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Dhoopbatti from Temple Waste: A solution to Vayupradushan

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Abstract : The paper aims to draw the attention of people towards the elevated risks of airborne transmission of diseases and the associated risks to students in classrooms of colleges, post pandemic. Students are observed sitting in close proximity coughing, sneezing and breathing which elevates their exposure to bioaerosols. To cleanse the classroom environment, a very simple, economical and sustainable approach was experimented by burning organic dhoopbatti made from temple waste (unused havan samagri and flower waste). The passive sampling study revealed an appreciable decrease in the total microbial count (28CFU/room) compared to initial TMC (388 CFU/room).

Keywords - Dhoopbatti, sustainable, Total Microbial Count, temple waste.

I. INTRODUCTION

Post pandemic, after a long period of confinement and with the return of students back to schools, shifting from online to offline mode, opened up a debate about health and air security in classrooms. The concern increased when the scientists began to show evidence of greater transmission by aerosols than by fomites in naturally ventilated classrooms.(1) During offline schooling it was observed that on an average students spent 6 hours in classroom, usual class schedules being from Monday to Saturday.

Comprehensive assessment of Children exposomes that is the sum of their environmental exposures during childhood would entail a comprehensive assessment of key indoor and outdoor environmental stressors impacting on school's indoor air quality. (2) Inside classrooms, students and teachers are the only source of airborne pollution and there is a relationship between weather conditions, ventilation, occupancy and teaching time.

Sasan Sadrizadeh et al. stated that a healthy learning environment can reduce absence rate, improve test score and enhance pupil-teacher learning teaching productivity and increase cognitive performance of pupils. (3) Classrooms are more congested than other workplaces, with an occupancy density of approximately four times that of office buildings (4) so the risk of air borne pollution increases.

Previous research studies in school environments have revealed inadequate and often poor classroom quality causing increased risk for respiratory illness and other health symptoms. (5,6,7) To improve air borne pollution a regular approach is to install ventilation systems, air purifiers and green vegetation.(8) New concept of Green cleansing methods in schools and colleges are not affordable to all. There has always been a search for simple economical air purifying methods. Simplest and most instant approach is the use of organic dhoopbatti.

In Indian culture, lighting of dhoopbatti, performing Hawan on auspicious occasions is a regular ritual. This ancient scientific knowledge has been validated by conducting experiment where 1 hr. treatment of medicinal smoke emanated by burning wood and a mixture of odoriferous and medicinal herbs (*havan sámagri* = material used in oblation to fire in all over India), on aerial bacterial population caused over 94% reduction of bacterial counts by 60 min and the ability of the smoke to purify (9) Hawan Samagri or disinfect the air and to make the environment cleaner was maintained up to 24 h in the closed room.

Absence of pathogenic bacteria in the open room even after 30 days is indicative of the bactericidal potential of the medicinal smoke treatment. Account for controlled chemical processing in the fire and lead to sublimation, chemical conversion and/or transformation into vapor phase of the herbal/plant medicinal preparation leading to release of medicinal phytochemicals. The decomposition and transformation (into vapor or gaseous phase/colloidal forms, etc.) of specific substances in the yagya-fire enter the human body in a gaseous form through the nose, lungs and the pores of the skin. (10)

Such studies have been supported by other findings on similar lines. (11) Burning hawan samagri during a yagna is a process of slow combustion at a higher temperature (as high as 1200°C to 1300°C), Small amounts of O2 are used in the slow combustion that occurs during the Yagna process, and the minimal CO2 that is released causes no damage to the environment. (12)

The current study is a combination of effective management of temple waste, transforming it to a value-added product with green and minimalistic air cleansing of college classrooms.

I. RESEARCH METHODOLOGY

2.1 Collection of Temple Waste

Material required for dhoopbatti crafting were collected in the form of temple floral waste, unused havan samagri and camphor from Gajanan Maharaj Mandir, Trimurti Nagar, Nagoba Mandir, Trimurti Nagar and Gayatri Mandir, IT park, Nagpur respectively Cow dung was collected from Rahi Gau Sanstha, Bhamthi, Nagpur. Neem leaves were collected from college premises. A2 Bilona ghee was procured from Paushtik Cow Milk, Dongargaon, Nagpur. Loban and Resin were purchased from Gajanan Mauli Kirana shop, Nagpur.

2.2 Preparation of Dhoopbatti

The collected material, except Bilona ghee, was sun dried and powdered using a grinder. For preparation of dhoopbatti, the mentioned quantity of powdered material was triturated. Resin solution, which acts as a binder, was added to the mixture along with the required amount of Bilona Ghee and other ingredients as mentioned in Table 1.

The mixture was finally molded to yield dhoopbatti weighing 2g each (Fig.1). Prepared Dhoopbattis were dried and stored in airtight containers.

Figure 1: Handcrafted Dhoopbatti

Table 1-Formulation of Dhoopbatti

Sr.No	Material	Scientific Name	Plant part used	Quantity (%)
1.	Cow Dung	-	-	20
2.	Resin	Acacia senegal	Gum	5
3.	Loban	Styrax Benzoin and Boswellia species		10
4.	Flower waste	Tagetes erecta	Flower	25
5.	Camphor	Cinnamomum camphora		5
6.	Ghee	-	-	5
7.	Havan Samagri*	-	-	20
8.	Neem	Azadirachta indica	Leaves	10

(*Havan samagri contains Tulsi **(Ocimum tenuiflorum),** Giloy **(Tinospora cordifolia),** Bahera **(Terminalia bellirica),** Deodar **(Cedrus deodara)**, Jatamansi **(Nardostachys Jatamansi**), Babchi **(Psoralea corylifolia)**, Castor seeds **(Ricinus communis)**, Nagarmotha **(Cyperus rotundus)**, Kapoor kachri **(Hedychium spicatum),** Brahmi **(Bacopa monnieri),** Clove **(Syzygium aromaaticum),** Guggul **(Commiphora wightii),** Mango wood **(Magnifera indica),** Red Chandan (Pterocarpus santalinus) and Sandalwood **(Santalum album).**

2.3 Phytochemicals composition of Material:

Phytochemical composition of ingredients used to prepare Dhoopbatti are mentioned in Table 2.

Table 2-Phytochemical Composition of Dhoopbatti Ingredients

Sr.No	Material	Phytochemical	Uses
1.	Cow Dung	Humic acid(15)	antimicrobial, antiviral agent(15)
2.	Resin	Gum Arabic, salt of arabic acid with metals such as Calcium, Magnesium and Potassium. (16)	Binding Agent(16)
3.	Flower waste	Flavonoid-patulitrin (17)	anti-bacterial activity(17)
4.	Camphor	Safrole 24.0%, linalool 18.6%. limonene 6.1%, eugenol3.0%, α-terpineol 1.7%, α-cadinol 1.4%,camphor 44.3%, (14)	Skin inflammation, irritability and body aches.(14)
5.	Bilona Ghee	complex lipid of glycerides (98%), free fatty acids, phospholipids, 2% sterols, sterol esters, fat soluble vitamins, carbonyls, hydrocarbons, carotenoids, small amounts of charred casein and traces of calcium, phosphorus, iron, etc.(18).	Promotes the combustion process. Decontaminate the air. Air is cleaned by producing oxygen (9).
6.	Hawan Samagri	Mixture of many medicinal herbs (12).	Air purification activity (12).
7.	Neem	Nimbin, nimbinene, 6- desacetylnimbinene, nimbandiol, nimbolide and quercetin(16).	Antifungal, Antimicrobial & Cytotoxic activity (16).

2.4 Air Cleansing Analysis

Microbial air sampling is a key component for effective environmental monitoring. Passive Air sampling was done with settle plates of Nutrient Agar to determine index of microbial air contamination. (13) This index corresponds to number of CFU counted on a settle with a diameter of 7cm placed according to the 1/1/1 scheme (for 1hour, 1m above the floor, about 1m away from walls or any major obstacles) for 1hr for quantitative analysis of total microbial count in air. Study was performed in Classrooms where a high number of students convene in closed rooms Average 50 students, (Mean room volume 171 m^3). Total microbial count was evaluated in the morning before the dhoopbatti burning and after dhoopbatti burning for 1 hour, at a regular interval of 2hrs for an average total time of 8 hrs. for 30 days. (Table No: 4). For experimental evaluation of TMC (Total Microbial Count) the exposed nutrient agar plates were incubated at a temperature of 36^0C for 48hrs. Presence of filamentous fungi was also evaluated using plates containing Sabouraud dextrose agar, incubated at 30^0C for 5 days.

Total Microbial count method- The number of viable cells reflect the change in bacterial growth in the classroom atmosphere. Procedure employed for Total viable count was referred from Indian Pharmacopoeia.

Table 3: Test design for 30 days

Classroom	Room Volume	Average Occupancy	Ventilation	Average Time
Class A (Control)	169 m^3	50	Ventilated	8 hours
Class B (Experiment)	172 m^3	50	Ventilated	8 hours

RH- 39% Temperature-20° C

II. RESULTS AND DISCUSSION

Different indoor environments have different levels of biocontamination with different number of people working in them. So the classroom environment of the college was taken for this present study. Settle plates of Nutrient agar and Sabouraud dextrose agar were prepared for Passive monitoring for Total microbial count. In the present study, the settle plates with nutrient agar and Sabouraud were exposed to airborne contamination for a period of 1 hour in two different classrooms selected for the study. (Classroom A-Control and classroom B experimental-). The study was performed during the teaching hours.

Microbial contamination in classrooms before and after experiment was studied as per the Test Design (Table No.3). Results of microbial study are shown in Table No. 4 and 5. Settle plates kept near the dhoopbatti (at a distance of 2m) showed higher CFU counts than the one kept away (at a distance of 7m) (Table No-4, Fig 2). Microbial accountability at variable time interval was studied (Fig 3) and it was found that The total microbial count before start of experiment was found to be 180 CFU and TMC (Total Microbial Count) after dhoopbatti burning at a time interval of 0, 2,4 and 6 hours was 38,23,25,23 CFU respectively (Table No-5) Total decrease in microbial count was found to be 92.8%. This reduction in total microbial population was in accordance with studies performed by Shivhare et al (2019) who reported 94% reduction of bacterial count after 1 hr. treatment of medicinal smoke.

Table 4.1: Microbial Accountability at variable distance

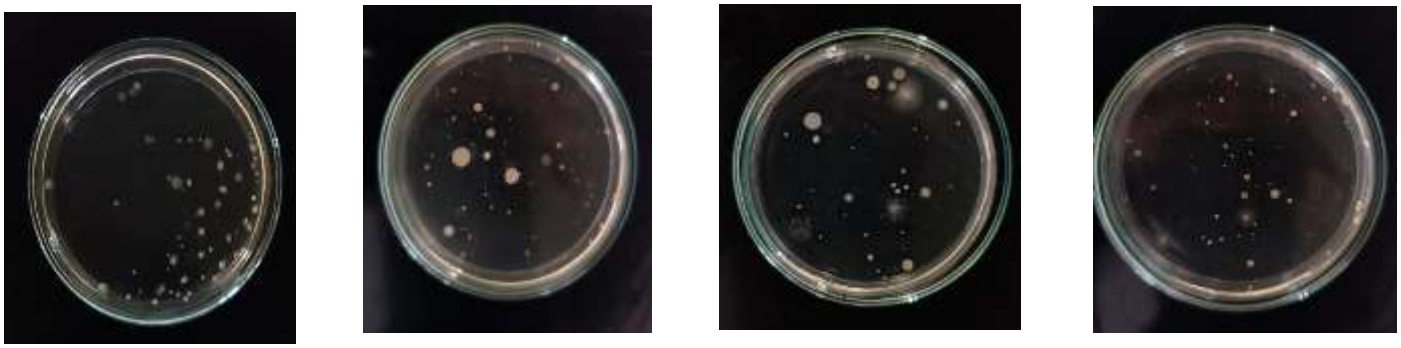
Sr.No.	Plates exposed	No. of bacterial colonies before experiment (CFU)	Distance (in meters) 2m	7m
1.	Classroom A (Control)	380	192	186
			No. of bacterial colonies after dhoopbatti burning (CFU)	
2.	Classroom B (Experimental)	388	48	28

I **II** **III**

Figure 2: Microbial accountability of Experimental classroom B at variable distance [I-Before Experiment, II-After experiment (2m), III- After experiment (7m)]

Table 5: Microbial Accountability at varying time

Sr.No.	Plates exposed	No. of colonies before experiment (CFU)	Time (in hours) 0hr	2hr	4hr	6hr
1.	Classroom A (Control)	380	186	190	198	200
			No. of bacterial colonies after dhoopbatti burning (CFU)			
2.	Classroom B (Experimental)	388	38	23	25	23



I II III IV

Figure 3: Microbial accountability of Experimental classroom B at varying time [I-at 0hr, II-at 2hr, III-at 4hr, IV- at 6hr]

III. CONCLUSION:

The concern of airborne transmission and the associated risks of epidemics or pandemics have been seeking great attention worldwide. The knowledge on generation of pathogen laden droplets due to respiratory activities, survivability of the pathogens, their dispersal indoors and their transfer to a healthy person is incomplete. Present methods for cleansing indoor air are inefficient and costly. There is a need for development of new, economical, sustainable, green though efficient methods for cleansing air spaces, particularly in college institutes. An attempt was made to tackle this prevailing issue successfully using a holistic approach where microbial contamination in classroom air was reduced by using dhoopbatti prepared from reusing temple waste with added medicinal values.

REFERENCES

1. Morawska, L., & Milton, D. K. 2020. It is time to address airborne transmission of coronavirus disease 2019 (COVID-19). *Clinical Infectious Diseases*, *71*(9): 2311-2313.
2. Konstantinou, C., et al., 2022. Assessment of indoor and outdoor air quality in primary schools of Cyprus during the COVID–19 pandemic measures in May–July 2021. *Heliyon*, *8*(5), e09354.
3. Sadrizadeh, S., et al. 2022. Indoor air quality and health in schools: A critical review for developing the roadmap for the future school environment. *Journal of Building Engineering*, 104908.
4. Katafygiotou, M. C., & Serghides, D. K. 2014. Indoor comfort and energy performance of buildings in relation to occupants' satisfaction: investigation in secondary schools of Cyprus. *Advances in Building Energy Research*, *8*(2): 216-240.
5. Alves, C., Nunes, T., Silva, J., & Duarte, M. 2013. Comfort parameters and particulate matter (PM10 and PM2. 5) in school classrooms and outdoor air. *Aerosol and Air Quality Research*, *13*(5): 1521-1535.
6. Choo, C. P., & Jalaludin, J. 2015. An overview of indoor air quality and its impact on respiratory health among Malaysian school-aged children. *Reviews on Environmental Health*, *30*(1): 9-18.
7. Daisey, J. M., Angell, W. J., & Apte, M. G. 2003. Indoor air quality, ventilation and health symptoms in schools: an analysis of existing information. *Indoor air*, *13*(LBNL-48287).
8. Bolashikov, Z. D., & Melikov, A. K. 2009. Methods for air cleaning and protection of building occupants from airborne pathogens. *Building and Environment*, *44*(7): 1378-1385.
9. Shivhare N. and Gour A., 2019. Management of atmosphere and health using Hawan Technique – A Review, *Journal of Current Science*, 20(2),9726-001X **https://journal.scienceacad.com**
10. Nautiyal, C. S., Chauhan, P. S., & Nene, Y. L. 2007. Medicinal smoke reduces airborne bacteria. *Journal of ethnopharmacology*, *114*(3): 446-451.
11. Mohagheghzadeh, A., Faridi, P., Shams-Ardakani, M., & Ghasemi, Y. 2006. Medicinal smokes. *Journal of ethnopharmacology*, *108*(2): 161-184.
12. Pt. SHRIRAM SHARMA ACHARYA. 1999. *The Integrated Science of Yagna.* Haridwar:Shantikunj.
13. Pasquarella, C., Pitzurra, O., & Savino, A. 2000. The index of microbial air contamination. *Journal of hospital infection*, *46*(4): 241-256.
14. Hamidpour, R., Hamidpour, S., Hamidpour, M., & Shahlari, M. 2013, Camphor (Cinnamomum camphora), a traditional remedy with the history of treating several diseases. *Int. J. Case Rep. Images*, *4*(2): 86-89.
15. Barot, N.S. and Bagla, H.K., 2009. Extraction of humic acid from biological matrix–dry cow dung powder. *Green Chemistry Letters and Reviews*, *2*(4): 217-221.
16. Wealth of India 2005 Revised Edn.New Delhi: CSIR.
17. Sahu, Bhavna, et al., 2022 "A Brief Review on Dhoop and Its Properties - JPMHH." *A Brief Review on Dhoop and Its Properties - JPMHH*.
18. Ganguli.N.C. and Jain.M.K, 1973.Ghee: It's Chemistry, Processing and Technology, *Journal of Dairy Science*, 56(1): 19-25.