Study the effects of Yadnya fumes on SOx and NOx levels in the surrounding environment.

Abhang Pranay D.[1], Pathade Girish[2]

Teaching Associate, Institute of Bioinformatics and Biotechnology, Savitribai Phule Pune University, Pune 411007, Maharashtra, India[1]. Email – pranayabhang@yahoo.co.in

Principal, H. V. Desai College, Pune 411002, Maharashtra, India [2]. Email – girishpathade@yahoo.co.in

ABSTRACT

Yadnya is a ritual of offerings accompanied by chanting of Vedic mantras derived from the practice in Vedic times. Due to Yadnya fumes and overall process it affects environmental elements, hence its effects on oxides of sulphur and nitrogen were studied as they are the major air pollutants. Effects of Agnihotra Yadnya, Shrisukta Yadnya and somyag Yadnya were studied by collecting surrounding air using handy sampler. SOx and NOx levels before Yadnya, during Yadnya and after Yadnya were calculated and compared from collected air. As per our results, SOx levels decreases up to 10 times (almost reduces to 90%) that of initial levels due to all three Yadnyas. NOx levels increases 10 -20 % that of initial levels, but at the end of all Yadnyas NOx level reduces that to initial. Hence by performing Yadnya SOx and NOx pollution can be controlled.

INTRODUCTION

Agnihotra Yadnya, Shrisukta Yadnya, Somyag Yadnya are rituals of offerings of ghee, dried twigs of various plants which are religiously mentioned in the Vedic literature and have medicinal potential ,as well accompanied by chanting of Vedic mantras derived from the practice in Vedic times. These Yadnyas are performed by using method mentioned in the Vedic literature.

In the air as a part of pollution various pollutants are found especially Sox and NOx. There are claims that Yadnya fumes and procedure reduce air pollutions. Hence an attempts were made to test scientifically the effect of Yadnya fumes and procedure on the levels of Sox and NOx.

METHOD

Air samples were collected by using respective absorbing reagents for SOx and NOx with the help of Handy sampler. (Spectralab, HDS -8)

A. Estimation of SOx –

SO_x was estimated by improved West and Gaeke method (1956), in short, SO_2 from the surrounding air stream was absorbed in a sodium tetra-chloromercurate solution, it forms a stable dichloro sulpho mercurate $(HgCl_2SO_3)^{2-}$ complex, which then behaves effectively as fixed SO_3^{-2} in solution. The amount of SO_2 was then estimated by the color produced when p-rosailine-hydrochloride and formaldehyde was added in solution, which can be measured on spectrophotometer at 560 nm. Calibration curve of standard sodium meta-bi sulphate was used for SOx estimation by using following formula-

$$SO_x \text{ in ppm (by volume)} = \frac{\mu g \text{ of } SO_2/mL \text{ (from calibration curve)}}{\text{Volume of air sampled /L}}$$

$$\mu g /m^3 \text{ of } SO_x = \frac{\text{ppm by volume} \times 64 \times 10^6}{24470}$$

B. Estimation of NOx –

NO_x was estimated by modified Jacobs - Hochheiser method (1972), in short, NO2 in air was collected by scrubbing a known volume of air through an alkaline solution of arsenite. The nitrite ions thus formed was reacted with sulfanilamide and N-(1-naphthyl) ethylenediamine (NEDA) in phosphoric acid to form the colored azo dye, which can be measured on spectrophotometer at 540 nm. The method was standardized statistically by using $NaNO_2$ standards. Standardization is based upon the empirical observation that 0.74 mole of $NaNO_2$ produces same color as 1 mole of NO_2. SO_2 can be removed using H_2O_2.

1. $\mu g \text{ NOx}/m^3 = \frac{\mu g \text{ of } NO_2/mL \text{ (from calibration curve)} \times \text{volume of reagent}}{0.85 \times \text{volume of air sampled in } m^3}$
2. $\text{NOx in ppm} = \mu g \text{ of NOx}/m^3 \times 5.32 \times 10^{-4}$

RESULTS

1. Agnihotra yadnya performed at Biotechnology department of Fergusson College, Pune

	level of SO_x in $\mu g /m^3$	SO_x in ppm	level of NO_2 in $\mu g /m^3$	NO_2 in ppm

Before Agnihotra	0.5642×10^5	1.4381	16.1152	0.0086
After Agnihotra	0.2196×10^5	0.5597	17.6471	0.0094

Table 1 - Effect of Agnihotra yadnya (Fergusson College) on SOx and NOx levels.

SO_2 level in atmosphere reduces from 1.44 ppm to 0.56 ppm (about 43%) due to Agnihotra fumes (performed at sunset). NO_2 level in the surrounding atmosphere was increased from 0.0086 ppm to 0.0094 ppm due to Agnihotra fumes (performed at sunset).

2. Agnihotra yadnya performed at Ramanbaug High-school, Pune

	level of SO_x in $\mu g /m^3$	SO_x in ppm	level of NO_2 in $\mu g /m^3$	NO_2 in ppm
Before Agnihotra	1.1698×10^5	4.4729	3.66	0.0019
During Agnihotra	0.1170×10^5	0.4473	5.37	0.0029
After Agnihotra	0.1244×10^5	0.4758	3.92	0.0020
Non Agnihotra	1.1698×10^5	4.4729	3.66	0.0019

Table 2 - Effect of Agnihotra yadnya (Ramanbaug High-school) on SOx and NOx levels.

SO_x in the surrounding environment reduce up to 10 times (4.4729 ppm to 0.4758 ppm) due to Agnihotra fumes. Effect of fumes remains after Agnihotra also, SO_x shows 10 times reduction (Performed at sunrise). NO_x in the surrounding environment increases up to 0.001 ppm due to Agnihotra fumes. But at the end of Agnihotra NO_x level become normal as before Agnihotra.

3. Shree-sukta Yadnya performed at Biotechnology department of Fergusson College, Pune

	level of SO2 in $\mu g /m^3$	SO2 in ppm	level of NO2 in $\mu g /m^3$	NO2 in ppm
Before yadnya	4.9353×10^5	6.29	6.36	0.0034
After yadnya	0.51×10^5	0.65	8.70	0.0046

Table 3 - Effect of shreesukta Yadnya on SOx and NOx levels.

As per results, SO_2 in the surrounding environment decreases 10 times (6.29 ppm to 0.65 ppm) due to the fumes of yadnya, NO_2 level in environment increases (from 0.0034 ppm to 0.0046 ppm) but there is no any drastic change in NO_2 level.

4. Somyag yadnya performed at Beed

	level of SO2 in µg /m^3	SO2 in ppm	level of NO2 in µg /m^3	NO2 in ppm
Before yadnya	0.137×10^5	0.1747	3.2088	0.00094
After yadnya	0.0114×10^5	0.0175	3.2550	0.00173

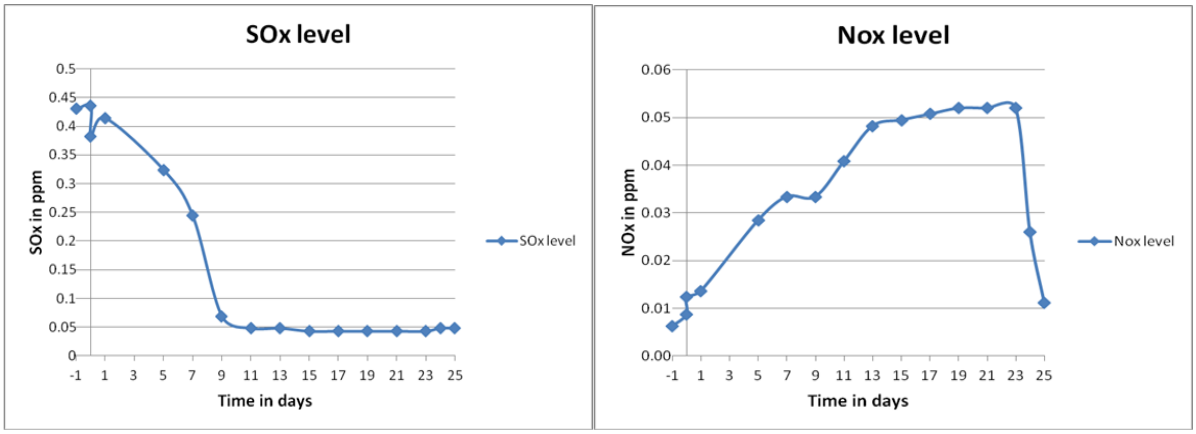
Table 4 - Effect of somyag Yadnya (Beed) on SOx and NOx levels.

SO_2 level in atmosphere reduces from 0.175 ppm to 0.0175 ppm (10 times) due to Mahasomyag fumes. There is no significant effect of Mahasomyag fumes on NO_2 concentration. There is slight increase (0.0008 ppm) in NOx levels i.e. from 0.00094 ppm to 0.00173 ppm.

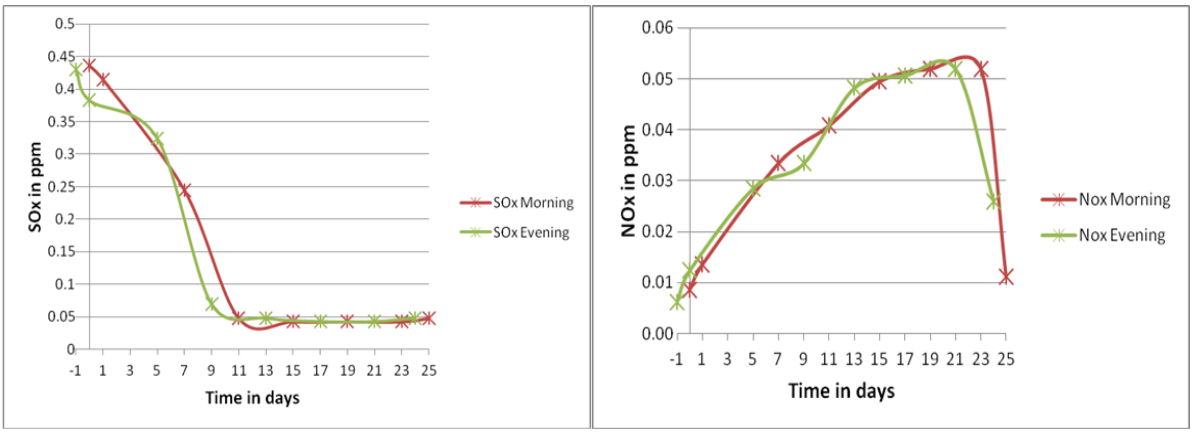
5. Somyag yadnya performed at Uruli (Devachi), Pune

Date and time	Day	SO_X in µg /m^3	SO_X in ppm	NO_X in µg /m^3	NO_X in ppm
6/2/2014 (Evening)	-1	3.3769×10^5	0.4304	11.6215	0.0062
7/2/2014 (Morning)	0	3.4186×10^5	0.4357	16.2701	0.0087
7/2/2014 (Evening)	0	3.0017×10^5	0.3826	23.2431	0.0124
8/2/2014 (Morning)	1	3.2518×10^5	0.4144	25.5674	0.0136
12/2/2014 (Evening)	5	2.5430×10^5	0.3241	53.4590	0.0284
14/2/2014 (Morning)	7	1.9177×10^5	0.2444	62.7562	0.0334
16/2/2014 (Evening)	9	0.5420×10^5	0.0691	62.7562	0.0334
18/2/2014 (Morning)	11	0.3752×10^5	0.0478	76.7021	0.0408
20/2/2014 (Evening)	13	0.3752×10^5	0.0478	90.6479	0.0482
22/2/2014 (Morning)	15	0.3335×10^5	0.0425	92.9722	0.0495
24/2/2014 (Evening)	17	0.3335×10^5	0.0425	95.2965	0.0507
26/2/2014 (Morning)	19	0.3335×10^5	0.0425	97.6208	0.0519
28/2/2014 (Evening)	21	0.3335×10^5	0.0425	97.6208	0.0519
2/3/2014 (Morning)	23	0.3335×10^5	0.0425	97.6208	0.0519
3/3/2014 (Evening)	24	0.3752×10^5	0.0478	48.8104	0.0260
4/3/2014 (Morning)	25	0.3752×10^5	0.0478	20.9187	0.0111

Table 5 - Effect of somyag Yadnya (Pune) on SOx and NOx levels.



Graph 1 – SOx and NOx levels monitored during somyag.



Graph 2 – SOx and NOx levels monitored in morning and evening during somyag.

SO_x level decreases during and after yadnya up to 10 times that of initial (Reduces from 0.43 ppm to 0.048 ppm). SO_x level remains decreased after the yadnya (at least up to 2 days) was finished. SO_x pollution in the air can be reduce up to 90% by performing yadnya.

NOx level increases during yadnya up to 0.05 ppm, but also decreases to normal level (0.01 ppm) after yadnya (on day 24 and 25).

NOx level increases up to 20% as compare to initial (day -1 and 0) NOx levels. Standard NO_x (mostly NO_2) level provided by 'National Ambient Air Quality Standards' (NAAQS) as well as 'Maharashtra Pollution Control Board' is 0.053 ppm (annual average per hour). Maximum value recorded was 0.052 ppm (during day 19 to 23) which is less as compare to standard levels.

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