

REPORT OF HYGIENE AUDIT

Submitted to
BHARATHIAR UNIVERSITY)
Coimbatore – 641 046, Tamil Nadu, India.

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Submitted by



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*(A Unique Research and Development Centre
for Society Improvement)*



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Motto

'Save the Nature to Save the Future' & 'Go Green to Save the Planet'

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1. Introduction

A hygiene audit will provide an insight into how an organization operates in a sustainable manner in terms of hygiene environment to the stakeholders as per the International Standard for Occupational Health and Safety Management Systems (ISOHSMS). If an organization has a hygiene auditing process implemented already, then it should apply environmental context into a clean environment. Environmental audit is a natural management tool and it will become more effective when hygiene audit is added to it. It is an essential requirement to adopt an audit process for a sustained utilization of resources in a hygienic way in both developed and developing countries like India. Hygiene will be of different types such as personal hygiene, environmental hygiene, medical hygiene and public hygiene which are all interrelated between each other in terms of maintaining a hygienic atmosphere to the stakeholders (Chen *et al.*, 2015; Jeanes *et al.*, 2015).

Hygiene audit is a process that leads to extraction of information about guided procedures in hygiene implemented in an organization which provides a realistic assessment of how it protects or affects the health of stakeholders. It also measures the effects and provides solutions to overcome or reduce the adverse effects due to unhygienic conditions. This audit can minimize the hazardous materials (for example: food wastes and human wastes) utility in the campus remarkably which in turn reduce the adverse effects to human beings as a whole (Gould *et al.*, 2016). As per the Government norms and guidance, the environmental legislations including food consumption should be followed by all the organizations and necessary steps should be taken to minimize the food waste in any campus. The food wastes will lead to high contamination rates in the campus and also lead to cause diseases to the stakeholders and the public (Gnanamangai *et al.*, 2018).

To ensure that the hygienic environmental management system, maintenance of environmental and personal hygiene, availability of clean resources, maintenance of water supply and hygiene, cleanliness ensured at the site of disposal of human waste materials and personal safety in the campus should be implemented effectively. Each year a plan for the hygiene audit should be prepared by the management of an organization (Rajalakshmi *et al.*, 2021). A committee of faculties and student representatives and social aware members appointed to take this plan forward in the beginning of every year will ensure that the entire hygienic environmental management system is implemented in the organization without any hindrance. An effective hygiene practice should be followed among the stakeholders which in turn useful to control a wide variety of disease outbreaks (Roethlisberger and Dickson, 2017).

A healthy population is the essential component of a country's wealth in terms of political, economic and environmental sustainability. In terms of population growth statistics, India is the fastest populating country to strike the second position in total population cover which is about 138 million and constitutes 17.25% of the total global population (IGBC, 2018; WGBC, 2018). Demographic status of India revealed that if the population increase continues to be at this rate, India is expected to be the most populated country by 2050. Along with the birth rate, social and environmental issues are also increasing and alarming now-a-days. As consequences of over population,

social well-being of man and status of quality environment of the country get affected by the developing pressure on food, clothes, housing and other basic necessities, unemployment, loss of standard of living, decrease of forest cover, environmental pollution, energy crisis, ecological degradation and lack of hygienic condition-resulting in the distortion of well-being of a country (Silvennoinen *et al.*, 2015).

2. About Hygiene Audit

According to M/s. Nature Science Foundation's hygiene audit guidelines, hygiene audit is a survey of extracting a cumulative information concerning the status of hygiene and sanitation of respective premises and individuals belonging to any organisation such as academic or non-academic institutes, industries, food establishments and any other enterprises. This audit provides realistic data on how the organisations' cleanliness affect people's health and environment. A set of prominent objectives and goals are predetermined prior to hygiene audit with an aim to reduce the adverse effects of contaminated surfaces to human beings and to eradicate hazardous substances from the compound remarkably to diminish the multiplication of infectious diseases (Presscott *et al.*, 2005).

As per the norms of the Health department of Indian Government, the environmental legislation's guidelines for food consumption should be followed by all the Organizations without any deviations. Hygiene audit process determines to monitor and record the sanitation status and personal hygiene to make strong recommendations for the complete cleanliness of environment and individuals associated with the organisation. The outcome of the hygiene audit suggests to give pure atmosphere to various stakeholders such as employees, faculties, supporting staff members, parents and students those who are depending upon the educational institutions and the employees and customers of other business establishments (Gnanamangai *et al.*, 2018).

To achieve a hygienic environmental management system in an academic institution and industry, maintenance of environmental and personal hygiene, availability of clean resources, maintenance of quality water supply and cleanliness ensured at the site of disposal of human waste materials in the campus should be implemented effectively (Rajalakshmi *et al.*, 2021). A periodic conduction of hygiene audit can ensure these practices in an institution-making both the human health and environmental safety protected which is the key focus of a hygiene audit.

Hygiene auditing is a management tool to objectively and systematically evaluate hygiene environment and sanitization management systems with the following objectives:

- Number of microbial load in the air.
- Methods of disposal of food and human wastes.
- Availability of hand wash, soap, sanitiser, dryer, tissue roll, etc.
- Placing environmental information in the public domain.
- Facilities of sufficient ventilation, napkin disposal and waste management.
- Effective water purification and recycle system for use of hygienic water.

3. Aims and Objectives of the Hygiene Audit

The main objectives of a hygiene audit is to achieve complete safety for both people and the environment of any organization by promoting the hygiene management and sanitization standards in the enterprise. The hygiene audit identifies, quantifies, describes and prioritizes the framework of hygienic environment in compliance with the applicable regulations, policies and standards to the stakeholders. The main objectives of a hygiene audit are:

- To assess the diversity and density of microbial wealth in the atmosphere.
- To assess the waste management strategies and methods of disposal of food and human wastes.
- To check the availability of tools and materials for hygiene such as hand wash, soap, sanitiser, dryer, tissue roll, hand gloves, masks, lab coats, etc.
- To be aware of the public domain with personal and environmental hygiene.
- To ensure the facilities of sufficient ventilation, napkin disposal and waste management in the campus.
- To check the availability of effective water purification and recycling systems for ensuring the safety of drinking water.

4. Checklists for the Hygiene Audit

The checklists for the conduct of a hygiene audit, different parameters on personal as well as environmental hygiene have been included. Availability of sanitizing materials like soap, hand wash liquid, detergents, sanitizer, lab coats, hand gloves, towels, tissue paper rolls, etc. nearby washbasins and restrooms should be made available to the customers. Lot of awareness programmes on personal and environmental hygiene, pest management strategies adopted, sanitation methods, hygiene maintenance and instructions to be followed for the stakeholders may be conducted regularly through hygiene clubs, forums, cells and associations. In addition, the details on water purification systems (if any), water recycling, disposal of food wastes, human wastes and other refuse along with the justifications on sufficient ventilation (both natural and mechanical) and proper napkin disposal facility should be made available (Gnanamangai *et al.*, 2018; Vinothkumar *et al.*, 2018).

In order to determine the quality practices undertaken by any organization or FBO (Food Business Operator) and to recommend more convenient strategies to eradicate contaminants coming out from the food wastes. Hygiene audit inspectors follow a set of predetermined checklists as per the International Standard for Occupational Health and Safety Management Systems (ISO, 2018; FSMS. 2018).

5. Procedures followed in the Hygiene Audit

Hygiene auditing ensures the monitoring and safeguarding the standards of sanitation by assessing both the organizations' as well as the associated people's hygiene practices and by suggesting such establishments with proper measures of cleanliness. According to hygiene audit criteria, in order to perform hygiene audit, the methodology included different tools such as preparation of questionnaire, physical inspection of the campus, observation and review of the documentation, interviewing key persons and data analysis, enumeration of various microorganisms such as bacteria, fungi and actinomycetes in air using suitable basal media, measurements and

recommendations (AOAC, 2018; Gnanamangai *et al.*, 2018). As the major contaminants causing hygiene issues and disease outbreaks due to various pathogenic microorganisms in the atmosphere that cannot even be seen with naked eyes, it focuses on the enumeration of several microbial colonies in the Petri plates containing nutrient medium (Pelczar *et al.*, 2000).

The food base that supports the growth of an organism is called culture medium. The culture media are formulated in various forms according to the growth habits of microorganisms. However, the culture media should be prepared under sterile condition by weighing and dispensing the individual ingredients (carbon, nitrogen, vitamin, amino acids, iron, zinc, magnesium, manganese, sodium, etc.) or procuring ready-made media from the market. Generally the common nutrient media contain both organic and inorganic nutrients required for the enriched growth of specific microorganisms. Agar agar can be used to solidify the media and culture plates can be exposed in different areas of an organization. This will help in ensuring the maintenance of hygiene and cleanliness of the area.

5.1. Preparation and Cleaning of Glassware and Plasticware items

Glassware and plasticware items and culture media were properly cleaned with 10% sodium hypochlorite solution and washed properly with distilled water subsequently sterilized using an autoclave at 120°C temperature and 15 lbs/psi pressure (Cappuccinio and Sherman, 2004). To evaluate the contamination source and rate of contaminants in the air at canteens, hostels, cafeterias/food court, seminar halls, auditorium, classrooms and the kitchen in the organization, simple culture media such as nutrient agar, potato dextrose agar and casein-nitrate agar were used to enumerate bacteria, fungi and actinomycetes; respectively. Conical flask, Sterile water, Non-absorbent cotton, Spatula, Autoclave, pH meter, Electronic balance, Brown paper, Butter paper, etc. were used for the preparation of basal media.

5.2. Preparation of Culture Media

Media components for Nutrient agar (NA) medium are Peptone (5.0 g), Sodium chloride (5.0 g), Beef extract (3.0 g), Yeast extract (3.0 g), Agar Agar (30.0 g) and Distilled water (1000.0 ml). Around 600 g of peeled potato (not infected) were boiled in 600 ml of distilled water and subsequently filtered through a muslin cloth thoroughly. It was made up to 1000 ml with distilled water in which 20.0 g each of Dextrose and Agar agar were added. Starch-casein agar (SCA) medium was prepared by mixing of 10.00 g of Starch, 0.30 g of Casein, 2.00 g each of KNO₃, NaCl, K₂HPO₄, 0.50 g of MgSO₄·7H₂O, 0.02 g of CaCO₃, 0.01 g of FeSO₄·7H₂O, 1 litre of Distilled water and 18.00 g Agar agar. They were sterilized using an autoclave at 120°C temperature and 15 lbs/psi pressure. After sterilization, these media were poured onto sterile Petri plates and allowed for solidification under sterile condition in a Laminar air flow hood.

5.3. Enumeration of Bacteria, Fungi and Actinomycetes in air samples

The sterile Petri plates containing nutrient agar, potato dextrose agar and casein-nitrate agar were taken for the enumeration of bacteria, fungi and actinomycetes; respectively in air to assess the number of aero-flora (IMTECH, 1998). These plates were exposed for 2-3 minutes at specific places where the number of microorganisms as

microflora in the air were to be enumerated. The exposed Petri plates were incubated under room temperature for 24-96 hours.

The number of bacterial colonies grown in the Petri plates containing nutrient agar medium within 24-48 hrs of incubation period were counted using a Colony counter. In the case of fungal growth, the Petri plates containing potato dextrose agar medium were observed after 72-96 hrs of incubation. The colony of actinomycetes were recorded in between the incubation period of 48-72 hrs. The bacterial colonies exhibited different shape, size, colour and texture on morphology. Fungal colonies were identified based on visual characteristics such as colony morphology, elevation, colony margin, aerial mycelium and colony colour. Actinomycetes showed a good sporulation with compact, chalk-like dry colonies of different colour variation from pink to white colour on the Petri plates and shown a branched mycelium in their cell morphology similar to fungal characters (Holt, 1989; IMTECH, 1998).

6. About the Organization

The Bharathiar University was established at Coimbatore by the Government of Tamil Nadu in February 1982 under the Bharathiar University Act, 1981 (Act 1 of 1982). The erstwhile Postgraduate Centre of the University of Madras formed the core of the Bharathiar University, which was functioning at Coimbatore before 1982. University Grants Commission (UGC) recognized Bharathiar University in 1985 for grants. The University has 39 Departments, offering 54 post-graduate programs besides offering M.Phil. and Ph.D. programs. The University is an affiliating University. The jurisdiction of the University covers the districts of Coimbatore, Erode, Tirupur, and The Nilgiris with 133 affiliated colleges.

The National Assessment and Accreditation Council have accredited the University with an 'A' Grade in the third cycle assessment. Bharathiar University is marching towards becoming a World Class University by garnering ranking in the International arena. The state-of-the-art facilities available for faculty members and scholars nurture a culture of research in cutting-edge areas. Industry infusion into the curriculum is given prominence by involving industry experts- R&D managers, product development managers, technical managers in the curriculum development as special invitees in the Board of Studies.

Our University is a partner in the MHRD National Knowledge Network. Through UGC - Infonet, and Inlibnet a collection of physical and electronic resources is available. The Intellectual Property Rights Cell of Bharathiar University protects the rights of inventions of faculty and young researchers in the University. The DRDO-BU-Center for Life Sciences was established in Bharathiar University as a joint venture by DRDO, Ministry of Defence, Government of India, as an autonomous research institute to pursue basic and applied research. Bharathiar University Centre for International Affairs (BU-CIA) facilitates admission of international students through study in India (MoU) and Indian Council for Cultural Relations (MEA). BU-CIA operates in liaison with the Association of Indian Universities, the Association of Commonwealth Universities, and Shastri Indo Canadian Institute. With a dedicated team of faculty with vast experience in teaching and research and dedicated and

experienced administrative members, the University has emerged as one of the strong pillars of higher education in this region.

Bharathiar University provides high quality education and training in the field of Arts, and Sciences to prepare students to contribute to India's social, technological and economic development. Apart from quality education, the Institute provides training to make students responsible and socially and culturally aware. The Institute is situated in a sprawling 720 acre in Coimbatore city. It is offering various Arts and Sciences, courses at postgraduate (M.A./M.Sc./M.Com./MBA./MCA.) level including M.Phil and Ph.D. degree programmes in various subject domains.

With a campus spread across 720 acres, the campus has a fine infrastructure and adequate state-of-the-art physical facilities which include administrative building, Department building containing classrooms, laboratories, staff cabins and restroom, central library, controller of examination building, DRDO centre, hostels, foot court, auditorium, seminar halls, canteen, playground and other sports, games and gym facilities, bank, ATM, post office, hostel, shed, farm, security cabin, green house and animal house, etc. The Organization provides hostel facility to boy and girl students in the campus facilities. The buildings and other infrastructural facilities are well-maintained and are put to optimum use. The Institution is open to students of all castes and creed, as envisaged in its lofty vision to cater to the higher education aspirations of the socially, educationally and economically marginalized sections of a rural population belonging to different communities, consisting mostly of economically weaker sections of the students. The Institution has a well-defined decentralized and participatory organizational structure to coordinate the academic and administrative functions very effectively.

The dedication of the Management and the Administration section of the Bharathiar University, combined with excellent infrastructural and teaching facilities help to maintain high standards in curricular and co-curricular spheres to the stakeholders like students, staff members and parents. It offers a well-established vision and mission coinciding with global standards to impart high quality of education to the students coming from rural background that lead to the challenges of an emerging India in a globalized world, by bringing in a positive difference in the socioeconomic-educational status of the state and the nation as a whole.

Bharathiar University is maintaining more than 80% of green cover area and open unutilized landfills zone after building construction as per the guidelines of World Green Building Council, Indian Green Building Council, Environmental Regulations and Compliances.

7. Audit Details

Date/Day of Audit	: 21.04.2018 (Saturday)
Venue of Audit	: Bharathiar University, Coimbatore - 641 046, Tamil Nadu.
Audited by	: Nature Science Foundation, Coimbatore - 641 004, Tamil Nadu, India.
Audit type	: Hygiene Audit
Name of ISO EMS Auditor	: Mrs. S. Rajalakshmi, Chairman & ISO EMS Auditor, NSF.
Name of the Lead Auditor	: Dr. R. Mary Josephine, Board of Directors & Botanist, NSF.
Name of the Hygiene Auditor	: Mrs. Gaanaappriya Mohan FSMS OHS Hygiene Auditor, NSF.
Name of Subject Expert-I	: Er. Ashutosh Kumar Srivastava, Lead Hygiene Auditor & ISO FSMS.
Name of Subject Expert-II	: Dr. N. Saranya, Lead Auditor & Professor in Biotechnology.

8. Observations of the Hygiene Audit

8.1. Enumeration of Microbes in air at different locations of the Organization

Studies were undertaken to enumerate the number of microorganisms such as bacteria, fungi and actinomycetes present in air at different locations of Bharathiar University using suitable basal media. Microbes such as bacteria, fungi and actinomycetes; respectively were enumerated using appropriate media such as nutrient agar, potato dextrose agar and casein-nitrate agar as contamination source, rate of contaminants and microflora in the air at different locations of the Organization such as Staff Room, library hall, laboratories, classrooms, canteens, hostels, seminar halls, meeting room and auditorium.

The results indicated that actinomycete colonies were found to be lesser than fungal and bacterial colonies in terms of number of colony forming units (cfu) in all the localities of the Organization. All the three microbes were found to be high at Hostel dining hall followed by canteen and hostel dining hall and least with classroom. The number of bacterial, fungal and actinomycete colonies at canteen was 38.7, 23.0 and 16.5 cfu and hostel dining hall recorded was 35.0, 23.7 and 13.7 cfu. Similarly, they were found to be moderate at library hall as 24.5, 19.0 and 11.5 cfu (Table 1).

Total number of microbial colonies showed that bacterial colonies were about 257.8 cfu, fungal colonies were about 185.0 cfu and actinomycete colonies were about 113.3 cfu (Table 1 and Figure 1). Generally, actinomycete colonies are found to be least (Avg. 11.33 cfu) always in all the places due to generic characteristic features. On the other hand, bacterial colonies are always exhibited higher (25.88 cfu) due to small size and rapid multiplication factors. The fungal colonies are always placed in between two microorganisms (18.50 cfu) such as bacteria and actinomycetes in terms of size, shape, growth, doubling time and generic characters.

Table 1. Number of Microbial colonies in air at different locations of Bharathiar University Campus.

S.No.	Name of the Place	Number of Microbial colonies (cfu) *			
		Bacterial colonies	Fungal colonies	Actinomycete colonies	Total colonies / Average
1.	Library hall	24.5	19.0	11.5	55.0 (18.33)
2.	Staff Room	20.7	16.5	07.5	4.7 (14.90)
3.	Botany Lab	25.3	20.3	16.7	62.3 (20.77)
4.	Physics Lab	30.7	22.3	11.3	64.3 (21.43)
5.	Canteen	38.7	23.0	16.5	78.2 (20.07)
6.	Hostel Dining hall	35.0	23.7	13.7	72.4 (24.13)
7.	Class Room	21.3	15.3	11.5	48.1 (16.03)
8.	Usha Kirthilal Auditorium hall	20.3	13.7	07.0	41.0 (13.67)
9.	Periyar Seminar hall	20.0	14.5	09.3	43.8 (14.60)
10.	Nachimuthu Seminar hall	21.3	16.7	08.3	46.3 (15.43)
Total / Average number of Microbial colonies		257.8 (25.88)	185.0 (18.50)	113.3 (11.33)	556.1 (55.71)

Cfu: Colony forming units

* Average three replicates

** Values in the parentheses are the average number of microbial colonies.

Note:

- Bacterial colonies were enumerated in Nutrient agar plates on 24 hrs interval.
- Fungal clusters were counted in Potato Dextrose agar plates on 72 hrs interval.
- Actinomycete colonies were counted in Casein Nitrate agar plates 48 hrs interval.

Standards (APHA, 2015):

- Number of bacteria maximal limit is 100 cfu
- Number of fungi maximal limit is 65 cfu
- Number of actinomycetes maximal limit is 50 cfu

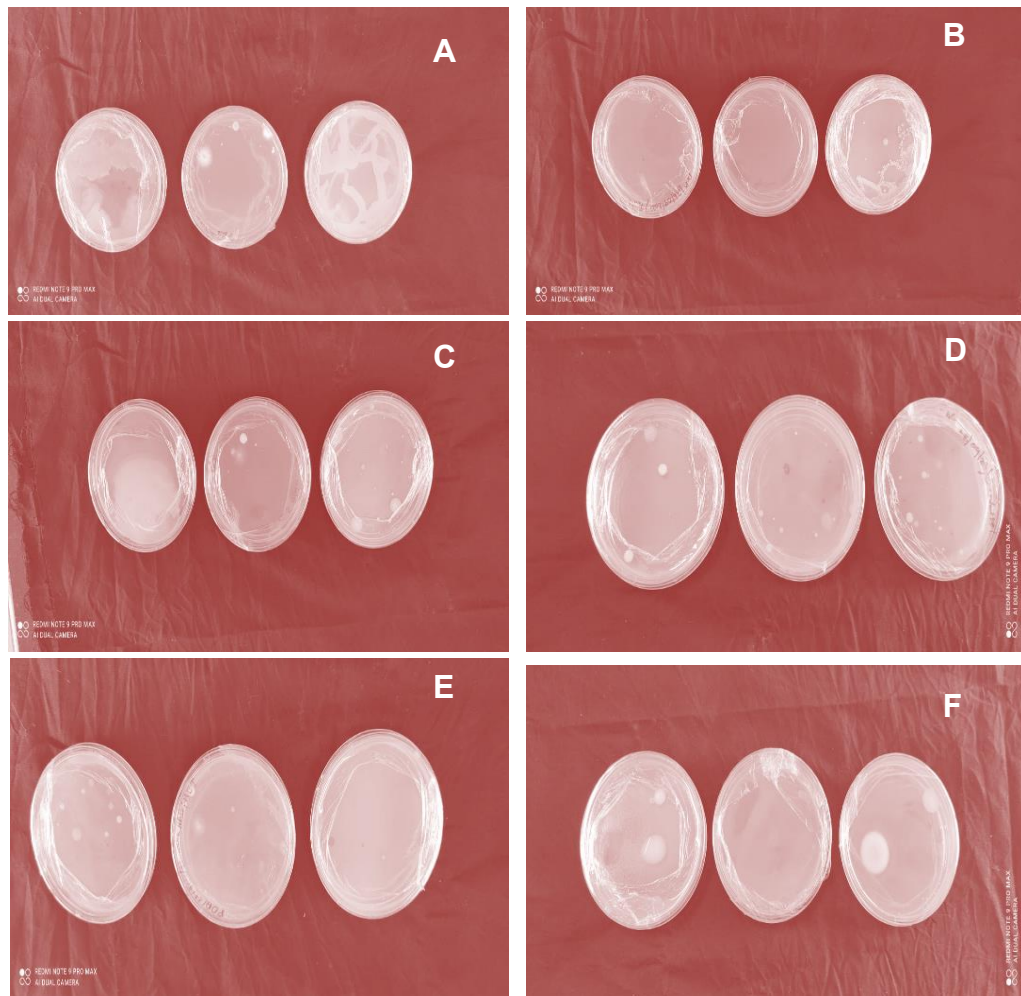


Figure 1. Growth of various microbial colonies in culture media kept at different localities of Bharathiar University Campus.

[A. Hostel dining hall, B. Canteen, C. Library hall, D. Classroom, E. Auditorium hall, F. Seminar hall]

9. Best Practices followed on Hygiene in the Organization

- No person is suffering from a disease or illness or with open wounds or burns among the students, teaching and non-teaching staff members including supportive staff and management people across the Bharathiar University campus
- It is observed that Bharathiar University is very keen interest in providing good hygiene atmosphere to the stakeholders.
- The sanitizing materials such as soap, liquid detergent, tissue paper role, hand gloves, hand towels, etc. are made available nearby the washbasins and restrooms focussing towards the personal hygiene and sanitation related concerns to the stakeholders.
- Appropriate dustbins and eco-friendly covers are made available at laboratories, canteens, food courts, cafeteria and hostels across the campus to control the spread of wastes and contaminants from one place to another place and without harming the environmental health.

10. Recommendations for Personal and Environment hygiene

- Suggested to keep sanitizing materials such as soap, liquid detergent, tissue paper roll, hand gloves, hand towels, etc. are made available nearby the washbasins and restrooms.
- Advised to keep dustbins and eco-friendly covers at laboratories, canteens, food courts and hostels across the campus to control the spread of wastes and contaminants from one place to another place.
- Recommended to control various pests like cockroach, house flies, mosquitos and rodents in canteen, hostels and food courts by keeping pest control traps and spraying the recommended dosage of biopesticides and insect repellents not to use any agrochemical.
- Implemented to use disposable hand gloves, full cover aprons and caps to minimize contamination and fire hazards at hostel dining halls and canteens by food handlers.
- Instructed to conduct a large number of awareness programmes on personal and environmental hygiene, pest management strategies, sanitation methods and hygiene maintenance to the stakeholders
- The Quality Policy of the Organization regarding personal, environmental, food, water and occupational hygiene may be developed generously to provide good hygiene to the stakeholders.

11. Conclusion

Bharathiar University, Coimbatore, Tamil Nadu is a well-established State Government University and it stands outstanding in India in terms of academic activities, efforts are continuously made in providing an eco-friendly hygiene atmosphere to the students, research scholars, parents and staff members. The laboratories, canteens, food courts, cafeteria, hostels and corridors across the campus are very neat and clean. The number of microbes such as bacteria, fungi and actinomycetes were found to be less in different localities of the Bharathiar University campus which reflected low level of contamination source and rate of contaminants including microflora in the air. Bharathiar University campus ecosystem is supported in making a sustainable environment to promote sanitation and cleanliness which enhance the teaching and learning. To conclude the hygiene audit report, Bharathiar University is an eco-friendly campus and providing pure atmosphere and personal safety to the stakeholders in terms of various hygienic measures such as regarding personal, environmental, food, water and occupational hygiene.

12. Acknowledgement

Nature Science Foundation, Coimbatore, Tamil Nadu, India is grateful to the Vice Chancellor and Registrar of Bharathiar University, Coimbatore, Tamil Nadu for providing us necessary facilities and co-operation during the hygiene audit process. This helped us in making the hygiene audit a success. Further, we hope that the best practices followed by the Bharathiar University on environment sustainability with respect to the personal hygiene and safety to the stakeholders and recommendations along with suggestions given by the NSF will boost the new generations to take care of the healthy environment and personal hygiene along with personal safety.

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