Decomposition of organic matter

Posted by Anonymous on Fri, 2016-06-03 08:35

Decomposition of organic matter: Isolating fungi and bacteria from grass cuttings: We are a school in tropical north Queensland. Can we conduct an experiment that requires wiping grass cuttings onto agar plates to look for fungi and bacteria that may be present? We will incubate the plates for 24hrs at 37^{o}C and use forceps that have been sterilised in a Bunsen flame. Do we need to conduct a risk assessment? Possible organisms in the area include: Stinkhorns, Cyanthus striatus, Leratiomyces, Chlorophyllum molybdites, bacillus species, Melioidosis and Lymphocytic choriomeningitis.

Decomposition of a chicken: Also, can Year 9 Forensic elective students leave a whole raw chicken outside in the sun for half an hour, then bury it and dig it up after 1 week and look for larvae?

Voting:
No votes yet

Year Level:
7
8
9
10
Senior Secondary
Laboratory Technicians:
Laboratory Technicians

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looking at decomposers -Micro biology experiment

Submitted by sat on 14 June 2016

Answer reviewed 1 February 2023

Science ASSIST recommends that before schools embark on working with microorganisms they should ask the following questions and perform a site specific biological risk assessment:

- Do the school facilities comply with the requirements of PC1 laboratories? School science laboratories are classified as (PC1) Physical Containment level 1, if they comply with the requirements of AS/NZS 2243.3-2022. Safety in laboratories. Part 3. Microbiological safety and containment. At this level they are only suitable for work with microorganisms where the hazard levels are low, and where laboratory personnel can be adequately protected by standard laboratory practice. PC1 laboratories are suitable for work with risk group 1 (RG1) microorganisms only. Higher levels of physical containment are required for handling fresh human tissues or body fluids and microorganisms of Risk Groups 2–4.1 Schools would require a classification of PC2 to safely handle microorganisms from Risk Group 2.
- Does the school have the necessary equipment for sterilisation and decontamination procedures?
- Do the staff have training in microbiological skills?
- What microorganism is being used?
- What manipulations are being performed with the microorganism? Are methods being used to eliminate or minimize exposure to potentially infectious material via aerosols, splashes, ingestion, absorption and accidental inoculation?
- Are any staff or students wishing to participate in microbiological activities immunocompromised or immunosuppressed (Include those who are pregnant or may become pregnant, or are living with or caring for an immunocompromised individual)? These individuals are more prone to infections. If so, it has been suggested that they should consult a doctor to determine whether their participation is appropriate.[2]

When handling micro-organisms it is important to use aseptic techniques at all times.

Aseptic technique is a fundamental skill in microbiology

- to avoid the contamination of culture media with unwanted microbes,
- to prevent contamination of personnel and work surfaces and
- to prevent microbes from being accidently released into the environment.

School policies: There are also differences between the state/territory educational jurisdictional policies on whether certain microbiological activities can be carried out. Schools are advised to check what activities are permitted in their jurisdiction/school sector before proceeding to work with any microorganisms.

Isolating fungi and bacteria from grass cuttings:

Collection of grass specimens: Precautions would be required for the collection of grass samples to reduce the risk of exposure to unknown microorganisms. When culturing from the environment, samples should **not** be taken from areas likely to contain human pathogens. Due to your tropical location you have indicated a number of potential microorganisms of concern.

Unknown microorganisms: The activity you describe will produce 'wild cultures' which will not be identified and hence the possibility of isolating pathogens. The lid and base of the Petri dish should be taped with 4 pieces of sticky tape 6 to allow for aerobic conditions and to prevent accidental opening of the plate during incubation. Plates can be sealed with sticky tape or preferably Parafilm completely around their circumference **after incubation** but prior to allowing students to examine them. This will prevent any exposure to moisture or drips that may seep out of the Petri dish which are potential sources of infection, as well as keeping the lid securely attached to the base. All observations of any 'wild cultures' must occur with the Petri dish taped. Wild cultures should never be sub-cultured in a school laboratory.

Sterilising forceps: Sterilising forceps in a Bunsen flame for 1 minute will result in the forceps becoming extremely hot and the risk of severe burns. Forceps are safely sterilised by wrapping in foil and placing in an autoclave or pressure cooker at 15psi, 121ºC for 15minutes. Several forceps can be sterilised for each group at a time. An alternative is to soak the forceps in 70% alcohol for 10min, air dry and wrap in aluminium foil avoiding touching the ends.

Type of agar: The type of media used should not select for pathogens. **Nutrient agar** is a simple media which supports the growth of a wide variety of bacteria and fungi and is recommended for use in school laboratories. Selective media designed to select for more fastidious microorganisms and pathogens such as Blood and MacConkey Agar **should not** be used.

Incubation temperature: The method specifies an incubation temperature at around 37º C. The recommended incubation temperature for schools is at **temperatures of 30ºC or below** to avoid the growth of human pathogens that are adapted to human body temperature.

Decontamination procedure: The method does not explain that the agar plates should be sterilised before disposal by being placed into an autoclavable bag, such as an oven bag, for sterilisation at 110kPa/15psi, 121º C for 15-30 minutes in an autoclave or laboratory pressure cooker.

Microbiology of soils: Soils contain a diverse range of microorganisms which include bacteria, fungi, algae and protozoa which are involved in the decomposition of plant materials as well as being involved in maintaining soil fertility and recycling nutrients. The rhizosphere (the area closely associated with the roots) of plant material is where much of the microbiological activity takes place.3 The soil microbial community is influenced by many factors such as temperature, moisture, acidity or alkalinity, oxygen levels, organic matter and soil porosity.

Bacteria and fungi are the most important microorganisms involved in the decomposition process of plant materials and some of these species can cause disease in plants, animals and humans.

There is also the possibility of microorganisms being introduced via animal excretions in the area. Lymphocytic Choriomeningitis (LCM) if present may be a consideration in your situation as rats from the nearby cane fields enter your school grounds. LCMV infections can occur after exposure to fresh urine, droppings, saliva, or nesting materials from infected rodents.

Decomposition of a chicken:

Science ASSIST considers this a high-risk activity and advises against its implementation in school science laboratories. The requirements of appropriate facilities and biosafety training and experience in order to deal with anything dead or decaying, puts this activity beyond the scope of most, if not all, schools.

Biohazards

- The primary hazards of concern in fresh raw poultry meat are salmonella and campylobacter spp. They are both the cause of many cases of food poisoning even in low numbers. 1, 2
- Salmonella species, campylobacter species and many soil microorganisms such as clostridium and some bacillus species are classified as Risk Group 2.
- Staff should have specific training in biohazards and possess suitable microbiological knowledge and training to deal with the potential hazards associated with anything dead or decaying.
- Incubating raw chicken in the sun for 30 minutes, followed by burial in the ground, provides good conditions for the growth of microorganisms whose presence, concentration and pathogenicity is unknown.
- Burial also provides an anaerobic environment which encourages the growth of some very hazardous anaerobic bacteria. In addition, there is a risk that the buried carcass may be dug up by local wildlife.
- Whilst there are some maggots that live underground, there is no guarantee regarding this. It has been suggested to leave the carcass on the surface, but the unpleasant odour from the decomposing carcass would be overwhelming and may also attract animals such as rats or local wildlife. Students generally do not cope well with the smell of appropriately sourced biological materials for dissections.
- Infectious microorganisms could be released in the form of aerosols when manipulating the decomposed carcass while extracting larvae from the decomposing carcass for examination in the laboratory. This would need to be done using strict aseptic techniques in a controlled environment and appropriate PPE, such as safety glasses, latex/nitrile gloves, laboratory coat, closed-in shoes and potentially a mask, to avoid any contact with microorganisms involved in the decaying process.
- It is recommended that microbiological material for use by students in school laboratories should **not** be taken from unknown origins or uncontrolled environments, which are likely to pose a health risk.

- For further information see https://education.qld.gov.au/curriculum/stages-of-schooling/CARA/activit... (accessed 01/02/2023).

We suggest that you consider an alternative activity to demonstrate the decomposition process. One idea is to suggest that the students perform a risk assessment on the proposed activity to identify the hazards, evaluate the risks and determine ways to eliminate or control the risks.

Forensic entomology

Forensic entomology is the study of the presence and life cycles of insects that colonise a decomposing body to estimate the time of death, often aiding criminal investigations.

Decomposition of a body begins with the action of microorganisms such as bacteria and fungi followed by the action of a series of insects. Decomposition is affected by the following factors.

1. The environmental conditions such as temperature, exposure to sunlight, humidity and oxygen levels.
2. Where the specimen is located (e.g. in water, enclosed space, buried, soil type and vegetation in the area).
3. The state of the body (e.g. size, weight, cause of death, if burnt, if clothed).
4. The presence of scavengers and insects, in particular, flies.

Weather conditions will affect how slowly or quickly a body decomposes. In general, the warmer the temperature, the faster the rate of decomposition. Temperature is also the most important factor affecting the rate of insect development.

The following links provide good information on various aspects of the decomposition process: http://australianmuseum.net.au/movie/stages-of-decomposition, http://australianmuseum.net.au/decomposition-fly-life-cycles

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