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Preparation and evaluation of Herbal Dhoop for cleansing the air

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Abstract
In various devout practices such as homa/ havans, cow dung, cow ghee, cow urine. etc has been used in order to cleanse the environment and feel pleasant. With an aim to minimize the usage of chemicals or disinfectants to cleanse the environment, efforts were made to devise an herbal dhoop using cow dung, cow ghee, cow milk, camphor and various other herbs having an appreciable fragrance. The current work focuses on preparation and evaluation of natural and herbal dhoop formulation for cleansing the environment. The antimicrobial activity of the prepared dhoop was checked and it was found that it can be a potential source for disinfection in various hospitals, hotels, labs. etc.

Keywords: Antimicrobial, herbal, cow dung, cow ghee, cow milk, Dhoop

1. Introduction
The environment has been a major concern in today's era. The constant pollution all around has gathered the attention of many people. A clean environment that includes clean air, water, land and energy, is essential for human existence [1, 2]. Microbial load of the air causes various airborne diseases. Disease-causing pathogens are organisms that spread from an infected person to another through coughing, talking and sneezing - even breathing and laughing. According to the U.S. Centers for Disease Control, flu droplets can travel up to six feet away! Numerous efforts are being taken to cleanse the air in a number of ways. Various chemicals are available in the market for the same. But the side effects and the impact of them on living organisms cannot be ignored [3, 4]. Bearing in mind the consequences of chemical substances and with an aim to cleanse the environment, an attempt was made to utilize herbal products to cleanse the air in a particular area and to create a positive atmosphere with the help of its appreciable fragrance. Therefore, the current research focuses on the development of a natural dhoop stick, which can be effectively used for reducing the count of aeromicroflora.
The formulation was developed using natural agents like cow dung, clarified butter, cow milk and certain herbs which are known traditionally for their fragrances. Cow dung has been used since time immemorial as a source of disinfection in different households [5-8]. In various religious practices such as homa/ havans, cow dung, cow ghee, cow urine, camphor, etc has been used in order to cleanse the environment and feel pleasant. [9-13] With the help of this traditional knowledge, we tried to devise a method to prepare a dhoop stick having pharmacopoeial quality using various cow products and plant powders for cleansing the air. This herbal dhoop stick is prepared from extremely economical sources and has a pleasant smell. It can serve as an alternative to the usage of chemicals for disinfection of air in various areas such as households, hospitals, washrooms, etc [14-18]

2. Materials and methods
2.1 Materials
All the plant powders were procured from local market and they were screened for their quality and then used for the preparation. Dried Cow dung was procured from a local dairy milk supplier from Pune district. The cow dung was then pulverized in a domestic grinder and sieved to obtain the fine powder. Cow's milk and ghee was also procured from local market after checking its quality. All the ingredients were taken in same proportion.

Table 1: The details of the ingredients

Sr. No	Ingredient	Scientific Names	Plant part used	Quantity
1	Cows Ghee (clarified butter)	----	----	2 gm
2	Cow dung	----	----	1 part
3	Cow milk	----	----	10 ml
4	Anantmula	*Hemidesmus indicus*	Root	10 gm
5	Guggul	*Commiphora mukul*[19]	Resin	10 gm
6	Dhoop	*Boswellia serrata*[20]	Resin	10 gm
7	Camphor	*Cinnamomum camphora*	----	10 gm
8	Kapurkachri	*Hedychium spicatum*	Rhizome	10 gm

2.2 Methods

All the plant powders and cow dung were taken in a clean, dry mortar and pestle and macerated finely. Cow's milk was boiled, and clarified butter was added in it and again digested on a hot plate for few minutes. This mixture was then added to the powder mix and again macerated finely to obtain a fine paste. A plastic syringe was cut from the apical side so as to open the mouth of the syringe completely. Dhoop sticks were made using the opened syringe and a plunger. These dhoop sticks were dried for 4 days in an oven at 40 ^{0}C and then stored in an air tight container. After storage for a month, the sticks were used for evaluation of cleansing activity.

Fig 1: Macerated mixture

Fig 2: Preparation of dhoop stick with the help of syringe

Fig 3: Prepared herbal dhoop sticks

The sticks were then evaluated for the phytoconstituents using biochemical tests for terpenoids, alkaloids and tannins. The Physical characters of dhoop were noted.

2.2.1 Microbiological Evaluation of cleansing activity of dhoop

Table 2: Experimental conditions for microbial evaluation of dhoop

Sr. No	Nutrient and Sabouraud Agar Plates (in duplicates) exposed to	Time of exposure
1	Garbage Area	10 mins
2	Kitchen of a restaurant	
3	Washroom	
4	Laboratory (As a representative of hospital) [21]	

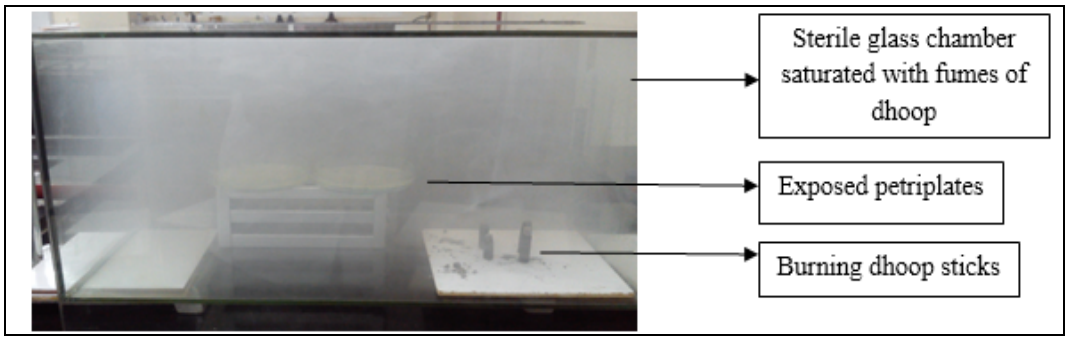

Fig 4: Experimental Set-up for evaluating the cleansing activity of prepared dhoop

Microbiological Tests

Nutrient agar and Sabouraud Agar Plates were exposed to various environments (Garbage area, Kitchen of a restaurant, Boys washroom, Laboratory) in duplicates. One set was exposed (plates numbered 2) to the prepared dhoop for 1 hour in a sterilized chamber as shown in the figure and the other set was unexposed (Plates numbered 1) to the dhoop. After 24 hours of incubation at 37 ºC for Nutrient agar plates and 48 hours of incubation at Room Temperature for Sabouraud agar plates, the following results were obtained:

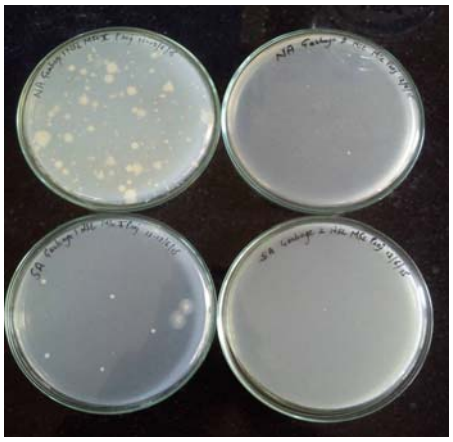

Fig 5: Garbage Area

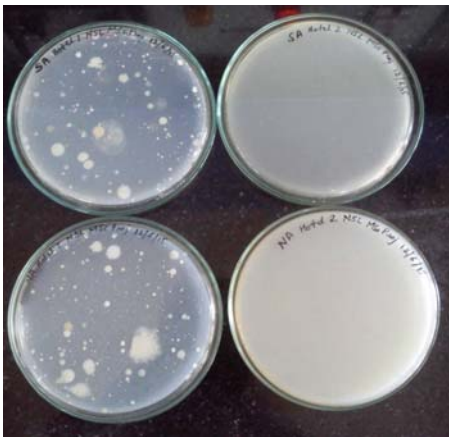

Fig 6: Kitchen of a Hotel

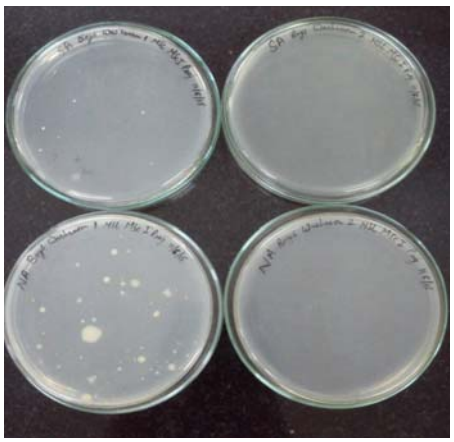

Fig 7: Washroom

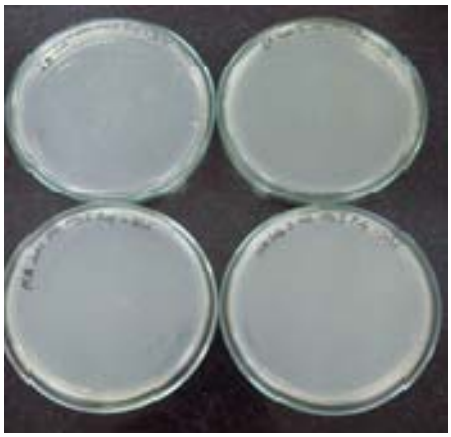

Fig 8: Laboratory

NOTE: Plates on the right (labeled 2) were exposed to the dhoop

The activity of the prepared formulation was also compared with existing sterilization agents such as Ultraviolet light and chemical agents (Formalin + $KMnO_4$):

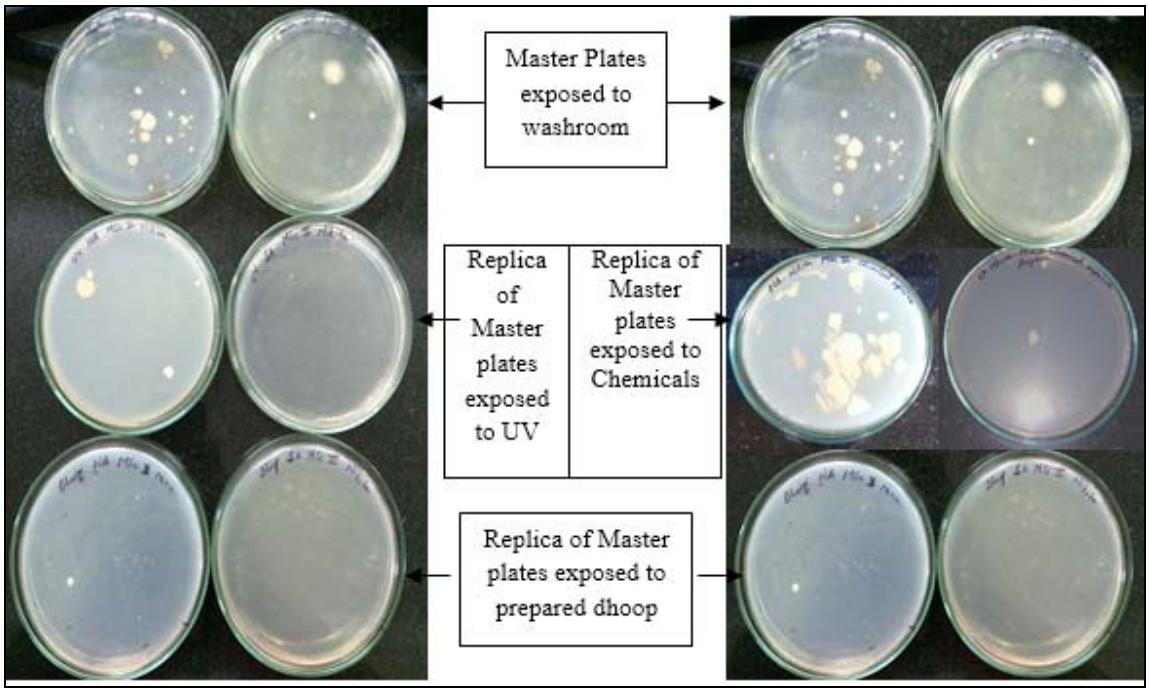

Fig 9: Comparison of antimicrobial activity of dhoop with UV light and chemical agents

A survey was also carried out in order to evaluate the acceptability of the herbal dhoop amongst 75 people. Various parameters such as smell, appearance, smoke and comparison with existing formulations were evaluated. The findings of which are mentioned in Table.4.

3. Results & Discussion

From Table.3 and Fig. 5, 6, 7, 8 and 10 it could be observed that on exposure of plates, consisting of various aeromicroflora, to the dhoop which was prepared according to the above mentioned procedure, growth of most of the aerial micro-organisms was inhibited. While Sabouraud's agar plate exposed for aero-mycological investigations revealed significant decrease in the colony count after burning of the dhoop.

3.1 Tables and Figures

Table.3: Statistics of the microbiological study

Sr. No	Plates exposed to	No of colonies before exposure to dhoop stick		No of colonies after exposure to dhoop stick	
	Media Used	Nutrient Agar	Sabaroud agar	Nutrient Agar	Sabaroud agar
1	Garbage Area	uncountable	9	5	1
2	Kitchen of a Hotel	uncountable	uncountable	1	1
3	Washroom	7	64	0	0
4	Laboratory	3	6	1	0

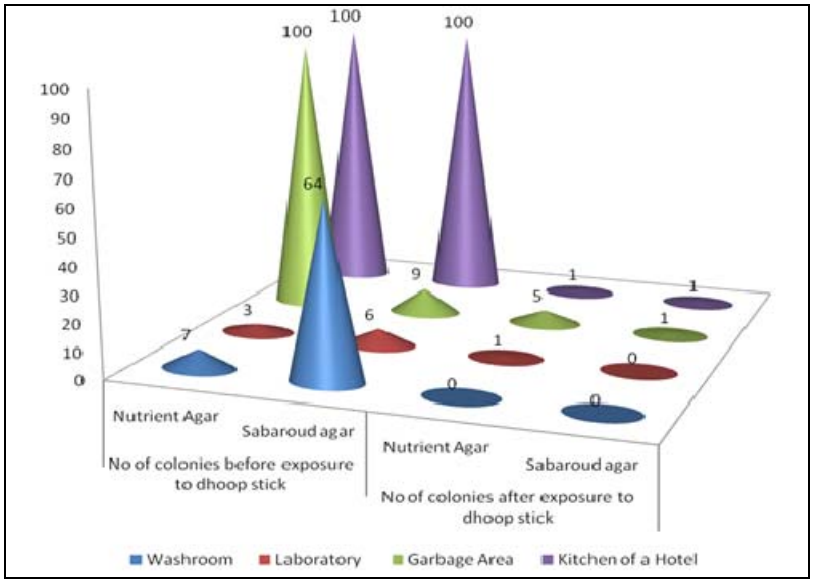

Fig 10: Statistical representation of the microbiological study

Thus all the exposed plates, were almost clear with negligible count of colonies. This can help us in predicting the anti-microbial activity of this herbal dhoop stick.

In Fig. 9, on mere observation with the naked eye, it is evident that the herbal dhoop stick is more effective than existing sterilizing agents such as UV light and chemicals like formalin and potassium permanganate used for fumigation. Thus on comparison with anti-microbial agents such as Ultraviolet light and chemicals, the prepared herbal dhoop showed greater antimicrobial activity on bacteria as well as fungus.

During the survey (Table 4), most of the volunteers found the smell of the dhoop appreciable. Majority of them found the smell woody and resinous and a few found it minty and peppermint (camphor) like. 80% of them did not experience any irritation in their eyes. Around 93% found the prepared dhoop better than the existing formulations in the market. All of them found the appearance acceptable and accepted that they would like to use/ recommend the dhoop, if it has proven to have anti-microbial activity.

Table 4: Survey to evaluate the fragrance and acceptability of the prepared dhoop.

Questions	Yes	No	Percentage of acceptability
Smell of the dhoop appreciable?	74	1	98.66%
Fragrant smell (e.g. floral and perfumes)	20	---	26.66%
Woody and resinous (e.g. pine or fresh cut grass)	46	---	61.33%
Chemical (e.g. ammonia, bleach, gasoline, paint or felt tip markers, alcohol and disinfectants)	1	---	1.33%
Minty and Peppermint (e.g. eucalyptus and camphor)	35	---	46.66%
Toasted and nutty (e.g. popcorn, peanut butter, almonds)	5	---	6.66%
Sharp/ Pungent (e.g. sour milk, faecal matter /manure, sweat, blue cheese, cigar smoke, oniony and garlicky)	5	---	6.66%
Decayed (e.g. sewage, burnt rubber, sulphuric acid, household gas, rotting meat, sour milk)	3	---	4.0%
Fruity (e.g. strawberries, banana, all non-citrus fruits)	---	---	0%
Citrus (e.g. lemon, lime, orange)	---	---	0%

Sweet (e.g. chocolate, vanilla, caramel)	---	---	0%
Smoke irritating to eyes?	15	60	80%
Appearance acceptable?	75	0	100%
Would like to use it in their vicinity?	75	0	100%
Would recommend it for use if proven to have antimicrobial activity?	74	0	98.66%
Is it better than the dhoop formulations available in the market?	70	5	93.33%

The effectiveness of this dhoop could be attributed to the combination of cow dung, cow ghee, cow milk and fire (agni) which is one of the element of the Panchamahabhutas. The cow, according to the Vedas, provides three products for human use: (i) Godugdha (cow milk): As per Ayurveda, cow milk has fat, carbohydrates, minerals and Vitamin B, and also has capacity for body resistance to radiation and for regenerating brain cells. (ii) Goghruta (ghee): The best ghee as per Ayurveda and is useful in many disorders. In yajna, it has proven to increase the air's oxygen level [22] (iii) Gomutra (urine): Eight types of urine are used for medicinal purpose, among which cow urine is held to be the best [23].

There are various dhoops available in the market consisting of coal, chemicals, incense, and saw dust, etc which increase the carbon footprint. The current product is free from all the above materials, burns completely and minimum amount of ash is produced. To add to it, it has a natural aroma of herbs which is advantageous for allergic population. The size and breadth of dhoop stick is adjusted in such a way that there is no eye irritation as seen in the survey and is thus acceptable. Thus with the use of these cow products and various herbal powders, an attempt was made to develop an extremely feasible and easy to use herbal formulation which can minimize the use of potentially harmful and toxic chemicals or aerosols used for disinfection.

4. Conclusions

The current work focuses on preparation and evaluation of natural and herbal dhoop formulations for cleansing the environment. From the above results it is evident that this dhoop can cleanse the environment and can be a potential and efficacious source of disinfection in various areas. Thus instead of using chemical sources and the harmful UV rays for disinfection in hospitals. etc, this herbal dhoop having defined quality and which is prepared from well accessible and affordable sources can be used. The current work can be extended to areas like schools, colleges, hospitals, public lavatories. etc. It can also help in creating a positive environment and can act as a room purifier and air freshener.

Natural and biocompatible measures like this herbal dhoop can potentially aid in internal environment cleansing and sustainable conservation without causing any harm to the environment unlike various chemicals and aerosols. In the future, a larger study could be planned to study the in-depth role of this formulation in residential or commercial zones with higher air pollution.

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