



Hygiene Audit Procedures and Assessment of Personal and Environmental hygiene in an organization

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Abstract: Efforts should be made continuously in providing an eco-friendly hygiene atmosphere to the stakeholders such as students, research scholars, parents, faculty members, visitors and staff members by educational institutions and industries. The laboratories, canteens, food courts, cafeteria, hostels and corridors across the campus should be very neat and clean. The number of microbes such as bacteria, fungi and actinomycetes should be less in all the localities of the campus which reflected low level of contamination source and rate of contaminants including microflora in the air and water samples. The air quality should be very good in terms of least number of microflora such as bacteria, fungi and actinomycetes in the air and water. The washbasins and restrooms should be equipped with the sanitizing materials such as soap, liquid detergent, tissue paper role, hand gloves, hand towels, etc. and made available to the stakeholders to improve their personal hygiene and sanitation. Monitoring of efficient hand wash, urinals and latrine and bath room facilities in the campus should be highly appreciated. The campus ecosystem should be supported in making a sustainable environment to promote sanitation and cleanliness which enhance the teaching and learning process in case of educational institutions and working atmosphere in case industrial sectors. The hygiene audit report may provide an insight of 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. The hygiene audit would definitely support to the organization campus in terms of providing hygienic environment to the stakeholders.

IndexTerms: Hygienic environment, personal hygiene, sanitation, air quality

I. 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 (Ponmurugan and Senthilkumar, 2020). 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. 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 (Chen *et al.*, 2015; Jeanes *et al.*, 2015). 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.

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 in the environment (Gould *et al.*, 2016). 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. 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 (IGBC, 2021; WGBC,

2021). 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 with respect to the hygienic environment (Silvennoinen *et al.*, 2015).

1.1 Personal and Environmental hygiene

Hygiene generally refers to conditions and practices that help to maintain health and prevent the spread of diseases among the workers. Personal hygiene, environmental hygiene, medical hygiene and public hygiene are the different hygienic parameters in which medical hygiene includes a specific set of practices associated with the preservation of health significantly. Public and environmental hygiene refers to municipal sewage and chemical wastes should not be released into the water bodies. It is therefore, municipal sewage as well as chemical wastewaters should be chemically or biologically treated to minimize the toxic effect. After treatments, these wastewaters can be released into the water bodies to avoid water-borne diseases to the public. Personal hygiene means the study and application of preventive medicines and principles of physiology for the preservation of health of an individual. Personal hygiene serves as an instrument for maintaining a healthy atmosphere and good health and also developing healthy habits, attitudes and emotional stability to a particular person. Personal cleanliness is one of the main ingredients of good health habits to trigger a large number of diseases (Roethlisberger and Dickson, 2017).

1.2 Role of Microorganisms in Hygiene

Microorganisms encompass the spectrum of variability (bacteria, fungi, actinomycetes, viruses and many more) in the natural world and as altered by human intervention. Microbial diversity considers the vast array of microorganisms that comprises of three primary groups of microorganisms namely bacteria, archaea, and eukaryotes. Bacteria and archaea are prokaryotes that have their genetic material held in a single chromosome. In eukaryotes, most of the genome is present in multiple chromosomes. 11,000 species of bacteria have been identified based on microscopic identification of cell shape and metabolic activity. Gram-staining techniques, genetic identification of RNA and DNA sequences are also applied in identification of species at various levels. There are about 500 named species of Archaea that are divided into two phyla: the euryarchaeota and the crenarchaeota are well known. Eukaryotes are grouped into eight super groups and they include single-celled organisms, and five are entirely microbial nature (Cappuccinio and Sherman, 2004). Research interest in microbial biodiversity over the past 25 years has increased markedly as Microbiologists have become interested in the significance of biodiversity for ecological processes and as the industrial, medical, and agricultural applications of beneficial microbes. One of the major challenges for these studies on microbial habitats is how to account for the extremely large diversity of heterogeneous populations with samples that represent only a very small fraction of populations. It presents an analysis of the way in which the field of microbial biodiversity has exploited sampling, experimental design, and the process of hypothesis testing to meet this challenge in terms of conservation. Microbial biodiversity conservation is concerned with various habitats related to water, soil, plants, animals and food. The effect of specific environmental factors and climatic changes are playing an important role in terms of microbial diversity conservation.

1.3 Background of Sanitation and Hygiene status in India

A survey conducted in 2008 on sanitation status of the country identified that more than 122 million households across the country were not having proper toilet facilities, 33% of the total population did not get the access to use toilets and around half of the population (around 638 million) defecated in the open environment. Between the years 1990-2008, India has improved in its people's increased access to better sanitation, but until 2014 a larger portion of Indian population had to suffer this problem of getting good sanitation. So roads and railway tracks turned into public toilets for such people. This scenario was terribly reflected in people's health significantly. Several million of Indians suffer from multiple stages of diarrhoea, intestinal worm infections, Hepatitis A, eye and skin infections, enteric fever and other various communicable diseases due to the lack of hygiene and impure drinking water (UNICEF India, 2011). In 2018, Government of India, under the Ministry of Drinking Water and Sanitation brought up with the initiative called 'Clean India Mission' (Also known as 'Swachh Bharath Mission' (SBM) or Swachh Bharat Abhiyan) as a nation-wide campaign with an intention to prevent open defecation and to improve the strategies for solid waste management. This initiative met with success from the year it launched as India was not just putting rules to open defecation but helpful actions were executed immediately. Investing 28 billion dollars, an exact 110 million public toilets were installed in the country. Within four years of Swachh Bharath Mission, *i.e.*, as of 2018, Indian households of about 95.76% could have got toilet access and as per the reports from Ministry of Drinking Water and Sanitation, Government of India declared our nation "Open Defecation Free".

1.4 Intervention strategies made by Indian Government on Sanitation

Several novel and practical approaches have been innovated and implemented by Indian Government in order to improve the standards of water supply and sanitation. In the early 2010s many of such practices were tested in India including certain demand-driven approaches started from 2015 in rural areas to improve the water supply, community led total sanitation campaigns, public-private partnership programmes in many states for the improvement in urban water supply standards and microcredit system among women to improve their access to drinking water. Total sanitation campaign of implemented by Government of India intends to provide strong emphasis on Information, Education, and Communication (IEC), Hygiene Education and capacity building to bring among the people and effective behavioural change with active involvement of PRIs (Pachayati Raj Institutions), community-based organisations and other NGOs (Non-Governmental organizations). Focused areas of interventions are IHHL (Individual House-Hold Latrines), SSHE (School Sanitation and Hygiene education, Anganvadi latrines sponsored by RSMs (Rural Sanitation Marts) and PCs (Production Centers). The major goal of Government of India in implementing sanitation and water supply improvement campaigns was to prevent the open defecation practices by 2020. The slummy areas, where proper education to both men and women still remains to be a challenge, are more affected by the lack of awareness about personal and environmental sanitation and hygiene-analytical survey reports suggested. Hence, providing awareness primarily on personal hygiene should be the key step towards environmental hygiene and healthy well-being of the people across India (Dubey and Maheshwari, 2009).

II. Personal Hygiene: Primary focus towards health

A number of illness and disease outbreaks are reported to be consequences of lack of maintaining proper personal hygiene among people. Gastroenteritis and the common cold are the most frequent among such health conditions. By touch, handling of contaminated food, contact with the untidy surfaces can cause invasion of germs and other contaminants. A good personal hygiene is primarily achieved by cleansing hands to remove germs. Soap washing or use of sanitizers ensures removal of 90% of germs and protects the person from catching illness and spreading it to other people. Especially for the current pandemic COVID-19 virus hygiene and hand sanitization is the only way to prevent contamination. Hence, it is important to create awareness among people on personal hygiene. Maintaining personal hygiene is not a practice to be done at several alternative intervals or once in a while, but it should be included in the daily routines of everyone. When taking bath, armpits and genitals- body areas prone to microbial infections should be gently and thoroughly washed with soaps, shower gel or hypoallergenic body wash to ensure the complete removal of germs. In the present scenario of COVID-19 pandemics, the Government has suggested proper hand washing and hand sanitizing. Health administrators advise to wet hands first, and then to wash hands for 20 seconds using a liquid detergent or to clean the hands by applying an alcohol based hand sanitizer, with thorough lathering in between the fingers and dorsal side of both the hands. Cleaning nails frequently will help to reduce germ infection. Wearing face shields, face masks and hand gloves are recommended to prevent the entry of COVID-19 virus into the body.



Demonstration of hygiene atmosphere during COVID-19 pandemics

Some health conditions emerged due to the unhygienic practices includes dysentery, gastroenteritis, respiratory disorders, colds, fever, staph infections, worm invasion, scabies, trachoma, tinea, athlete's foot disorder, decayed tooth, etc. are the conditions that can be developed as a result of reduced personal hygiene. Rather than sanitation and personal hygiene issues, another side of hygiene challenges India has faced and facing at present is food security related concerns. Handling food safely is another concern related to hygiene to avoid direct intake of contaminated foods causing chronic stomach infections (Pelczar *et al.*, 2000). Before preparing and consuming food proper hand washing should be ensured, especially while handling raw meat. Food hygiene is the primary and essential part of a better health of an individual especially among food handlers. A healthy individual and society in turn is the backbone of a powerful nation and sustainable environment.

III. Importance of 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, Vinothkumar *et al.*, 2021). 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 (Rajalakshmi *et al.*, 2021). 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. 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 in which 1) number of microbial load in the air, 2) methods of disposal of food and human wastes, 3) availability of hand wash, soap, sanitiser, dryer, tissue roll, etc., 4) placing environmental information in the public domain and 5) facilities of sufficient ventilation, napkin disposal and waste management and effective water purification and recycle system for use of hygienic water.

IV. Objectives of a 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 1) To assess the diversity and density of microbial wealth in the atmosphere, 2) to assess the waste management strategies and methods of disposal of food and human wastes, 3) 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., 4) to be aware of the public domain with personal and environmental hygiene, 5) to ensure the facilities of sufficient ventilation, napkin disposal and waste management in the campus and 6) to check the availability of effective water purification and recycling systems for ensuring the safety of drinking water.

V. Significance of a Hygiene Audit

As health concerns rise alarmingly mostly by the disease outbreak caused by microbial pathogens, Government and health organizations are focusing keenly on personal and environmental hygiene (Ounsaneha *et al.*, 2017). For a house or a residential area the hygiene issues can be ensured to certain extent by giving proper awareness to the resident people. Most probably it is easy for people to take responsibility for the protection of themselves, their family members, children and house premises. But for any public gathering places like institutes, industries, organisations, food manufacturing enterprises, markets, etc., the issues on environmental and personal hygiene is becoming a challenge that cannot be easily made people adhere to the health and safety guidelines in such places. Otherwise, people refuse to take responsibilities towards the hygiene maintenance in their workplace unlike their homes. Hence providing awareness or amending rules and regulations will not be sufficient to make people follow the guidelines of hygiene (Gnanamangai *et al.*, 2021). It is so as to achieve the cleanliness and decontaminated environment along public organisations, industries and educational institutions, along with providing awareness, proper monitoring of maintenance of hygiene and sanitation and recommending adequate implementations and practices for 100 % assurance of personal and environmental hygiene should be undertaken in every public forums including canteens, hostels, restaurants, cafeterias and food courts associated with those, food establishments, hospitals and other similar organisations and here is the importance of hygiene audit is getting highlighted (Pelczar *et al.*, 2000). Especially for the recent health scenario of global society, hygiene might be the only way to protect the entire human race from the corona virus contamination and hence hygiene audit is an appropriate process to be undertaken.

VI. Checklists for a 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. 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.

6.1 Food Hygiene Audit

Canteens, restaurants, cafeterias and food courts in the campus should be more focussed towards hygiene and sanitation related concerns. Food hygiene audit team comprising of management representatives, faculties, staff members and social aware members should visit these places without prior intimation to inspect the raw materials quality, storage, expiry details, food processing methods, cleanliness of kitchen premises, processing, packaging, serving and delivery of food. The cleanliness and organisation of the food serving areas of the corners and the hand wash areas are to be monitored and reports on any untidiness should be taken stern action. The following are the food hygiene parameters commonly assessed by the auditing team. In order to conduct hygiene audits effectively in organizations, training of personnel is a prerequisite. It will be really useful to control disease outbreaks from food contaminants and food storage areas. For this, section 16 (3) (h) of the Food Safety and Standards Act 2006 prescribes that the Food Authority shall, “provide whether within or outside their area, training programmes in food safety and standards for persons who are or intend to become involved in food businesses, whether as food business operators or employees or otherwise (Gnanamangai *et al.*, 2021). To implement this policy, FSSAI has designed a large scale, Food Safety Training and Certification Programme (FoSTaC) for food handlers across the value chain.

VII. Hygiene Audit Procedure

In the current COVID-19 pandemic scenario, personal as well as environmental hygiene is the most adequate requirement that everyone regardless of age and gender have to follow properly without fail. As industries, academic and non-academic institutes and other organizations including research and development centres found to be crowded areas, where, the multiple people interactions cannot be restricted or completely avoided, monitoring the risk factors on good hygiene and sanitation of such establishments is inevitable. Hygiene auditing can ensure 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 (Gnanamangai *et al.*, 2021). 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 (Pelczar *et al.*, 2000). As the major contaminants causing hygiene issues and disease outbreaks due to various pathogenic microorganisms in the atmosphere that cannot even seen with naked eyes, it focuses on the enumeration of several microbial colonies in the Petri plates containing nutrient medium. 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 chemical can be used to solidify the media and culture plates can be exposed in different areas of an organization. This will help ensuring the maintenance of hygiene and cleanliness of the area.

VIII. Safety Rules for a Hygiene Environment

As far as the stakeholders and employees are concerned, the safety and convenience of everyone working/access to the organization, the following safety rules should be observed at all times (AOAC, 1990). The following basic steps should be followed at all times to reduce the contamination of the working environment especially in edible preparation areas. Always wear a laboratory coat or apron along with hand gloves and caps before entering a working environment for protecting clothes from contamination or accidental discoloration by staining solutions.

- Keep the working bench clean of everything (e.g. books, purses, papers, etc.) except equipment and notebook.
- At the beginning and ending of each session, clean the work bench with a disinfectant solution.
- Never smoke, drink or eat in the working place.
- Never keep pencils, erasers, sharpeners, labels or any other material in mouth.
- On completion of each session, place all microbial cultures and food materials in the disposal area.
- Wash the hands with liquid detergent upon entering and prior to leaving the place.
- Washbasins should contain liquid detergent, soap, towel, tissue paper roll, etc.
- Long hair should be tied back to minimize contamination of cultures and fire hazards.
- After completing an experiment, dispose of all the material properly and clean the workbench with a neat cloth at the close of each experiment.
- Keep the doors and windows closed when experiments are in progress.
- Maintain an observation notebook to record the data for evidence.
- Recording the results or data in the observation notebook is important.
- Analyse and compare the data using statistical tools and standard values.
- Take photographs whenever necessary to document the results for evidence.



IX. Preparation and Cleaning of Glassware and Plasticware items

Glassware and plasticware items used in any experiment have to be properly cleaned, washed and sterilized before and after use. Improper cleaning and sterilization may interfere with results and may cause contamination. Newly purchased glassware and plasticware items also have to be cleaned and washed properly as they may be the source of chemical or microbial contamination. Before sterilization and after use, glassware and plasticware items like Petri plates, conical flasks and test tubes have to be washed using the following procedures (Cappuccinio and Sherman, 2004; Ponnuragan and Prabhu, 2013). All contaminated glassware and plasticware items should be autoclaved at 120°C temperature and 15 lbs/psi pressure before cleaning. If this is not possible, glass containers with discarded microbial cultures can be replaced in 10% sodium hypochlorite solution or simple disinfectant after use. Glass containers contaminated with spore bearing microorganisms must be autoclaved. The discarded microbial spores must be placed in a hot detergent solution. The containers placed in hot detergent solution / treated as recommended by manufacture / finally rinsed in deionised water. The glassware is then dried in a hot air oven at 100°C temperature for 3 hrs.

X. Water Quality analysis by MPN method by Presumptive test

Portability of the water provided to the workers/staff/students should be taken care as a first priority to ensure the good health of the stakeholders. Cleanliness of the water storage tanks, pipelines and the water outlets should be frequently inspected for water leakage, colour of the water and other changes. Water can be collected at various points and checked for the total dissolved solids (TDS) and pH very often to ensure the quality. Fortnightly or monthly checking for microbial contamination is also important. Care should be taken the used water outlets and the inlets pipes don't meet at any point in the campus. It is highly important to ensure the absence of coliforms and disease-causing pathogens in the water (APHA, 1981). As far as the used water is concerned, the water recycling should be ensured. Filtering the water into the temporary collection tanks is must and the solid sludge in the water should be gathered and added to the biodegradable processing tank. Filtered water from canteen outlets can be filtered and used for gardening purposes. Used water from the labs and the toilets should be subjected to chemical and microbial treatments and the quality should be ensured before allowing for other purposes.

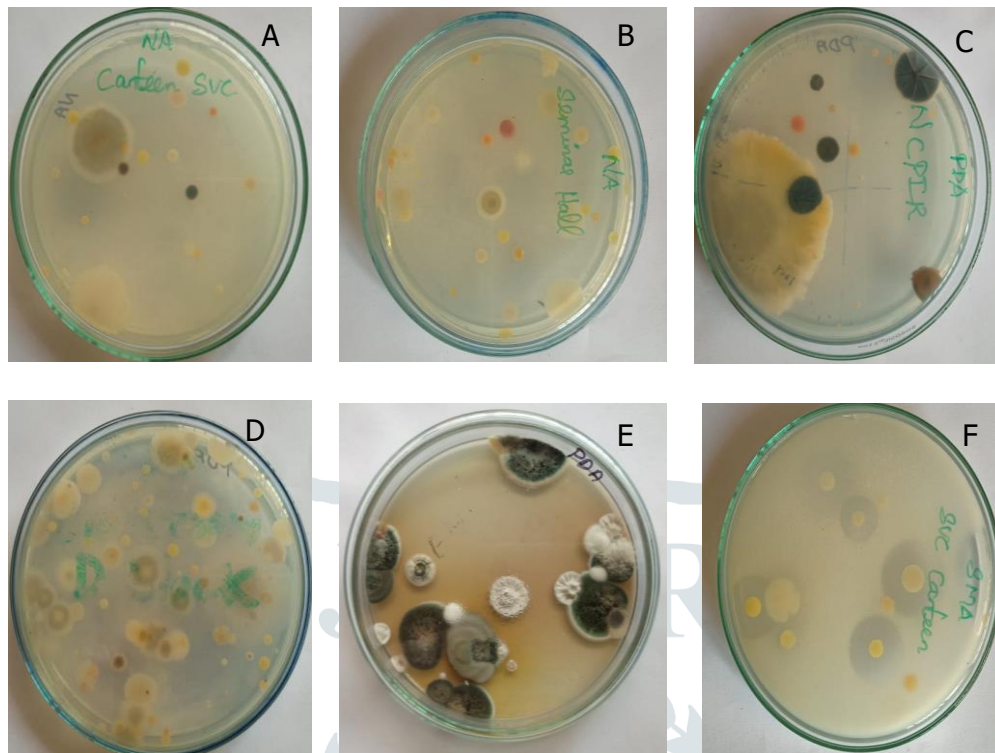
XI. Enumeration of Bacteria, Fungi and Actinomycetes in air

Air quality in different places in an Organization should be checked frequently by mean of enumerating the microflora in the air and any concern should be addressed immediately. Presence of allergy causing microbial spores in the air in the closed environments can cause respiratory issues and disease outbreaks to the stakeholders who are using the facility. Microorganisms such as bacteria, fungi and actinomycetes are freely living or associating with hosts covering soil, plants, animals and water including air. The growth as well as number of microorganisms are depending upon moisture, pH, temperature, gaseous oxygen and organic and inorganic composition of host which are crucial in determining the specific microflora of a particular sample. A single technique cannot be used to count the different type of microorganisms present in the given cultivation procedure that can provide all for the growth of all diverse microbial populations. Different natural, semi-synthetic and synthetic media are employed to support the growth of microorganisms under *in vitro* condition. For enumeration of bacteria, fungi and actinomycetes, the media such as nutrient agar, potato dextrose agar and casein-nitrate agar are normally recommended to use (IMTECH, 1998).

The sterile Petri plates containing media such as nutrient agar, potato dextrose agar and casein-nitrate agar have to be taken for the enumeration of bacteria, fungi and actinomycetes; respectively. These plates may be exposed for 2-3 minutes at specific places where the number of microorganisms as microflora in the air are to be enumerated. The exposed Petri plates should be incubated under room temperature for 24-96 hours. The number of bacterial colonies may be grown in the Petri plates containing nutrient agar medium within 24-48 hrs of incubation period. In the case of fungal growth, the Petri plates containing potato dextrose agar medium may be observed after 72-96 hrs of incubation. The colony of actinomycetes may be recorded in between the incubation period of 48-72 hrs.

The number of microbial colonies in each Petri plate after the incubation period may be counted by naked eyes. The bacterial colonies exhibit different shape, size, colour and texture on morphology. Different types of bacteria will produce different-looking colonies, some colonies may

be different coloured, some colonies are circular in shape, and others are irregular. Fungal colonies are identified based on visual characteristics such as colony morphology, elevation, colony margin, aerial mycelium and colony colour. Actinomycetes show a good sporulation with compact, chalk-like dry colonies of different colour variation from pink to white colour on the Petri plates and may show a branched mycelium in their cell morphology similar to fungal characters (Holt, 1989; IMTECH, 1998).



Microbial colonies in potato dextrose agar medium in different petri places such as a) class room, b) staff room, c) canteen, d) dining hall, e) auditorium and f) seminar hall of an organization at Coimbatore, Tamilnadu, India

Microbes such as bacteria, fungi and actinomycetes; respectively were enumerated using suitable 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 an Organization. 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 Auditorium and seminar halls and least with other premises. The number of bacterial, fungal and actinomycete colonies at Hostel Dinning hall recorded was 40.0, 31.7 and 20.5 cfu. Similarly, they were 32.7, 24.0 and 17.3 cfu at Canteen. Generally, actinomycete colonies are found to be least (Avg. 2.21 cfu) always in all the places due to generic characteristic features. On the other hand, bacterial colonies are always exhibited higher (22.26 cfu) due to small size and rapid multiplication factors. The fungal colonies are always placed in between two microorganisms (17.83 cfu) such as bacteria and actinomycetes in terms of size, shape, growth, doubling time and generic characters.

XII. Conclusion

Maintain a healthy environment and ambience to prevent the spreading of diseases due to the breeding of mosquitoes, house flies, moths, and microorganisms. Garbage should be kept in covered dustbins so that house flies do not breed inside which can directly control disease outbreaks. Wastewaters should not be stagnated outside the places and neighborhoods areas to avoid water pollution. All drain outs and water bodies should be properly covered which will avoid breeding of mosquitoes and house flies. There should be proper sewer lines connected to sewage treatment plants and drainage systems. The drinking water should not be mixed with drainage water to prevent contamination and also alter the water quality parameters. A healthy environment is directly proportional to personal hygiene which is one of the most important tasks among the food handlers, customers and public. It provides the foundation for providing a safe environment to others and to control foodborne and waterborne illness outbreaks. In addition, a large number of awareness programmes on personal and environmental hygiene, pest management strategies adopted, sanitation methods, hygiene maintenance may be conducted to the stakeholders regularly through hygiene clubs, forums, cells and associations which supports to the nation as a whole in terms of providing hygienic environment.

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