Life Science Informatics Publications

Research Journal of Life Sciences, Bioinformatics, Pharmaceutical and Chemical Sciences

Journal Home page http://www.rjlbpcs.com/

RJLBPCS
ISSN 2454-6348

Original Research Article **DOI: 10.26479/2022.0801.07**

STUDY OF AIR MICROFLORA IN THE VICINITY OF 'COMMON BIOMEDICAL WASTE FACILITY CENTER GOVANDI, MUMBAI' AND ITS IMPACT ON COMMUNITY HEALTH

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ABSTRACT: Air Microflora may contains pathogens and non -pathogens. Pathogens if are remain present in the form of 'Droplets' and 'Droplet nuclei'. Such 'Droplets' and 'Droplet nuclei' get disseminated through air over longer distance and may pose serious threat to community health. 'Common Biomedical Waste Facility Centers' are CPCB approved organizations meant for collection and incineration of Biomedical Waste. Study of air microflora was carried out in the vicinity of 'Common Biomedical Waste Treatment Facility Center Govandi, Mumbai'. Control study was carried at different parts of Mumbai including Dadar, Fort, Antop hill and Washi. Area in the vicinity of 'Common Biomedical Waste Facility Center Govandi, Mumbai' was dominated by pathogenic bacteria. Drug sensitivity study of the isolates revealed multiple drug resistance.

Keywords: Biomedical Waste Management, CBWTFC, Medical Waste, Droplets

Article History: Received: Jan 06, 2022; Revised: Jan 20, 2022; Accepted: Jan 30, 2022.

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1. INTRODUCTION

It is estimated that 10 to 20 % of Biomedical waste generated through hospitals is hazardous and such waste is the cause of variety of health problems including fatal upper & lower respiratory tract infections. On global scale, about 64% of health care institutions have been reported for having unsatisfactory biomedical waste management facilities. Documented transmission through biomedical waste includes *Tuberculosis* (8.51%), *HIV* (74.47%), *Pseudomonas sp*. (29.4%), *Proteus* *vulgaris* (5.88%), *Citrobacter sp*. (2.20%), *Staphylococci* (8.82%), *Enterococci* (3.67%), *Escherichia* (22.79%), *Hepatitis* A (10.64%), *Hepatitis* B (56.19%). Common Biomedical Treatment Facility Centres have claimed for safe disposal of the biomedical waste. Irrespective of following Central and State pollution Control Board guidelines such centres often spread pathogens in air and adversely affect the health of nearby society. The definition of biomedical waste vide Gazette of India Extraordinary part II Section III, Sub-section (i) Dated 28th march, 2016 as amended in 2018 & 2019 is "Any waste, which get generated during the diagnosis, treatment or immunisation of human beings or animals or research activities pertaining thereto or in the production or testing of biological or in health camps, including the categories mentioned in Schedule I appended to these rules". As per the Central Pollution Control Board there are 3,22,425 number of Health Care Facilities out of which 1,06,796 number of Health Care Facilities are bedded and 2, 15,780 number of Health Care Facilities are non-bedded. 1, 53,885 number of Health Care Facilities are granted authorization under the Biomedical Waste Rules. 2,35,571 number of Health Care facilities utilises Common Bio-medical Waste Treatment Facility Centres and 18,015 number of Health Care Facilities are having captive bio-medical waste treatment and disposal facilities. There are 202 number of Common Bio-medical Waste Treatment Facility Centres in operation (35 under construction). The total generation of bio-medical waste is about 656 tonnes per day out of which about 544 tonnes per day are treated in Common Bio-medical Waste Treatment Facility Centres and captive treatment facilities. About 55 tonnes per day are treated by captive treatment facilities and about 489 tonnes per day are treated by Common Bio-medical Waste Treatment Facility Centres. As reported, 29,062 number of Health Care facilities/Common Bio-medical Waste Treatment Facility Centres observed to be violating the provisions of the Biomedical Waste Rules. States namely Assam, Maharashtra, Bihar, Karnataka, Kerala, Nagaland, Odisha, Chhattisgarh, Jammu & Kashmir, Madhya Pradesh, Manipur and Rajasthan are the States where gap in generation and treatment of biomedical waste has been observed. Hence, concerned State Boards should examine this issue and ensure that biomedical waste is disposed off in line with provisions under Biomedical Waste Management Rules, 2016. States having Class I cities namely New Delhi, Chennai, Mumbai and Kolkata have minimum of about 28 tons/day of biomedical waste however, States namely Kerala, Uttar Pradesh Gujarat, Bihar, Karnataka also generates enormous quantity of biomedical waste. The states namely Andaman & Nicobar, Himachal Pradesh, Jharkhand, Assam, Chhattisgarh, J & K, Nagaland, Odisha, Puducherry, Karnataka, Kerala, Lakshadweep, Maharashtra, Meghalaya, Mizoram, Madhya Pradesh, Rajasthan, Sikkim, Tamil Nadu, Tripura and Uttarakhand use deep burial pits for disposal of Biomedical waste, however as per Biomedical waste Rules, 2016 use of deep burials is allowed only in remote or rural areas where there is no access of Common Bio-medical Waste Treatment Facility Centres (CBWTF). There are no CBWTF Centers in nine states including Andaman and Nicobar, Arunachal Pradesh, Daman-Diu and Dadra, Nagar Haveli, Ladakh, Lakshdeep, Mizoram, Nagaland, Sikkim and Tripura. Remaining states do not have any alternative to deep burial method in rural areas. On this background, air sampling was carried out in the close vicinity of 'Common Biomedical Waste Facility Center Govandi, Mumbai' using FKC-1 Microbial Air Sampler. Sampling duration was 20 seconds with air volume of 100 litres /cycle. Sampling was carried out on 'Mueller Hinton Agar Plates' and 'Sabourauds Dextrose Agar Plates. Control study was carried at different parts of Mumbai including Dadar, Fort, Antop hill and Washi. Area in the vicinity of 'Common Biomedical Waste Facility Center Govandi, Mumbai' was dominated by pathogenic bacteria. Drug sensitivity study of the isolates revealed multiple drug resistance. Control study revealed no pathogens in selected areas.

2. MATERIALS AND METHODS

1. Air Sampling:

The following sampling methodology was used.

- Make: - FKC-1 Microbial Air Sampler
- Sampling duration: - 20 seconds
- Air volume: - 100 liters

2. Media preparation:

Four types of media were used for air sampling as ,

- Mueller Hinton Agar (MHA)
- Sabourauds Dextrose Agar (SDA)
- Lowenstein Jensen Medium
- Blood Agar

3. Identification of the selected isolates using MALDI-TOF mass spectrometry
4. Drug resistance study using 'Kirby-Bauer Disc Diffusion method':

Suspensions of the pathogenic isolates was prepared and compared with 0.5 McFarland standard following NCCLS guidelines and are tested for 'Antibiotic Susceptibility Test' using 'Kirby-Bauer Disc Diffusion method'. Medium used was 'Muller Hinton agar' (pH adjusted to 7.4 ± 0.1 at 25°C).

3. RESULTS AND DISCUSSION

Table 1: Non pathogenic microbial isolates as obtained during control study

Sr. No.	Name of the organism	Method of identification	Location
1	*Exiguobacterium artemiae*	MALDI TOF	Dadar
2	*Lactobacillus paraplantarum*	MALDI TOF	High Court area Fort
3	*Acinetobacter indicus*	MALDI TOF	High Court area Fort
4	*Bacillus flexus*	MALDI TOF	Dadar
5	*Janibacter indicus*	MALDI TOF	Washi
6	*Micrococcus endophyticus*	MALDI TOF	Antop Hill
7	*Arthrobacter tumbae*	MALDI TOF	Antop Hill

Table 2: Pathogenic microbial isolates as obtained during control study

Sr. No.	Name of the organism	Method of identification	Distance from CBWTFC Govandi
1	*Mycobacterium tuberculosis*	MALDI TOF	50 Meters Approx
2	*Staphylococcus aureus*	MALDI TOF	200 Meters Approx
3	*Streptococcus pneumoniae*	MALDI TOF	2 km
4	*Klebsiella pneumoniae*	MALDI TOF	5 km

Drug Resistance study:

Staphylococcus aureus was resistant to Amikacin (AN), Cefuroxime (CR, Sparfloxacin (SF), Ampiclox (ACX), Ciprofloxacin (CIP), Cefotaxime (CF) and Roxythromycin (RX). *Klebsiella pneumoniae* was found resistant to Netilmycin (NET), Lomefloxacin (LM), Gentamycin (G) and combination of Ampicillin and Sulbactam (SLB). *Streptococcus pneumoniae* was observed to be resistant to Cefotaxime (CF), Cefadroxil (CD), Netilmycin (NET), Cefoperazone(CFP), Ceptazidime (CPZ), Ceftriaxone (CTX) and combination of Ampicillin and Sulbactam (SLB).

DISCUSSION:

Before transportation of biomedical waste from hospitals, it is segregated in accordance with Schedule I of 'Central Pollution Control Board' in India [11]. Containers and bags are labelled as per Schedule IV following bar codes. It is expected that, hospital authorities should follow pretreatment guidelines for microbial waste and clinical laboratory waste to sterilization to Log 6 or disinfection to Log 4 following WHO guidelines. Unfortunately, it is not followed in all hospitals and is the prime reason for having heavy pathogen load in disposed biomedical waste. Guidelines for functioning of 'Biomedical Waste Incinerators' expect two chambered machines, where primary chamber get operated at 850º C and secondary chamber get operated at 1050ºC [9,10]. The burning process is dependent on blow motor whose capacity remains between 4 HP to 8 HP (1 HP IS EQUAL TO 746 watts). The high power of blow motor enforces air currents at high speed and is the cause of release of thermostable pathogens in the form of 'Droplets' and 'Droplet nuclei'. Such pathogens are passed along with flue gases in the environment. Anderson B.M. (2018) reported the mobility of pathogens in the form of 'Droplet nuclei'. Paul C.H.et al.(2008) discussed the role of size and velocity in Droplet dissemination. Anderson B.M. (2017) reported survival of Ebola virus in the environment for more than 15 days, He also claimed for failure of infection control guidelines against Ebola. In India, Maharashtra Mumbai, people residing at 'New Sangam Welfare Society, Govandi' reported for alarming increase in Tuberculosis and other respiratory diseases in the vicinity of 'Common Biomedical Waste Tratment Facility Center'. This study confirmed the presence of disease causing organisms including *Mycobacterium tuberculosis, Staphylococcus aureus, Streptococcus pneumoniae* and *Klebsiella pneumoniae* in the vicinity of 'Common Biomedical Waste Facility Center, Govandi'. Most of such pathogens were showing multidrug resistance. Their impact on the neighbourhood society was reflected through high number of Tuberculosis cases and of other respiratory diseases.

4. CONCLUSION

Air microflora in the vicinity of 'Common Biomedical Waste Facility Center Govandi, Mumbai' was studied. It was dominated by disease causing organisms including *Mycobacterium tuberculosis, Staphylococcus aureus, Streptococcus pneumoniae* and *Klebsiella pneumoniae* and its impact on community health was found in terms of high number of cases as reported through community hospitals, newspaper articles and public interest litigation filed by the resident of Gavandi.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

HUMAN AND ANIMAL RIGHTS

No animals or humans were used for the studies that are based on this research.

CONSENT FOR PUBLICATION

Not applicable.

FUNDING

None.

ACKNOWLEDGEMENT

Dr. Renuka Ballal for extending her valuable help for air sampling work.

CONFLICT OF INTEREST

Authors declare that, they do not have conflict of interest.

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