 74.69% of the chlorophyll reduction was observed in the studied plants that were within 15 kilometers from the cement industry. Syed Sana et al [4] investigated the health risks of cement factory workers at Kashmir, India and concluded that the workers had considerable health impact that further increased in summer.

Shukla Sudheer Kumar et al [5] worked on impact of dust emission on plant vegetation in the vicinity of cement plant and found that the test plants suffered from necrosis/chlorosis. Syed Sana et al [6] found that within a radius of 2 to 3 km from the cement industry, mean SO_2 was 4.09 times more than the control site and NO_x was found to be 6.01 times more than the control site. The authors observed that people closer to the cement factories suffered with increased respiratory problems and 95% of them with eye irritations and dermatological problems.

Findings of Kamparia et al [7] indicate that there is a considerable increase in electrical conductivity, pH, $CaCO_3$, cation exchange capacity in the soil near the vicinity of the cement factory. Also, in the vicinity of the cement industry the authors found that there is a decrease in nitrogen, boron, zinc, manganese, copper, and iron in the soil. Anand Dev Gupta [8] found that the PM_{10} was higher than standard values in the vicinity of the cement industry. Guguloth et al [9] in their study found that the haemopoietic function may perturb due to long term exposure to cement dust.

According to World Health Organization (WHO) [10] Coronavirus disease (COVID-19) is an infectious disease caused by a newly discovered contagious virus. Most people will recover without requiring special treatment. Serious illness may develop in people with underlying medical problems and older people. Washing hands and not touching the face with hands will protect from the spread of the virus. Respiratory etiquette is mandatory since the spread of the COVID-19 virus is mainly due to saliva droplets, nasal discharge when an infected person coughs or sneezes.

According to WHO as of 1st October 2020, there is no vaccine, no medicine, about 33.8 million confirmed cases, and more than one million deaths due to COVID-19 virus throughout the world. In India the total cases as of 1st October 2020 is more than 6 million. Yongjian Zhu et al [11] worked on the relation between air pollution and COVID-19 confirmed cases. Their work indicated that with

the increase in air pollution there is a significant increase in the COVID-19 infection. Xiao Wu et al [12] in their work concluded that "A small increase in long-term exposure to $PM_{2.5}$ leads to a large increase in the COVID-19 death rate". Antonio Frontera et al [13] concluded that persisting exposure to $PM_{2.5}$ and high atmospheric NO_2 may provide worse outcome in COVID-19 patients. Daniele Contini et al [14] concluded in their work that "Exposure to air pollution could increase vulnerability and have detrimental effects on the prognosis of patients affected by the COVID-19". Kai Chen et al [15] observed that improved air quality and reduction in $PM_{2.5}$ reduced some cardiovascular deaths and $PM_{2.5}$-related deaths.

Abdolali et al [16], have reviewed Medicinal Smokes from different countries in different continents. According to their review, one of the three main methods for administering smoke is inhalation, directed smoke, and as air purifier. First is used in the treatment of pulmonary and neurological disorders. Second is used for dermatological and Genito-urinary disorders. The third is used as an air purifier.

A. Cement factories around Vedadri near Jaggayyapet, Andhra Pradesh, India

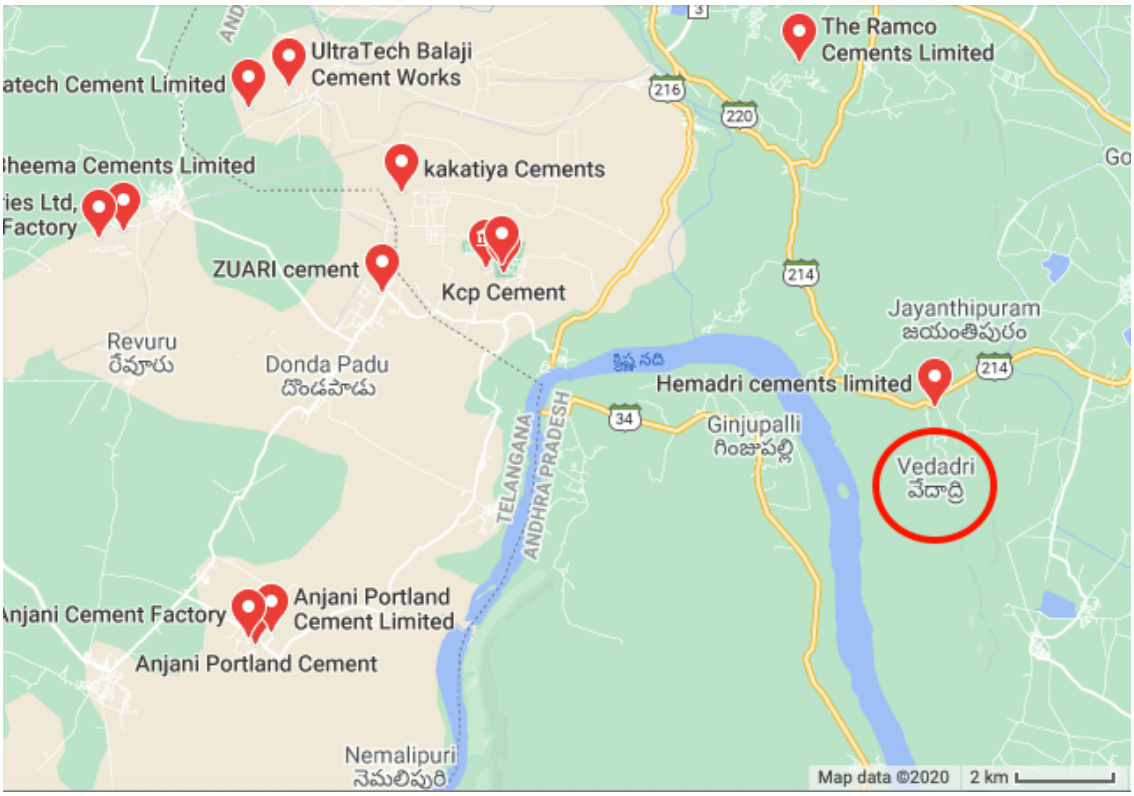

Figure – 1 Location of Vedadri and Cement Factories near it. [Courtesy google maps]

As seen from fig-1 we notice that Vedadri (circled in red) is in the closest vicinity of Hemadri Cements Ltd and within a distance of 10 -15 km from 5 other cement factories and within 25 – 30 km from 5 more cement factories. This is a serious concern for heavy pollution from the cement factories in the vicinity of these factories.

B. Methods followed by the government to prevent pollution from these factories

The Pollution Control Board of Andhra Pradesh directed [17] some cement factories to provide automatic water sprinkling system along the roads to minimize dust emission.

C. What is the method followed by the world for combating COVID-19?

Since there are no definite medicines, vaccines, or therapy for COVID-19, various countries are following the guidelines given by WHO [18], or by following government lockdowns, house quarantine, wearing mask, washing hands with soap, and social distancing etc. In India there had been a lockdown for more than two months, but evidently the situation did not improve.

D. Problem Statement

At the time of writing this paper, there are no serious methods implemented either by the government or the factories to curb the pollution caused by the cement factories. There are no scientific evaluations done by the government and the people in and around the cement factories are under constant exposure to dangerous levels of air pollution, water pollution, and soil pollution. Before November 2020 there were no vaccines available for the cure of COVID-19 and the air pollution causes more problems for patients suffering from COVID-19 and lung problems.

E. Factors that interested us to reduce the air pollution at Vedadri that was closest to Hemadri Cement Factory

Figure - 2 Yajna (source: https://sreenivasaraos.com/tag/yajna)

"Yajna" is a scientific process that is carefully carried by specialists who are well trained in executing the process. As shown in the above Fig – 2, a fire pit is prepared, and fire is kept inside the pit with the help of special sticks known as "Samidhas". These "Samidhas" are obtained from various trees such as Ashwath, Udumbar (Ficus Glomerata), Palaash (Butea Frondosa), Shami (Propsopis), and Vikadgand (Capparis Spinosa). Then cow ghee (Butter turns to ghee on heating), other food materials, precious metals, scented materials such as sandalwood, and herbs are kept in the fire at regular intervals.

In Yajna four types of materials are used for offering in the fire Yajna. (1) Scented materials such as Kasturi, and saffron. (2) Sweet materials - jaggery, honey, etc., (3) Strength producing materials such as cow ghee, cow milk, and rice. (4) Health preserving materials – herbs, precious metals, etc. These materials are acquired and purified before offering them in proper proportions in the Yajna. As a result, air and rainwater get purified and everyone gets pleasure. The above said materials when offered in the fire of Yajna, become minute and mix with the air.

When these materials are offered in the fire Yajna hot smoke and steam are produced. Due to heat these materials get dried by releasing the vapors from them. These vapors mixing with the air enters the atmosphere. In that vapor the water part is steam and particles mixed with steam part is smoke. These vapors and particles interact with the atmospheric particles and purify the air. These vapors and particles collect and form clouds. Because of this we get good rains with purified water.

An ahuthi is the selected/allowed material that is offered in the fire pit or Yajna fire. Each ahuthi is equal to about 10 grams of either ghee, herbs, or cooked food such as sweets. For our experiments we have offered anywhere from 5,000 to 10,000 ahuthis depending on the Yajna design.

The Yajna fire generally is between 200 to 1,000 degrees Celsius and above. At this temperature generally all materials (eatables, herbs, etc.) are vaporized and the molecules/atoms/ions rise high into the atmosphere. These molecules have high kinetic energy and travel long distances and climb great heights as the density of these vapors is lesser than the surrounding air. These molecules have the capacity to interact with the atmospheric gases/particles and cause reduction in pollution. As an example, Sulphur dioxide can be removed using Carbon (Sappok and Walker) [19].

Experimental results [20] showed that the air pollutants could be reduced by Yajna. It was shown that Sulphur Oxide compounds reduced by about 51% and Nitrogen Oxide compounds reduced by about 60% while respiratory suspended particulate matter reduced by 9% and suspended particulate matter reduced by 65% respectively.

It was found that the Particulate Matter (PM_{10}, $PM_{2.5}$, and PM_1) values [21] after the Yajna were reduced by more than 50%, the quality of the rainwater that was collected within three days after the Yajna was having a pH of 6.5, and the Total Dissolved Solids were 34 indicating clean rainwater or water purification.

A scientific study of Yajna was done by Pathade and Pranay [22] and their report indicates that Yajna fumes reduce the microbial load in air up to 30 feet in their setup, Agnihotra fumes increases plant growth, Yajna ash removed water pathogens, and ultimately purifies the water. The work performed by Vasanthi [23] observed that there could be a possibility of phytosteroid precursors or brass in brassinosteroids being produced or triggered in plants due to the volatile substances produced by Yajna fire. Experiments conducted on Yajna by Narayana Rao et al [24] found very high concentrations of Zinc (Zn) in SPM (suspended particulate matter). The authors expressed that it could be due to the materials such as pumpkin that were offered in the Yajna.

Venkata et al [25] have conducted Yajna at Rajahmundry (Andhra Pradesh, India) to see the effect of Yajna on air pollution and combating COVID-19 cases in Godavari districts of Andhra Pradesh, India. Their experiment showed that the more than 15,000 active cases have been reduced in those districts when compared to the trendline predictions before the experiment (Yajna) along with decrease in the air pollution.

Based on the research works that were mentioned in the previous paragraphs and the air pollution near Vedadri near Jaggayyapet, Andhra Pradesh, we, collectively, decided to do the Yajna at Vedadri and reduce the air pollution and check the number of COVID active cases for reduction. This paper gives the process and results of the Yajna and its effect on reducing the air pollution near Vedadri and nearby areas. The closest Pollution Control Board measuring instruments are in areas like Amaravati (Figure-3, that is about 20 – 25 km air distance from Vedadri), and Vijayawada (that is about 60 – 70 km air distance from Vedadri). Yajna effects spread for 50 km for the Yajna Kunda size used in Jaggayyapet and the good results may continue for 5 days after the last day. We will compare the results of Pollutants at Amaravati location keeping September 2018 results as another control point. September 2019 dataset was not available. The Yajna was performed by Vedadri Gosala, Jaggayyapet from 18th September to 1st October 2020 under the technical knowhow provided and guided by Vedas World Inc, GA USA. Since the Yajna took place in September 2020, and India is a tropical country with consistent seasonal changes, we considered to check the similarities of the reports during the September months of previous years if available and compared to the Yajna period results.

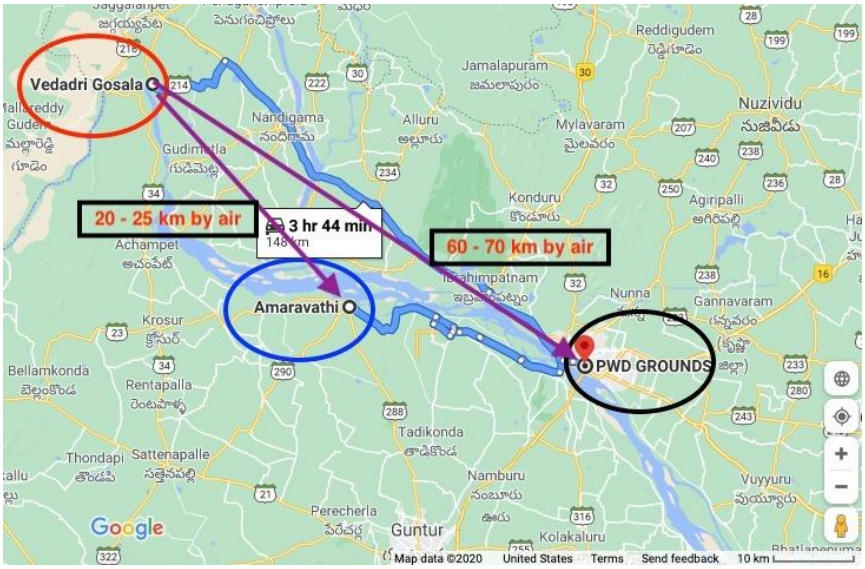

Figure - 3 Amaravati and Vijayawada AQI stations – from Vedadri Gosala
[Courtesy google maps]

I. MATERIALS AND METHODS

The members of Vedadri Gosala were convinced to conduct Yajna for minimizing the air pollution at Vedadri and improve immunity in nearby areas of Jaggayyapet. One of the key members of Vedadri Gosala - Priest Mr. Kishore Jonnabhatla had done preliminary survey of the area and facilities that would be a good location for the Yajna near Vedadri and sought the opinion of Vedas World Inc. Couple of cities and towns were proposed and logistics were evaluated. With their (Vedas World) wide experience of performing Yajna with scientific reasoning has suggested an innovative model to reduce the air pollution and improve immunity. Vedas World proposed to conduct Yajna in one location - Vedadri Gosala as it was nearby 10 cement factories. The entire operation was done under the agile managership of Mr. Venkata Nagendra Sai Ram Karumanchi the Vice President of Vedas World Inc.

A. Yajna Kunda Design and Rationale

Figure – 4 Shapes of Yajna Kunda (Fire pit)

Different structures (Figure -4) of Yajna kundas were designed for optimizing the benefits of Yajna. Square shaped Yajna Kunda (Figure -4-1) was selected and designed with 3.5 feet - each side and depth 3.5 feet for this Yajna.

The Chairman of Vedadri Gosala Mr. Chakrapani Rao Tadimeti had geared up swiftly and conducted the Yajna for 15 days with the help of Priest Mr. Kishore, under the able guidance of Vedas World, from the evening of 18th September 2020 (Amavasya or new moon day) to 1st October 2020 (Poornima or full moon day). The Yajna had started on 18th September 2020 (Amavasya) at sunset with a special ignition process of fire. The Yajna is carried out uninterruptedly every day – morning 3 hours right after sunrise and then for 2 hours before sunset.

B. Materials used in the Yajna

Table-1 Yajna Material - Wood and Herbs Used in Yajna

Wood	**Daily**	**Morning**	**Evening**
Butca frondosa And Ficus religiosa wood	8 kg	5 kg	3 kg
Banyan and Mimosa Suma wood	8 kg	5 kg	3 kg
Mango and Fig wood	10 kg	7 kg	3 kg
Herbs	**Daily**	**Morning**	**Evening**
Cow Ghee	15 to 20 kg	10 to 12 kg	5 to 8 kg
Dry grapes	1 kg	0.7 kg	0.3 kg
Dry dates	1 kg	0.7 kg	0.3 kg
Kasturi	10 grams	8 grams	2 grams
Saffron	1 gram	0.5 grams	0.5 grams
Agar and Tagar	50 grams	30 grams	20 grams
Cardamom	250 grams	150 grams	100 grams
Nutmeg	100 grams	75 grams	25 grams
Mace	100 grams	75 grams	25 grams
Tinospora cordifolia	10 kg	7 kg	3 kg
Camphor	250 grams	150 grams	100 grams
Gum Guggul	500 grams	300 grams	200 grams
Sandalwood	20 grams	15 grams	5 grams
Jaya phal	100 grams	70 grams	30 grams
Teja leaves	250 grams	150 grams	100 grams
Khus-Khus grass	500 grams	300 grams	200 grams
Cloves	150 grams	100 grams	50 grams
Basil Seeds	100 grams	70 grams	30 grams
Bulrush	100 grams	70 grams	30 grams
Moringa leaves	100 grams	70 grams	30 grams
Nannaari	100 grams	70 grams	30 grams
Green grams	1 kg	700 grams	300 grams
Rice	1 kg	700 grams	300 grams
Punarnava leaves	100 grams	70 grams	30 grams
Herbs made as paste	**Daily**	**Morning**	**Evening**

Basil Powder	200 grams	150 grams	50 grams
Sesame	4 kg	3 kg	1 kg
Turmeric	200 grams	150 grams	50 grams
Gud	2 kg	1.5 kg	500 grams
Ginger	200 grams	150 grams	50 grams
Pepper	200 grams	150 grams	50 grams

List of herbs, wood, and other materials offered in the Yajna are given in Table-1.

II. RESULTS AND ANALYSIS

We have collected two datasets – (1) Air Quality Index (AQI) data from Amaravati AQI station and (2) COVID Active Cases for Krishna and Guntur districts from Andhra Pradesh and from other sources for Telangana Districts – Suryapet, Khammam and Nalgonda. We have analyzed AQI and COVID datasets before/during/after Yajna period using various intervals – hourly, daily, and weekly. We have compared AQI data from prior year (2018) for the same period for conclusions.

Table – 2 Air Pollutant Values at Amaravati and Vijayawada. NA = Data Not Available.
Courtesy Central Control Room for Air Quality Management – All India

Location	Experiment	Period	$PM_{2.5}$	PM_{10}	NOx	CO
Amaravati	No Yajna	Sep-2017	NA	NA	NA	NA
Amaravati	No Yajna	Sep-2018	27.06	63.9	17.66	1.1
Amaravati	No Yajna	Sep-2019	NA	NA	NA	NA
Amaravati	***Yajna Period***	Sep-2020	18.46	37.24	13.5	0.57

From Table-2 we see that the data for Sep-2017 and Sep-2019 are not available for Amaravati location but Sep-2018 and Sep-2020 for the Yajna period are available. Therefore, we will compare the results of Sep-2018 at Amaravati with that of Yajna period in Sep-2020. On comparing with the results, we see that during Yajna period (18^{th} Sep-2020 to 1^{st} Oct-2020) we see that at Amaravati $PM_{2.5}$, PM_{10}, NO_x, and CO have come down considerably when compared to the available values in 2018. Among the pollutants of cement industry CO and PM are prevalent. We see from Figure-5 that $PM_{2.5}$ has fallen by about 31%, PM_{10} has fallen by about 41%, NO_x has fallen by about 23%, and CO has fallen by about 48%.

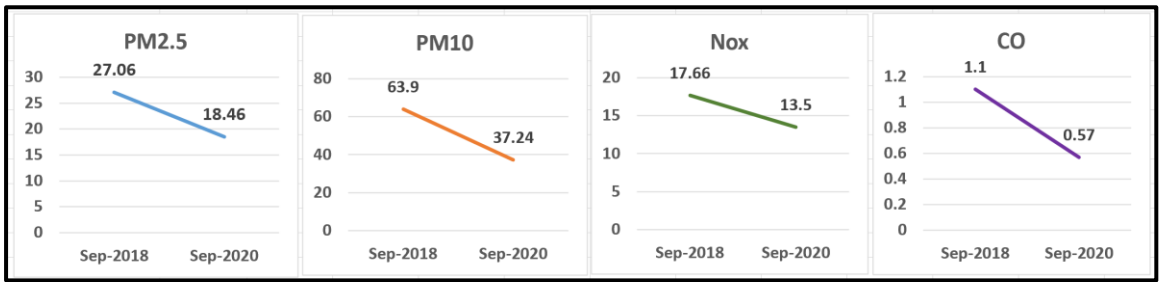

Figure – 5 Pollutants Values at Amaravati for Sept-2018 and Sept-2020

Importance of Active Cases [27]: While we can track any of the COVID-19 confirmed, active, recovered, or fatal cases, it is meaningful to track the active cases. The lesser the active cases, the better hospitals and medical professionals can attend the COVID-19 patients. This is referred to as "flattening the curve".

Projected Trendline [29]: We created a mathematical model, regression equation, using the relationship between dependent X (days) and independent variables Y (active cases) to find the best fit line to make predictions or draw trendline of the future active cases. Calculate the R-squared value, a statistical measure, of the trendline – is between 0 and 1. If it is closer to 1, the data fits to the model very well. Based on the data fluctuations [29], various quadratic equations – linear, logarithmic, exponential, or polynomial – can be applied to get the best model. Linear regression is a simple algebraic equation relating X and Y variables using a simple algebraic

equation: Y = m * X + c, where m is the slope of the line and b is the y-intercept. In Linear regression, we predict the value of continuous variables.

Logarithmic regression can be applied in scenarios where the data changes rapidly and then levels out. Exponential regression will be applied when data increases slowly initially and then increases rapidly thereafter. When data fluctuates throughout the dataset with one or more ups (hills) and downs (valleys), polynomial regression can be applied.

In the case of Jaggayyapet dataset, the trendline can be a simple linear regression as the data did not fluctuate much.

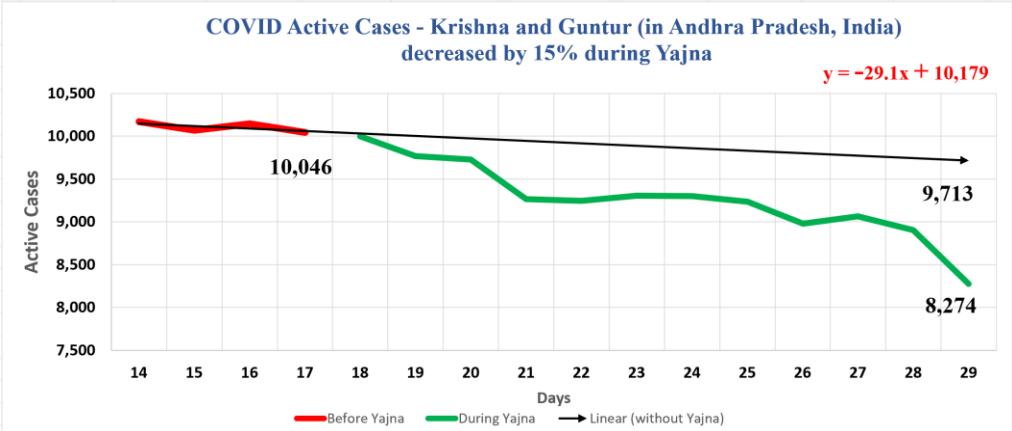

Figure-6 COVID Active Cases – Krishna and Guntur Districts together, Andhra Pradesh.

From Figure-6, on observing the trendline and the actual active cases we conclude that active cases have been reduced to 8,274 (15% less) than the predicted 9,713 cases.

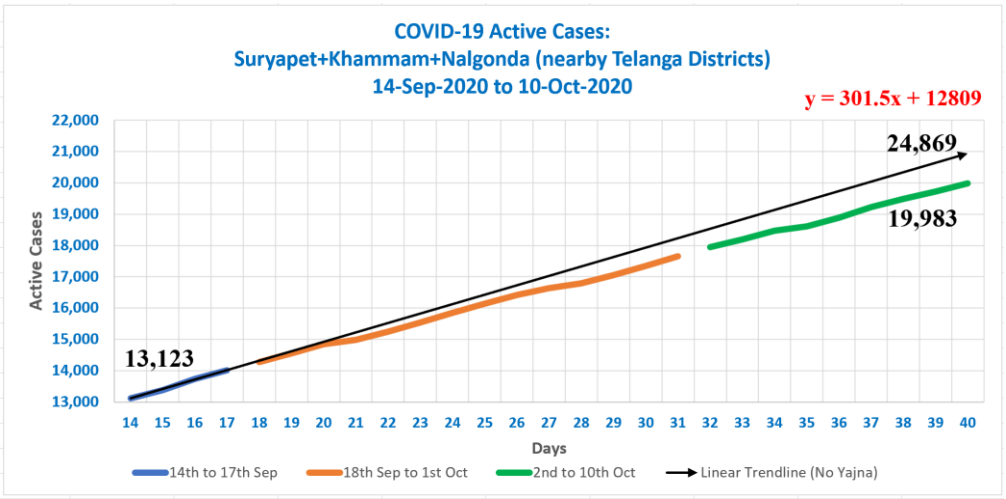

Figure-7 COVID Active Cases Telangana Districts – Suryapet, Khammam and Nalgonda that are adjacent to Jaggayyapet.

From Figure-7, on observing the trendline and the actual active cases we conclude that active cases have been reduced to 19,983 (20% less) than the predicted 24,869 cases.

III. CONCLUSION

It is evident from the past Yajna results [13 -15] that air pollution gets reduced consistently after the conduction of Yajna for a few days. From this experiment at Vedadri Gosala, Jaggayyapet, Andhra Pradesh, we can again observe that Yajna can reduce the air pollution to a commendable extent. We observed that $PM_{2.5}$ has fallen by about 31%, PM_{10} has fallen by about 41%, NO_x has fallen by about 23%, and CO has fallen by about 48% when compared to previous year (2018). We also observed that COVID actives cases have fallen by 19.4% in the neighboring districts surrounding Jaggayyapet. In any case it would be ideal to do Yajna around all the Cement Factories for consistent reduction in the air pollution for improved air quality in the surrounding locations extended to a few kilometers and improved immunity in all living beings – humans, animals, and plants. Yajna process should be considered as a proven

and efficient methodology to reduce the air pollution and promote it as one of the best solutions to the continuous air quality challenges. As added benefit, it would naturally improve the immunity in human beings as observed how it reduced the COVID active cases in prior [25] and current experiments.

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