

B.Sc. (H) Microbiology
SEC , Sem I

Air as a medium and habitat??

- Life in the sky!!
- Though, atmosphere is a hostile environment for microbes, substantial number found in the lower troposphere where thermal gradients cause rapid mixing of air
- Movement through air is a major mechanism of dispersal of microorganisms
- Atmosphere may provide Temporary habitat
 - Clouds have water content permitting growth
 - Light intensities, gaseous content are favourable for growth
 - Condensation nuclei may provide inorganic mineral or organic nutrients for the growth
- Survival and dispersal of spores

Factors affecting Viability of microbes

- Viability in air is dependent on
 - Relative humidity
 - Water content
 - Oxygen
 - Radiation (UV!!)
 - Temperature (desiccation)
 - Chemicals (ozone, pollutants)
 - Variability between micro-organisms

Indoor environments

- Indoor air consists of a myriad of solid aerosol particles, including inhalable bioaerosols.
- Impacts on public health, so the focus of scientific research
- Microbial causative agents of adverse health conditions have been documented in aerosols of different indoor built environments & such agents can be transmitted between individuals in close proximity.
- Therefore, microbial community assessments to determine the nature and extent to which individuals in indoor settings are exposed to microbial life and the breadth of microbial life in which transmission can occur.

Bioaerosols

- Mixture of solid or liquid particles in air (airborne particles) containing whole or parts of biological materials.
- May be living organisms or originate from living organisms
- Biological materials include human pathogens, toxic or parts/pieces of microorganisms (allergic), dust mite parts or faeces, animal dander, fur, dried saliva, and animal waste products etc.

Some examples of Bioaerosols

- Human pathogens (fungi, bacteria, parasites, viruses)
- Endotoxin (LPS from Gram negative bacteria)
- Mites, animal dander (other allergens)
- Fungi (molds, spores, mycotoxins)

Bioaerosols:

- Capable of eliciting diseases that may be **infectious, allergic, or toxigenic** (acute or chronic)
- Size range **0.02–100 micrometers (typically 2-10 microns size range of the most concern)**
- Composition of the particles varies with source & environmental conditions
- Presence in air is a result of dispersal from a site of colonization or growth
- Particles can contain varying amounts of water
- Some are colloidal particles of soil, vegetation, other material
- Viruses, bacteria and fungi (spores and hyphae) in aerosols due to small size, many protozoa too large to remain airborne

Sources of bioaerosols

- Surface water – splash
- Soil & Plants – particles are 'raft' for organisms
- Human/animal – Sneezing, cough
- Agriculture – mechanical disturbance of soil
- Wastewater treatment - splash
- Transport - exhaust
- Industry - exhaust
- Bioterrorism - weapons

- **Aerosols:** Airborne particles, either solid or liquid, about 0.5 to 20 microns in diameter, that remain airborne for extended periods of time.
- **Droplets:** >20 (usually 100+) microns in diameter; settle rapidly or evaporate to form droplet nuclei in the aerosol size range.

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Impact of bioaerosols

1. Health effects: Exposures to bioaerosols in the occupational/residential environment are associated with a wide range of health effects with major public health impact, including infectious diseases, acute toxic effects, allergies and cancer
2. Environmental effects – smog, crop diseases, detrimental to objects, buildings, metals etc. (deterioration of cultural heritage).

Adverse effects associated with exposure to airborne microorganisms

Microbial agent	Associated adverse effect	
	Human health	Environment
Algae	Allergic reactions	Odor problems
Bacteria	Hypersensitivity pneumonitis, infections, mucous membrane irritation	Deterioration of building materials, loss of agricultural productivity (crop and livestock diseases), odor problems
Endotoxin	Cough, headache, fever, malaise, muscle aches, nausea, respiratory distress	None reported
Fungi	Allergic reactions, exacerbation of asthma, dermal irritation, hypersensitivity pneumonitis, infections, mucous membrane irritation	Deterioration of building materials, loss of agricultural productivity (crop and livestock diseases), odor problems
Mycotoxin	Headache, muscle problems, neurologic disorders, respiratory distress, toxicosis	Loss of agricultural productivity (disease in livestock)
Protozoa	Encephalitis, hypersensitivity reactions, infections	Possible protection from biocide treatment to other microorganisms, loss of agricultural productivity (disease in livestock)
Virus	Infections	Loss of agricultural productivity (crop and livestock diseases)