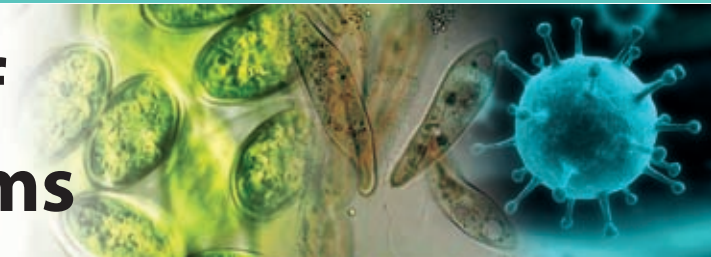


1 Importance of Microorganisms



1.1 Microorganisms

There are living organisms which are visible and also invisible to the naked eye in our environment. Let us do Activity 1.1 to observe the invisible living organisms.



Activity 1.1

You will need: - A sample of coconut water, a glass slide, a cover slip, light microscope

Method: -

- Put the coconut water into a clean container and keep it for three days.
- Then put a drop of coconut water on to the glass slide and cover it with a cover slip.
- Observe the prepared slide through the optical microscope under low power. (Get the help of your teacher)
- Present your observations through diagrams.

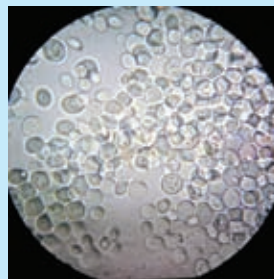


Figure 1.1 ▲ Microorganisms in a sample of aged coconut water

It is obvious that the unicellular fungal variety called 'yeast' can be observed mainly in the above sample. This organism cannot be examined to the naked eye in isolation, but can be observed through a microscope. Therefore yeast is a microorganism.

The uni-cellular (single celled) or multi cellular organisms which are invisible to the naked eye when taken individually are called microorganisms.

These microorganisms can be observed clearly through microscopes.

Microorganisms are found in every habitat on the planet. They live and thrive in all environments such as atmosphere, water, soil, in and on living organisms including hostile environments (glaciers, deserts, hot springs, deep sea and saline environments). There is a tremendous biological diversity among microorganisms. They differ in their morphological characters as well as in their feeding mechanisms.

e.g.:- bacteria, some algae, some fungal species, protozoans like amoeba and paramecium

You can observe some permanent slides of microorganisms in your laboratory.

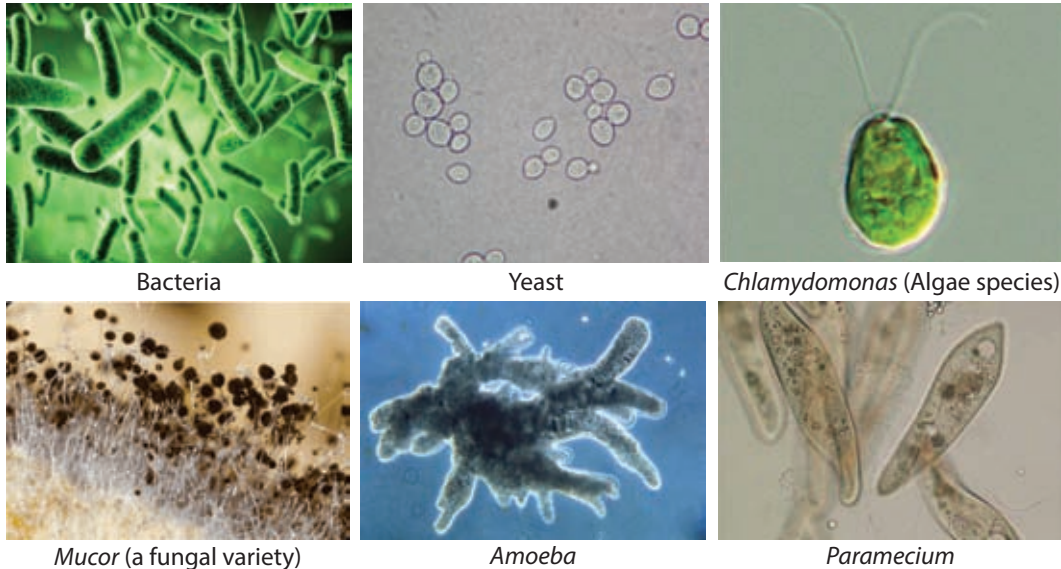


Figure - 1.2 ▲ Microscopic appearance of some microorganisms

Use Figure 1.2 to identify different species of microorganisms.



For extra knowledge

Viruses show living features as well as non-living features. Although viruses are discussed under microorganisms, there is no conclusion yet as to whether they are living or non-living. Viruses can be observed through electron microscope.

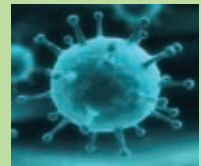


Figure 1.3 ▲ Antonie van Leeuwenhoek

The Dutch scientist Antonie van Leeuwenhoek observed microorganisms for the very first time in 1674, using a simple microscope that he invented. Exploration of microorganisms was possible with further developments in microscopy.

1.2 Effects of microorganisms on food

The growth of some microorganisms on food makes the food not suitable for consumption.

Do Assignment 1.1 and Activity 1.2 to observe the effects of microorganisms on food.



Assignment 1.1

- Get some food samples of bread, vegetables, fruits, milk, meat/fish, rice, butter in fresh condition.
- Observe their nature carefully.
- Again observe the nature of these samples after 24 hours, 48 hours and 72 hours.
- Tabulate your observations.

Table 1.1- Effect of microorganisms on food

Food item		Fresh food	After 24 hours	After 48 hours	After 72 hours
1. Bread	colour				
	texture				
	odour				
	appearance				
2.					

The microbial activities change the colour, texture, odour and appearance of food. The taste and the nutritional value of food also change. Food become unfavourable for consumption due to the changes of properties. This is known as spoilage of food. The main reason for food spoilage is the growth of microorganisms on food.



Activity 1.2

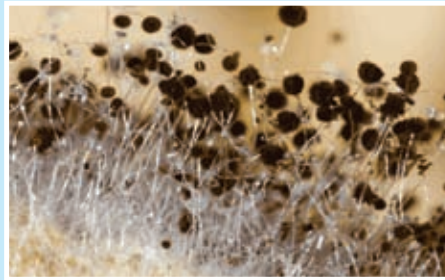
You will need: - A slice of bread, some water, a glass slide, a cover slip, microscope

Method: -

- Spray some water on the slice of bread and keep it for three days.
- Take some of the substance grown on the slice of bread and place on the glass slide. Put a drop of water on it.
- Cover the slide with a cover slip.
- Observe the slide through the microscope under the low power.
- Draw what you observed.



Slice of bread with fungi



Microscopic view of fungi

Figure 1.4 ▲

You will observe that there are some fibres and black structures on bread. They are a kind of fungi which spoils bread.

So, you can observe that microbial growth causes food spoilage.

The main reason for food spoilage is the growth of microorganisms on food and release of their byproducts.

Let us do Activity 1.3 to study microbial activity.



Activity 1.3

You will need: - Sugar, yeast, a balloon, warm water (40 °C), a bottle (500 ml), a beaker/suitable container

Method: -

- Dissolve two teaspoons of sugar in 200 ml of warm water.
- Add one teaspoon of yeast into the above sugar solution.
- Leave it for about 20 minutes and observe (Figure 1.5 a).



Sugar and yeast mixture

Figure 1.5 (a) ▲

- Next pour a newly prepared solution into the bottle.
- Then fix a balloon to the mouth of the bottle.
- Record your observations after about 20 minutes. (Figure 1.5 b).



Figure 1.5 (b) ▲

When sugar and yeast are mixed in a solution, it will bubble and become warm (Figure 1.5a/1.5b). You will smell the odour of alcohol. It is because ethyl alcohol is produced due to the activity of yeast in sugar solution.

As shown in Figure 1.5 b you will see that the balloon has been inflated. This is because a gas is produced due to the activity of yeast in sugar solution. The gas produced here is carbon dioxide.

Yeast is a key ingredient in bakery products. The activity of yeast forms carbon dioxide and makes the dough rise. Ethyl alcohol evaporates during the process of baking.



Figure 1.6 ▲ Rising of bread due to the activity of yeast

When food is exposed to air, microbes act on it very easily. This is because the environment provides suitable moisture and temperature for their growth.

Also when a moist food item is exposed to an environment with favourable temperature, microorganisms start to grow rapidly.

But if the food is refrigerated the microbial activity is minimized because the amount of moisture and temperature are controlled in a refrigerator.

Moisture and **temperature** are the main factors that contribute to microbial activity. Food spoils rapidly at room temperature (25 °C-30 °C). This is because room temperature is favourable for microbial growth. The enzymes produced by these microbes change the taste, odour, colour, texture and the nutritional value of the food.

Microbial activities depend on the type of food.

- **Fermentation** :- Microbial activity on food high in sugars leads to fermentation.
- **Putrefaction** :- Microbial activity on food high in protein leads to putrefaction.
- **Rancidity** : - Microbial activity on food high in fats leads to rancidity.

A substrate, suitable temperatures and pH ranges are the factors for the growth of different microbes. Therefore, microbial activity can be controlled by controlling these factors.

1.3 Impact of microorganisms on humans and their activities

Some microorganisms are beneficial to humans while some are harmful.

Let us do Assignment 1.2 to understand the importance of microorganisms.



Assignment 1.2

- Collect information about beneficial and harmful effects of microorganisms and present them to the class.

Beneficial effects of microorganisms

Beneficial effects of microorganisms are of several types. Some of them are usage of microorganisms in different industries, microbial decomposition of dead plant and animal matter, biological pest control.

- Since ancient times man has been using microorganisms in different industries. Some examples are given in Figure 1.7.



Figure - 1.7 ▲ Applications of microorganisms

- Microorganisms decompose dead plant and animal matter. If not these matter get collected and it affects the balance of environment. Therefore, microorganisms contributes to the well-being of the environment.
- Microorganisms are also used to control pests. This is a biological control method of pests.

Next let us consider harmful effects caused by microorganisms.

Harmful effects of microorganisms

Harmful effects of microorganisms are of several types. Food spoilage, causing infectious diseases for man, animals and crops, cause economical damage to clothes and wooden furniture are some of them.

- Microbial activity causes food spoilage. (This was discussed in section 1.2)



growth of microorganisms on vegetables



growth of microorganisms on bread



growth of microorganisms on fruits

Figure - 1.8 ▲

- Microorganisms cause various infectious diseases for man, animals and crops.

Infectious diseases caused to man

Virus - common cold, dengue, AIDS(Acquired Immuno Deficiency Syndrome)

Bacteria - tuberculosis, leprosy, typhoid fever

Protozoa - malaria, leishmaniasis, amoebiasis

Fungi - pityriasis, sore



dengue haemorrhagic patient



deformity due to leprosy



fungi on skin (Pityriasis)

Figure - 1.9 ▲

Infectious diseases caused to animals

Animals get infectious diseases due to microorganisms and Figure 1.10 shows some of the examples for such diseases.



a dog suffering from hydrophobia



a bull suffering from foot and mouth disease
Figure 1.10 ▲



a cow suffering from mastitis

Infectious diseases caused to plants

Plants get infectious diseases due to microorganisms and Figure 1.11 shows some of the examples for such diseases.



a potato plant with blight



papaw leaves with mosaic disease



chillie plant with leaf curled sickness

Figure 1.11 ▲

- Damage caused due to the growth of microorganisms, on surfaces of objects.

The growth of microorganisms on clothes, walls of buildings and wood has been caused adverse effects on the economy. These effects are mostly caused by fungi.



fungi on clothes



fungi on walls



fungi on wooden surfaces

Figure - 1.12 ▲ The growth of microorganisms on different surfaces



Summary

- The uni-cellular (single celled) organisms which are invisible to the naked eye when taken individually are called microorganisms.
- Microorganisms cause beneficial effects as well as harmful effects.
- Usage in various industries, decomposition of dead plant and animal matter and pest control are beneficial effects.
- Food spoilage and infectious diseases for man, animals and crops are harmful influences caused by microorganisms.
- Nutrients, moisture, favourable temperatures and favourable pH values are necessary for microbial growth.
- Food can be preserved by implementing necessary methods to control microbial activities.

Exercise

1) State whether the following statements are true (✓) or false (×)

- i) Bacteria belong to the category of microorganisms. ()
- ii) A virus causes Tuberculosis. ()
- iii) Refrigerating food helps to control the temperature suitable for microorganisms. ()
- iv) Moisture and warmth are necessary factors for the growth of fungi. ()
- v) The scientist Antonie van Leeuwenhoek observed microorganisms for the first time. ()

2) Select the correct answer

I. A disease **not** caused by a virus is

- 1) AIDS 2) Measles 3) Leprosy 4) Hydrophobia

II. The food type that undergoes fermentation in the presence of microorganisms is

- 1) Food with proteins 3) Food with sugars
2) Food with lipids 4) All three types

III. Environmental conditions, suitable for microbial growth are given below.

- a) Temperature b) Moisture c) pH

which of the above conditions are controlled by refrigerating food?

- 1) a and b 2) a and c 3) b and c 4) a, b and c

IV. The microbial activity on lipid food such as 'dodol'/'dothal' and 'kavum'/'paniyaram' is known as,

- 1) Fermentation 2) Putrefaction 3) Rancidity 4) All the above

V. A favourable impact for humans by microorganisms,

- 1) Decomposition of dead plant and animal matter
2) Cause diseases to humans, animals and crops
3) Make food unsuitable for consumption
4) Cause economical impact by growing on non living surfaces

3) Give short answers.

- I. Write four examples for microorganisms
II. Mention two factors required for microbial activity
III. Name three products in which microorganisms are used.
IV. What factor needed for microbial growth is controlled when food is stored in sugar/honey?
V. Mention two microbial applications in the field of medicine?

Technical Terms

Microorganisms	-	கீழ்நிலை	-	நுண்ணங்கிகள்
Microscopic	-	அணுஅணு	-	நுண்ணங்குகாட்டி
Food spoilage	-	அவசர வரக் காலம்	-	உணவு பழுதடைதல்
Microbial degradation	-	கீழ்நிலை பாகுபடுத்தல்	-	நுண்ணங்கிப் பிரிகையாக்கம்
Application of microbes	-	கீழ்நிலை பயன்பாடு	-	நுண்ணங்கிகளின் பிரயோகம்
Infectious diseases	-	வெளிநோய்	-	தொற்று நோய்கள்